Appendix A Notice of Preparation (NOP) and NOP Comments

San Francisco Redevelopment Agency
San Francisco Planning Department

NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT

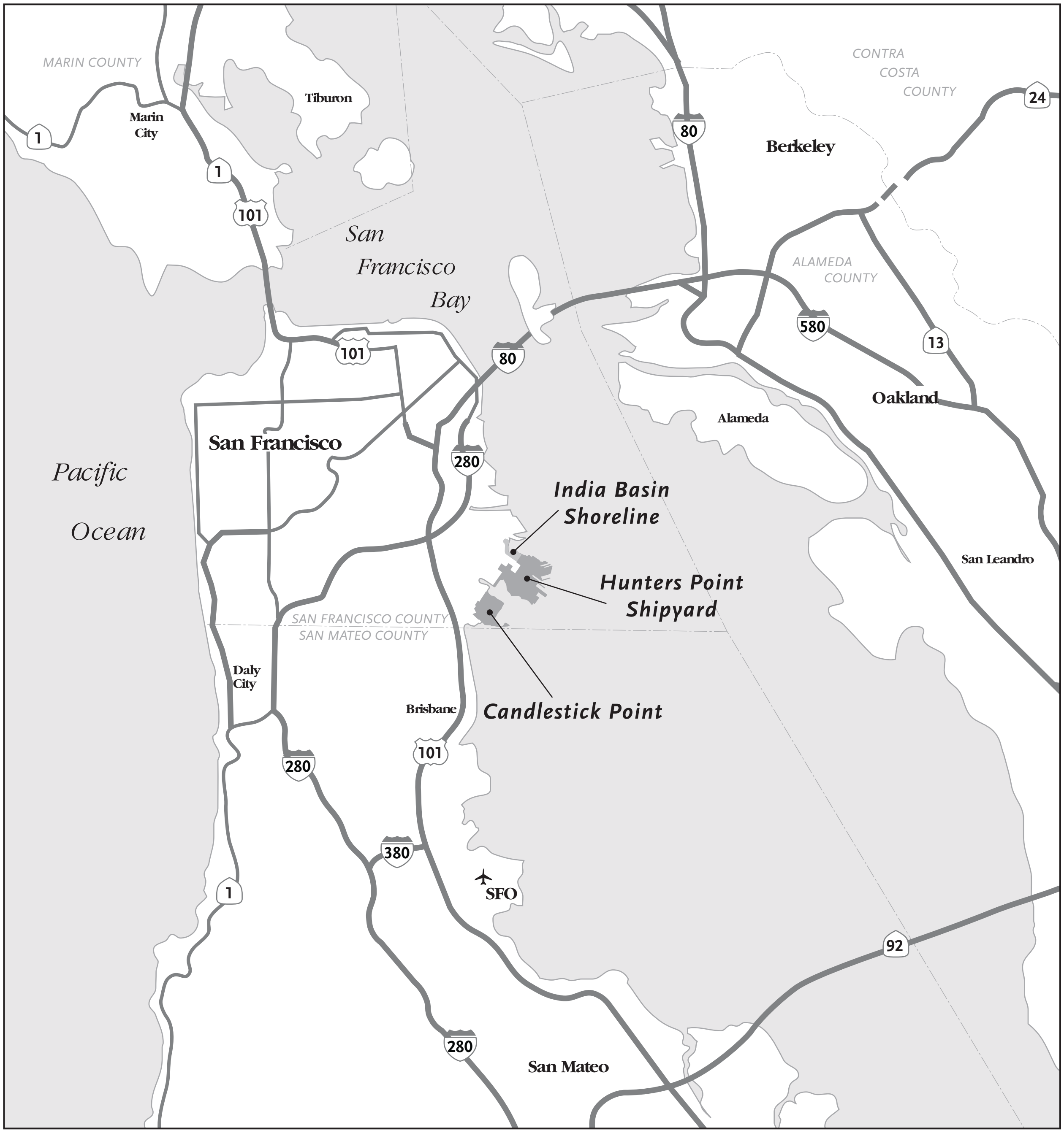
Project Title: BAYVIEW WATERFRONT PROJECT

(SFRA File No. ER06.05.07 Planning Department File No. 2007.0946E)

The Bayview Waterfront Project would include new plans for the Candlestick Point, Hunters Point Shipyard, and India Basin Shoreline areas of San Francisco. The Project encompasses an approximately 780-acre area east of US 101 in the southeast area of the City and occupies the waterfront area from India Basin to approximately Candlestick Point. The plans consists of a new stadium for the San Francisco 49ers and a mixed-use community with residential, retail, office/research & development(R&D)/industrial, civic and community uses, and parks and recreational open space. To implement the Project, the existing Bayview Hunters Point (BVHP) Redevelopment Plan and Hunters Point Shipyard (Shipyard) Redevelopment Plan would need to be amended and conforming changes made to zoning and the Design for Development for the Shipyard Redevelopment Plan. The Bayview Waterfront Project also would include rezoning of Area C of the BVHP Survey Area. That portion of the BVHP Survey Area was not incorporated in the Bayview Hunters Point Project Area adopted by the Agency in March 2006. Area C is also referred to as the India Basin Shoreline.

PROJECT LOCATION: The Project site is the Bayview Hunters Point (BVHP) Redevelopment Project Area B (Candlestick Point), the Shipyard Redevelopment Project Area, and Area C (India Basin Shoreline) of the BVHP Survey Area. The site is approximately 780-acres in area, occupying the waterfront from India Basin to approximately Candlestick Point, and extending inland from the waterfront. The BVHP and Shipyard areas are in the southeast portion of San Francisco, generally bounded by Cesar Chavez Avenue Street to the north, US 101 to the west, the Visitacion Valley and Executive Park neighborhoods and the City and County of San Francisco – San Mateo County line and the City of Brisbane to the south, and San Francisco Bay to the east. See Figures 1 and 2.

CURRENT LAND USE: The Candlestick Point area of the BVHP Project Area is immediately east of Executive Park, with the Hunters Point Shipyard to the north and east, and Candlestick Point State Park along the Bay frontage. See Figure 2. Current land uses at Candlestick Point include Monster Park, the stadium owned by the City and County used by the San Francisco 49ers National Football League team, and associated parking lots and access roadways. The stadium and parking are under the jurisdiction of the San Francisco Recreation & Park Department. The Candlestick Point area also includes the Alice Griffith Housing, owned by the San Francisco Housing Authority, and several private parcels near Gilman Street and Jamestown Avenue, to the north of the stadium.

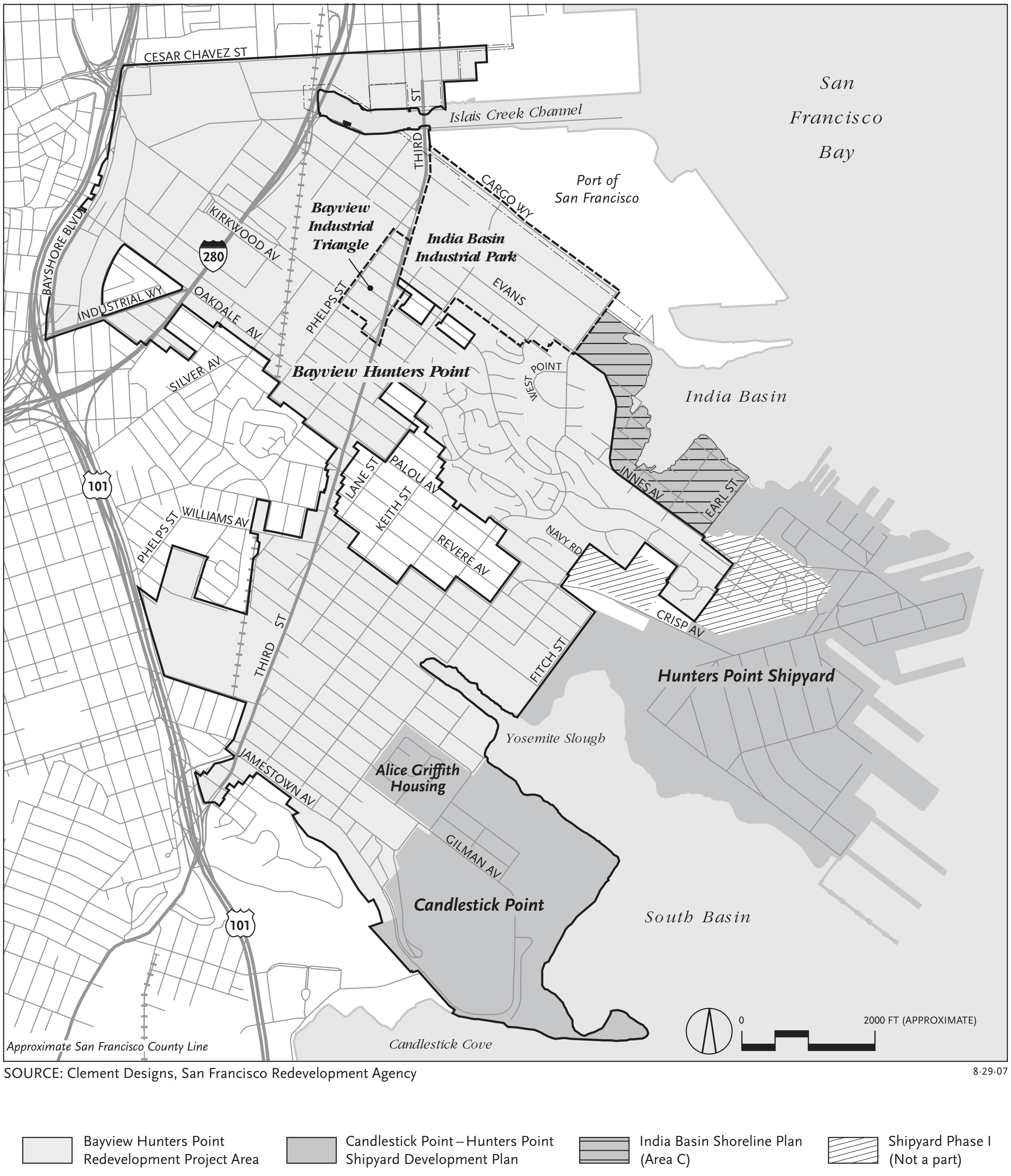


SOURCE: Clement Designs

8-29-07

Bayview Waterfront Project EIR

FIGURE 1: PROJECT VICINITY



Bayview Waterfront Project EIR

FIGURE 2: BAYVIEW WATERFRONT PROJECT AREAS

The Shipyard, as shown on Figure 2, has extensive frontage on San Francisco Bay, and is bounded by the BVHP Project Area, and Area C of the BVHP Survey Area (India Basin Shoreline), to the west. The Shipyard includes many structures associated with ship repair, with piers and dry-docks, and ancillary storage, administrative, and other former Navy uses. Several former Navy buildings are currently leased and occupied as artist studios, and by light industrial tenants. In 1997, the Agency and City adopted a redevelopment plan for the Shipyard. Phase 1 of that redevelopment plan, a 75-acre portion of the Shipyard, is under construction with new housing on Parcel A. The Phase 1 area is not part of the proposed Project. Most of the Shipyard currently remains under the jurisdiction of the U.S. Navy.

The India Basin Shoreline area is northwest of the Shipyard, as shown on Figure 2. The India Basin Shoreline area currently contains residential uses and light industrial and boatyard operations along Innes Avenue, a 28-acre privately owned vacant parcel fronting the Bay east of Innes, India Basin Shoreline Park, and the former PG&E Hunters Point power plant, and an associated fuel tank farm, now being demolished.

PROJECT DESCRIPTION: The Bayview Waterfront Project to be evaluated in the EIR encompasses, as noted above, the new plans for the Candlestick Point, Hunters Point Shipyard and India Basin Shoreline areas of San Francisco. The Candlestick Point - Hunters Point Shipyard Development Plan portion of the project would consist of a new stadium for the San Francisco 49ers and a mixed-use community with residential, retail, office/R&D/industrial, civic and community uses and parks and recreational open space. This proposal also includes new infrastructure necessary to serve the development. The India Basin Shoreline Plan proposes to rezone a largely industrial zoned area to support a mix of residential, commercial and industrial uses.

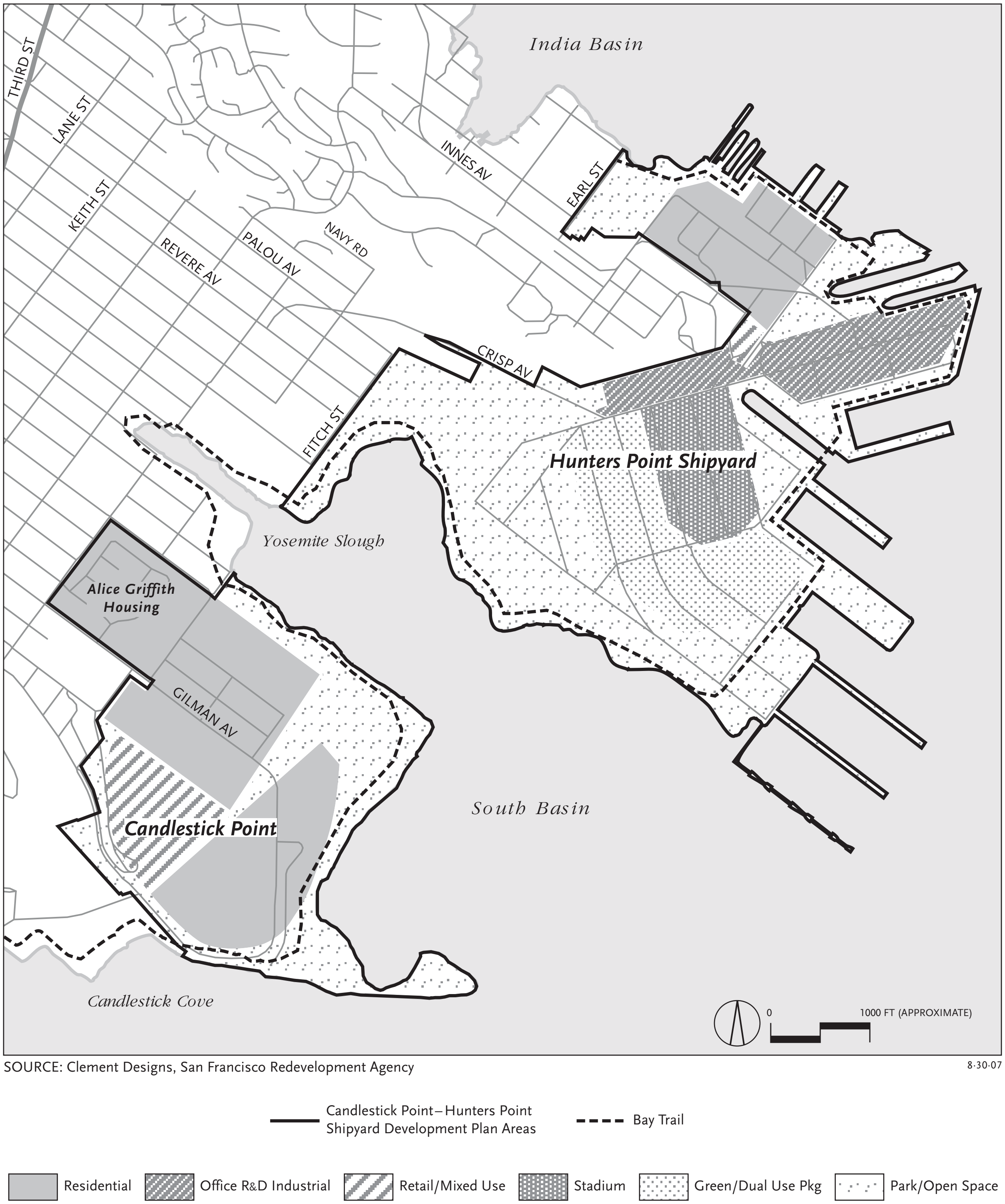
Lennar is the lead developer for the Candlestick Point - Hunters Point Shipyard Development Plan. The EIR will provide project-level review of the development plan. The India Basin Shoreline Plan will be a programmatic plan expected to be developed by various private parties. The EIR will provide program-level review for India Basin Shoreline area.

Table 1 below identifies the land area of the Project sites, totaling about 780 acres.

The Candlestick Point - Hunters Point Shipyard Development Plan

The proposed Candlestick Point - Hunters Point Shipyard Development Plan would be a mixed-use community with residential, retail, office/R&D/industrial, civic/community, parks/recreation/open space, and a new stadium for the San Francisco 49ers, as shown in Figure 3, and outlined in Table 2, below.

At Hunters Point Shipyard, the Project would include approximately 2,500 new residential units, with a range of housing types that would include: stacked flats, attached townhomes, mid-rise and high-rise structures. The residential development would range from two to four story structures over parking, to buildings of 12 to18 stories. The Project may include residential towers up to 35 stories. The residential land density would range from 50 units per acre up to 170



SOURCE: Clement Designs, San Francisco Redevelopment Agency

Bayview Waterfront Project EIR

FIGURE 3: CANDLESTICK POINT – HUNTERS POINT SHIPYARD DEVELOPMENT PLAN

TABLE 1
BAYVIEW WATERFRONT PROJECT SITE AREAS

	Existing Redevelopment Project Areas (acres)	Proposed Redevelopment Project Areas (acres)	Proposed Project (acres)
Bayview Hunters Point	1,499	1,499	
Candlestick Point [a]	[284]		284
India Basin Shoreline [b]		+76	+76
Total BVHP	***1,499***	***1,575***	***360***
Hunters Point Shipyard [c]	493	493	
Phase I [d]	[75]	-75	
		418	418
Total Project			**778**

Source: San Francisco Redevelopment Agency; Lennar.
Notes:
a. Candlestick Point is within total existing BVHP Project Area of 1,499 acres.
b. India Basin Shoreline Survey Area to be added to BVHP Project Area.
c. Land area only. Shipyard Project Area also includes 443 acres of submerged lands.
d. Phase I of the existing Shipyard Project Area now under construction would not be part of Bayview Waterfront Project.

TABLE 2
CANDLESTICK POINT –
HUNTERS POINT SHIPYARD DEVELOPMENT PLAN

	Shipyard	Candlestick Point	TOTAL	
Residential	2,500	6,500	9,000	dwelling units
Retail				
Regional	-	585,000	585,000	sq. ft.
Neighborhood	60,000		60,000	sq. ft.
Total Retail			645,000	sq. ft.
Office/R&D/Industrial[a]	2,000,000	150,000	2,150,000	sq. ft.
Football Stadium	69,000		69,000	seats
Arena/Performance Venue		8,000	8,000	seats

Source: Lennar.
Notes:
a. R&D: Research and Development

units per acre. The housing would be intended for a range of income levels, and would provide both rental and for-sale units.

Pursuant to the 1997 Shipyard Redevelopment Plan, development would include a mix of research and development space, possible biotechnology space, and other industrial uses. The commercial uses would also provide approximately 80,000 square feet of neighborhood-serving retail.

The Shipyard would accommodate a new approximately 69,000-seat National Football League stadium for the San Francisco 49ers. The stadium parking plan would include “green parking” surfaces that would accommodate parking for stadium events, and would serve public recreational uses such as playing fields at other times. The Shipyard would also include approximately 2 million square feet of office/R&D/industrial uses in three- to six-story buildings.

Additionally, the EIR may consider a Candlestick Point - Hunters Point Shipyard Development Plan option with up to 10,000 residential units.

The EIR will also consider a Candlestick Point - Hunters Point Shipyard Development Plan that would substitute other uses for the football stadium. Without the stadium, there would be additional R&D space and residential uses distributed across the Candlestick Point - Hunters Point Shipyard area.

The Candlestick Point area of the BVHP Project Area is approximately 284 acres. It includes Monster Park, the existing San Francisco 49ers home stadium (also known as Candlestick Park Stadium) on a 77-acre site; Candlestick Point State Recreation Area, totaling approximately 134 acres; the 20-acre San Francisco Housing Authority site of the Alice Griffith Housing; 12 acres of land owned by the Port of San Francisco; privately owned parcels totaling 21 acres; and approximately 20 acres of streets and roadways. See Figure 3, above.

At Candlestick Point, the proposed Project would include approximately 6,500 new residential units (in addition to the 2,500 units in the Hunters Point Shipyard) and a regional retail center. Approximately one-third of the units are planned to be low-rise apartments and townhomes concentrated on the easternmost portion of the Candlestick Point area. About one-third would be in mid-rise buildings and the remaining one-third of the units in high-rise towers. Residential development proposed near existing neighborhoods and the Candlestick Point State Recreation Area would be primarily three- to four-story buildings. Remaining areas would be mid-rise buildings ranging from seven to 18 stories; and taller high-rise buildings in certain locations. Figure 3 shows the location of the proposed uses.

The residential land density at Candlestick Point would range from approximately 40 units per acre up to 130 units per acre. The housing would be intended for a range of income levels, and would provide both rental and for-sale units.

The Project would redevelop the San Francisco Housing Authority’s Alice Griffith site (also known as Double Rock Housing), replacing the 263 existing units with a total of about 925 units, consisting of one-for-one replacement public housing, affordable homeownership/rental and market rate for-sale units. These homes would be a mix of townhomes, stacked townhomes and four-story stacked flats.

The proposed regional retail center at Candlestick Point would be approximately 735,000 square feet, of which 150,000 square feet would be office space. The center would also include an 8,000-seat arena/performance venue. The proposed retail program would also include neighborhood-serving uses such as a grocery store; entertainment uses such as a multi-screen movie theatre and clubs with live music; large format retail; and restaurants. The center would be oriented around a retail 'Main Street' and might include some housing above retail.

The Candlestick Point - Hunters Point Shipyard Development Plan would include open space improvements. Through a proposed land exchange with the California Department of Parks and Recreation, portions of the existing Candlestick Point State Recreation Area would be improved and new State park area would be created at the Shipyard. There would be a net increase in State park land. The Project open space improvements would also allow for realignment of the Bay Trail in the southeastern portion of San Francisco. The Project would include a number of recreation facilities and sports fields, and smaller, neighborhood-oriented parks. At the Hunters Point Shipyard, a heritage park is proposed that would focus on the Shipyard's past.

To implement the Project, the U.S. Navy may transfer the Shipyard property to the City or Agency for reuse after the Navy has completed remediation in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), Section 120, 42 U.S.C. Section 9620. Reuse may also occur concurrently with remediation under the provisions of CERCLA that authorize a title transfer prior to completion of remediation under certain conditions (referred to as an Early Transfer). Finally, CERCLA may authorize interim reuse activities to occur concurrently with remediation activities through a lease, either with or without provision for later deed transfer, provided the property is found suitable for the planned interim reuse activities.

It is anticipated that the Candlestick Point - Hunters Point Shipyard Development Plan would be under construction by the end of 2009 and that the 49ers football stadium would be completed by 2012. Full buildout of the plan is anticipated by 2025.

India Basin Shoreline Plan

The BVHP Survey Area included the "Hunters Point Shoreline Activity Node." Within that 131-acre Activity Node is an approximately 76-acre area that was not included in the adopted BVHP Project Area. See Figure 2, above. At the time of consideration of the BVHP plan in 2006, the Agency found that further land use analysis was needed before adoption of a future plan amendment and area-specific controls. This excluded portion of the BVHP Survey Area was designated Area C. Also referred to as the India Basin Shoreline, Area C, as noted above, has an existing mix of residential uses; a vacant parcel fronting the Bay; and the former PG&E Hunters Point power plant, currently being demolished. The India Basin Shoreline area is currently zoned for industrial use.

The Planning Department is considering rezoning to accommodate a mix of residential and commercial uses, along with some continued industrial use and development controls to facilitate mixed use development. The EIR will analyze an overall land use program for the India Basin Shoreline as a detailed site plan has yet to be undertaken. It is anticipated that the rezoning and other planning controls for the India Basin Shoreline would reflect community goals expressed earlier during BVHP planning to provide:

- New housing on available infill development sites northwest of Innes Avenue
- Mixed-use neighborhood southeast of Innes Avenue
- Small industrial or R&D businesses
- Neighborhood-serving retail and commercial services and some residential units
- Water-oriented neighborhood
- Space for artists
- New waterfront open space and recreational activities

Transportation Improvements

The Bayview Waterfront Project would require substantial transportation infrastructure to support new development. Transportation improvements related to or affecting the Project generally would fall into three categories including:

1. *Transportation improvements within the Project boundaries and necessary to serve the Project uses*. This category would encompass improvements such as new and improved streets and related circulation improvements including a new roadway on the Shipyard from the Innes gateway to the Crisp Road gateway and a new Candlestick Point arterial, transit-related improvements, and pedestrian and bicycle circulation improvements. Additionally, a new ferry terminal on the Hunters Point Shipyard shoreline to accommodate additional ferry service, and the construction of a bridge over Yosemite Slough are under consideration. A Hunters Point Shipyard Transit Center would be constructed adjacent to the new ferry terminal and a Candlestick Transit Center would be included in the Candlestick Point area. A traffic control center would be developed near the new stadium on the Shipyard to assist in managing game-day traffic. The transportation improvements in this category will be analyzed in the EIR.

2. *Transportation improvements that may be necessary to serve the Project and other local and regional development.* This category would include transportation improvements in the general area of the Project that would serve the Project but other local and regional development as well. Among transportation improvements that could be included in this category are, the widening of Harney Way from US 101 to Jamestown Avenue; Carroll Avenue improvements (reconstruction and re-striping); a Carroll Avenue extension from Third Street to Bayshore Boulevard; a Harney Way Bus Rapid Transit system from Bayshore Boulevard, possibly extending to the Shipyard, a Palou Transit Preferential Bus route, improvements on Illinois Street from Cesar Chavez to 25th Street and on 25th Street from Illinois to Pennsylvania Street, including the possible widening of the existing Illinois Street Bridge; and improvements to local intersections, including the intersection of Evans and Cesar Chavez. The EIR will evaluate whether, and the extent to

which, these or other improvements are necessary to serve the Project and other nearby development.

3. *Major transportation improvements proposed as separate projects.* Several major transportation projects are planned in the Project vicinity as part of local or regional transportation system improvements. Included in this category is a new US 101/Geneva/Harney interchange, with an extension of Geneva Avenue from Bayshore Boulevard, a Bayshore Transit Center, the Bayview Transportation Improvements Project (BTIP), and a new Oakdale Caltrain Station. The EIR will evaluate the implications of these transportation projects on the Project and other development in the area.

Infrastructure Improvements

The Project would require substantial new or improved utility infrastructure improvements, including but not be limited to, new water, sewer, drainage, and other services throughout the Project site:

- Low Pressure Water system – potable water and fire protection water from the University Mound Reservoir.
- Reclaimed Water – network of reclaimed water mains to serve future availability of reclaimed water used for dual plumbing in buildings and for irrigation of landscaped areas.
- High Pressure Water system – to serve fire flows and high-rise buildings.
- Separated Sanitary Sewer – to collect wastewater flows to be conveyed to the southeast Water Pollution Control Plant.
- Storm Drainage -- storm sewer system separate from the combined sewer system, designed to handle up to a five-year storm and ultimately discharge to San Francisco Bay.
- Overland Flow - for an event above a five-year storm and up to a 100-year storm, excess stormwater will be routed to San Francisco Bay by overland flow along the network of street gutters and roadway.
- Joint Trenches – to serve electrical, communications and gas utilities.

The EIR will evaluate the need for new or improved infrastructure and the proposed infrastructure improvements.

Redevelopment Plan Amendments

The Bayview Waterfront Project would require changes in the Redevelopment Area land use controls in the BVHP and Shipyard Redevelopment Plans. The adopted Shipyard Redevelopment Plan allows for a different mix of industrial and commercial uses on Shipyard Parcels C and D than the now-proposed Shipyard plan, either with or without the football stadium. The adopted BVHP Redevelopment Plan Candlestick Point Activity Node included a new San Francisco 49ers football stadium, and 1.2 million square feet of retail, instead of the now-proposed residential mixed-use plan. Accordingly, both the Shipyard and BVHP Redevelopment Plans would need to be amended to accommodate the proposed Project.

The BVHP Redevelopment Plan would be amended to add the India Basin Shoreline (Survey Area C) to the BVHP Project Area, and to add the zoning and land use controls resulting from the Planning Department rezoning efforts. The BVHP Plan would also be amended to allow public improvements to be financed and implemented.

PROJECT APPROVALS AND IMPLEMENTATION: The Bayview Waterfront Project requires numerous review and approval actions from the San Francisco Redevelopment Agency, the City and County of San Francisco, regional agencies, state agencies, and federal agencies, including:

San Francisco Redevelopment Agency Commission

City and County of San of San Francisco

Planning Commission
Municipal Transportation Agency
Recreation and Park Commission
Public Utilities Commission
San Francisco Housing Authority
Port Commission
Board of Supervisors

Regional Agencies

State Regional Water Quality Control Board
San Francisco Bay Conservation & Development Commission
Association of Bay Area Governments

State of California

Department of Parks & Recreation
Department of Fish & Game
Department of Transportation
State Lands Commission
Department of Toxic Substances Control

Federal Agencies

US Navy
US Army Corps of Engineers
US Fish & Wildlife Service
US Department of Housing & Urban Development

The Bayview Waterfront Project EIR will be a new EIR that will not supplement or tier off prior EIRs for the Bayview Hunters Point Redevelopment Plan or the Hunters Point Shipyard

Redevelopment Plan. The EIR will include a discussion of the projects compatibility with existing zoning and plans. Current public plans, policies and regulations pertinent to the Project site, based on the BVHP Plan, the Shipyard Plan, and nearby plans such as the proposed Executive Park General Plan Amendment, and the Visitacion Valley Project Area will be reviewed and summarized. The proposed Project will be evaluated in light of the General Plan, the Planning Code, and applicable City ordinances and regulations. Jurisdictions, regulations, policies, and guidelines of other City, regional, state, and federal agencies will be addressed. Plans for lands under the jurisdiction of Candlestick Point State Recreation Area will be reviewed.

PROBABLE ENVIRONMENTAL EFFECT TOPICS: The EIR will include the following topics, addressing existing conditions, Project-specific and cumulative effects, mitigation measures, and alternatives. The EIR will evaluate effects of a Candlestick Point-Hunters Point Shipyard Development Plan without a football stadium.

- Land Use and Zoning
- Visual Resources
- Population and Housing
- Cultural Resources
- Transportation and Circulation
- Noise
- Air Quality
- Wind
- Shadow
- Recreation
- Public Services and Utilities
- Biological Resources
- Geology and Soils
- Hydrology and Water Quality
- Hazards and Hazardous Materials
- Energy
- Growth Inducement

DATE: August 31, 2007

Stanley Muraoka	William Wycko
Environmental Review Officer	Acting Environmental Review Officer
San Francisco Redevelopment Agency	San Francisco Planning Department
FILE NO. ER06.05.07	FILE NO. 2007.0946E

Comment Letters

Stanley Muraoka/REDEV/SFGOV

09/12/2007 03:58 PM

To Bayview Waterfront

cc

bcc

Subject Comment on the Bayview Waterfront NOP

I received a voice message on Friday, September 7 from Bill Graziano, a resident of Palou Avenue in Bayview Hunters Point, and followed up with a phone conversation today. Mr Graziano is concerned about three topics:

1. Accessibility to the [South Basin] waterfront. Currently, there are industrial businesses along and off of Ingalls with property fronting the waterfront area. Consequently, there is no public access to the waterfront.
2. Aesthetics/neighborhood character. Related to the concern about waterfront access, is the concern about neighborhood character along the waterfront area, and how inviting (uninviting) the area is, particularly at night.
3. Traffic along Palou, particularly before and after events at the new 49ers stadium.

I believe topics 1 and 2 are appropriate for the land use and urban design discussions in the EIR and topics 1 and 3 are appropriate for inclusion in the transportation discussion.

Thanks,
Stan

Stanley Muraoka
Environmental Review Officer
San Francisco Redevelopment Agency
One South Van Ness Avenue, Fifth Floor
San Francisco, CA 94103

ph: 415-749-2577
fax: 415-749-2524
email: Stanley.Muraoka@sfgov.org

Literacy for Environmental Justice

Sept 13, 2007

Dear Stan:

Sub: Case # ER06.05.07 & 2007.0946E
Bayview Waterfront Project.

Thank you for sending us the NOP of an EIR.

PLEASE INCLUDE US IN YOUR LIST OF RECIPIENTS FOR THE DRAFT EIR & ALL SUBSEQUENT DOCUMENTS PERTAINING TO THIS PROJECT.

THANK YOU.

Sudeep M. Rao.

COMMENT: THE ZONING CHANGES PROPOSED MUST ENSURE THAT EVEN ~~T~~ THOUGH THERE WILL BE INDUSTRIAL COVERS & BUILDINGS, THE CLEANUP OF THE SHIPYARD MUST BE TO RESIDENTIAL STANDARDS.

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BRISBANE
CALIFORNIA

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(415) 508-2100
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September 17, 2007

Stanley Muraoka
Environmental Review Officer
San Francisco Redevelopment Agency
One South Van Ness Avenue, 5th Floor
San Francisco, CA 94103

Re: EIR NOP- Cases ER06.05.07 and 2007.0946E (Bayview Waterfront Project)

Dear Mr. Muraoka:

Thank you for the opportunity to review the above-referenced Notice of Preparation. While the City of Brisbane generally concurs with the list of topics to be addressed in the forthcoming EIR, we have concerns with the characterization of certain transportation improvements on Pages 9 and 10 of the NOP.

Specifically, the new US 101/Geneva/Harney interchange and Geneva Avenue extension are referenced as "major transportation improvements which are proposed as separate projects" and that "The EIR will evaluate the implications of these transportation projects on the Project." This implies that the design and construction of these improvements are a given, when neither final designs nor funding strategies or commitments for implementation are currently in place, and construction timing is unknown. To more accurately reflect the relationship of the Project to these future transportation improvements, the City of Brisbane recommends that the Geneva interchange and Geneva extension projects be characterized as "transportation improvements that may be necessary to serve the Project and other local and regional development" and that the Project impacts be evaluated in this context.

Thank you for your consideration, and we look forward to reviewing the draft EIR when published. Should you have any questions regarding this letter, please contact me at 415.508.2120, or City Engineer Randy Breault at 415.508.2130.

Sincerely,

John A. Swiecki, AICP
Principal Planner

c: Randy Breault, City Engineer

State of California • The Resources Agency
Arnold Schwarzenegger, *Governor*
DEPARTMENT OF PARKS AND RECREATION
Ruth G. Coleman, *Director*
Diablo Vista District
845 Casa Grande Road
Petaluma, California 94954

Stanley Muraoka
San Francisco Redevelopment Agency
One South Van Ness Avenue
San Francisco, CA 94103

September 21, 2007

RE: Bayview Waterfront Project Notice of Preparation of Draft Environmental Impact Report, SCH #2007082168

Dear Mr. Muraoka,

Thank you for the opportunity to comment on the Bayview Waterfront Project Notice of Preparation of Draft Environmental Impact Report, SCH #2007082168. Candlestick Point State Recreation Area (SRA) is of statewide significance because it is the first State Park System unit purposely acquired to bring State Park System values into an urban setting. In addition, Candlestick Point SRA provides critical open space and shoreline protection along the most significant estuarine system in California. Candlestick Point SRA provides open space and recreational opportunities to millions of citizens who live within the greater bay area urban context. Candlestick Point SRA includes approximately 134 acres, and was classified as a SRA by the State Park and Recreation Commission since it is capable of withstanding extensive human impact.

Candlestick Point SRA includes approximately three miles of bay shoreline. Of particular interest is the Yosemite Slough Habitat Restoration project, which is scheduled to begin during the spring of 2008. The Yosemite Slough project will restore tidal wetlands in a 34 acre parcel within the park unit, as well as providing interpretive trails and an interpretive center. State Parks is currently in talks with the United States Navy and looks forward to working with the Navy in their efforts to restore tidal and freshwater wetlands that are adjacent to Yosemite Slough. State Park staff has also been involved with the San Francisco Department of Public Works Third Street Bypass project.

The Candlestick Point SRA General Plan was adopted by the State park Commission on May 8, 1987. The Candlestick Point SRA General Plan provides guidance on all future and proposed development and management within the park unit. The Candlestick Point SRA General Plan includes the following objectives:

- Identify valuable land acquisition opportunities outside the existing park boundaries.

- •Determine the potential environmental impacts of visitor activities and land uses within the park unit.
- •Increase the quality of urban life, and install a sense of responsibility and pride in the environment around the city.
- •Identify and understand the ecological life styles of the San Francisco shoreline and its natural and cultural resources.
- •Identify the surrounding influences on the site and the recreational and human resources of the San Francisco Bay.
- •Provide public accessibility to the shoreline of San Francisco Bay.
- •Expand visitor opportunities for reflection, appreciation, and enjoyment of natural, cultural, recreational, and human resources.
- •Identify the need for paid and voluntary public participation in building, maintaining, and programming the unit facilities.
- •Establish policies for management, protection, and interpretation of the park resources.
- •Recommend additional studies beyond the scope of the Candlestick Point SRA.

In addition to the above listed objectives, the Candlestick point SRA General Plan identifies the following activities that could be developed within the SRA:

- •Concession facilities including a first class restaurant, bike rentals, small food service, bait and tackle shop, ferry service, and transient boat docking.
- •Trails for hiking, biking, jogging, wheelchair, and emergency vehicle service access.
- •Group and family picnic areas and campgrounds
- •Fishing piers
- •Non-powered boat rental and Wind surfing facilities
- •Boating center and boat access facility
- •Sand Beach and quiet areas
- •Cultural program center
- •Open grassy areas
- •Service area (maintenance and service yard)

The Bayview Waterfront Project has identified Candlestick Point SRA as part of the project area, as outlined in Figure 2 of the NOP. Candlestick Point SRA currently has an approved general plan for the park unit. Any redevelopment proposals targeted within the Candlestick Point SRA, that are not consistent with the purpose and scope of the existing Candlestick Point SRA General Plan may require the following:

1) Extensive public input and review
2) Adoption by State Parks and the public
3) Possible amendments to the general plan
4) Update the existing general plan with a new general plan
5) Regulatory review and permitting approval
6) State Park real property and acquisition review and or approval
7) State Park Commission review and approval
8) Special land use planning studies
9) Special landfill, natural, cultural and recreational studies

While moving through the planning process it is critical to bring forward the primary purpose of the candlestick Point SRA; which is to make available to the people recreational opportunities, both passive and active, that are offered by the shoreline, waters, and environment of the San Francisco Bay and the adjacent bay waters. The Lands and resources of the site may be modified or enhanced to achieve optimum realization of this recreation potential. When determining what recreational activities should be provided and or developed at Candlestick Point SRA, the primary concern should be to meet the needs of the people(primarily urban dwellers) in conformity with maintaining a desirable physical setting on the bayshore.

The design criteria for Candlestick Point SRA improvements should create an environment which supports the physical, social, psychological, economic, and esthetic needs of both the local and regional bay area communities that will use the park unit in the future.

On page 8 of the NOP there is mention of a possible land exchange with State Parks for lands currently owned by the US Navy, and that there would be a net increase in State Park land. While this may sound good in concept, State Parks is aware of the Navy's parcel E, E2, and F Remediation Investigation and Feasibility Studies and has concern over the location and extent of hazardous substances, ground water contamination, radiological contamination, and PCB contamination in the parcel E, F, and E2 shoreline areas, and has concern over US Navy full and partial remediation measures in areas to be considered or targeted as part of a future land exchange. State Park staff has additional concerns over current US Navy tidal wetland design plans and shoreline restoration designs that may pose management challenges if identified as part of a land exchange.

Page 9 of the NOP focuses on transportation improvements within the project boundaries and mentions construction of a bridge over Yosemite Slough as being under consideration. To date, State Parks has taken the position that the bridge options, which have been identified as part of the City's Third Street Bypass project, are not consistent with the current general plan. The Yosemite Slough bridge options may also compromise the Yosemite Slough tidal wetland restoration project as well as bisect an existing State Park. Through the planning process we look forward to identifying transportation alternatives.

Other concerns include storm water discharge into the bay from the project area. Storm water runoff should be collected and treated in accordance with all regulatory conditions, prior to being discharged into the bay and or shoreline areas within Candlestick Point SRA. While we understand there are runoff limits of capacity for long duration high intensity storm events, we also believe redevelopment is a prime opportunity to integrate state of the art engineering practices and options (such as bioswales, storm septors, underground collection systems and various forms of oil and grease separator systems), that can assist in the treatment process prior to being discharged into the bay and or shoreline areas of Candlestick Point SRA.

State Park staff have been actively involved with local planning issues that may directly or indirectly influence Candlestick Point SRA. State Park staff are aware of the Hunter's Point Redevelopment planning effort and are very excited to be part of this planning process. It is the sincere hope of State Parks that redevelopment efforts adopt plans that reflect local and regional interests. State Parks believes this is an excellent opportunity to create a state of the art urban park unit that will be a focal point of activity for decades to come. We look forward to being an integral part of the planning process.

Thank you for the opportunity to provide comment on the Bayview Waterfront Project Notice of Preparation of Draft Environmental Impact Report, SCH #2007082168. If you have any questions please contact me anytime.

Sincerely,

Stephen Bachman
Associate Park & Recreation Specialist
(707)769-5652 xtn 21

cc: Donald Monahan, District Superintendent
State Clearinghouse
Natural Resources Division
California Department of Water Resources

Arc Ecology
4634 Third Street
San Francisco, California 94124

October 1, 2007

Mr. Stanley Muraoka
Environmental Review Officer
San Francisco Redevelopment Agency
One South Van Ness Avenue 5th Floor
San Francisco, California 94103
By *e-mail*: Stanley Muraoka <Stanley.Muraoka@SFGOV.ORG>

RE: BAYVIEW WATERFRONT PROJECT NOTICE OF PREPARATION
SFRA File No. ER06.05.07

Dear Mr. Muraoka:

Thank you for the opportunity to submit our concerns about the Notice of Preparation referenced above. First I would like to acknowledge some promising features of the environmental review process as indicated by the NOP text:

- apparent effort to define a comprehensive project rather than to segment into separate EIRs;
- designation of all mandatory impact categories as potentially significant;
- decision not to supplement or tier this EIR off of previous EIRs;
- two scoping sessions.

Nonetheless, we have serious concerns about the NOP itself and its implications for adequate environmental review of this huge project – one that lacks the benefit of substantial public participation. The deficit of community involvement in the project's planning places a great burden on the environmental review process to devise alternatives that reflect the vision and goals of the Bayview-Hunters Point community. An NOP that reassures the public that they will ultimately have an opportunity to participate in planning a project that does not impose negative impacts on the surrounding community would help to gain public acceptance of a final project. Several features of the NOP and the EIR it promises would need to be modified to ensure such an outcome.

Our specific concerns fall into the following categories:

- NOP shortcomings
  - changes to the project since publication of the NOP
  - lack of an Initial Study
  - lack of a map of changes to the roadway system
  - public notice
- level of environmental review is unclear.
- non-mandatory impacts to analyze
- project alternatives
  - must bracket the uncertainties, conflicting views, and unresolved political questions about main features of the project (e.g., stadium, bridge over Yosemite Slough, conflicting State Park plan)
  - must provide for active public participation in their formation
  - need for full, rather than normal abbreviated environmental analysis

We request that you revise and recirculate the NOP, so that it provides

- a consistent project description that clearly distinguishes the project from potential mitigation measures;
- an Initial Study;
- a commitment to provide public notice to organizations and individuals that have participated in the planning and the environmental review processes for Bayview Hunters Point and the Hunters Point Shipyard redevelopment projects;
- a map of the changes to the roadway system within and serving the project;
- a commitment to prepare a Master EIR;
- a public participation process that will be used to develop project alternatives;
- a commitment to providing full environmental analysis of the project alternatives; and
- a commitment to analyze environmental justice, economic, and social impacts even though these are not required by CEQA.

Our concerns, described in greater detail, are attached.

Yours truly,

Eve Bach

Eve Bach
Staff Economist/Planner

cc: Hunters Point Shipyard Citizens Advisory Committee
Bayview Hunters Point Project Area Committee
San Francisco Board of Supervisors2

ARC ECOLOGY CONCERNS ABOUT
THE BAYVIEW WATERFRONT PROJECT NOP

I.NOP Shortcomings

Unclear Project boundaries

The environmental review staff distributed a revised diagram of the project at the September 25th Scoping Meeting that slightly revised the boundaries of the India Basin Shoreline Plan (Area C). However, the NOP maps are inconsistent with the NOP text (page 9) that identifies the construction of a bridge over Yosemite Slough as a transportation improvement "**within the Project boundaries** and necessary to serve the Project uses." [emphasis added] In contrast, this text *is* consistent with maps displayed at the meeting, which included the area surrounding Yosemite Slough and the shoreline area along Candlestick Cove to the west of Candlestick Point as part of the project.

This inconsistency, and apparent official uncertainty about the definition of the Project is a symptom of a much bigger problem. The NOP currently treats the roadway changes,, including the much-debated bridge over Yosemite Slough as if it is merely a mitigation for the development of the three sites. Since on-going, extensive studies of the bridge predate the current project, it is apparent that the roadway changes themselves represent a major project. The scale and the potential impact of the roadway changes are obscured by this treatment by the NOP, which presumably foreshadows the EIR.

Lack of an Initial Study

It is unfortunate that this NOP does not include an Initial Study, or even discussion (as opposed to a listing) of the Project's potentially significant environmental impacts. Even though an Initial Study is not required since the EIR will analyze all of the required impact areas,[1] omitting it deprives the public of information about the City's preliminary thinking about the Project's impacts, and precludes us from identifying specific gaps, and from providing supplementary information.

In the case of this Project, which is not the product of a public planning process, transparency about the City's views of its environmental impacts is especially needed. One of the purposes of an Initial Study is to "facilitate environmental assessment early in the design of a project."[2]This early environmental assessment is also needed for further articulation of the preferred alternative, and for the design of project alternatives.

Lack of a map of changes to the roadway system

Greater transparency is also needed in the discussion of the major changes being considered to the neighborhood, city, and regional circulation system . The description of these changes is buried in the text of the NOP and is presented as if they are incidental to the Project rather than the major, highly controversial transportation project that has been under consideration for several years. A map of the changes is needed to inform the public as early as possible of a project that will have major impacts on their living environment.

Public notice

We are puzzled why Arc Ecology was not directly notified about this NOP, despite the fact that we have consistently participated in all planning processes for Shipyard redevelopment, and have commented extensively on all environmental review documents related to the Shipyard. A mailing list should be

1 PRC §15060
2 PRC § 15063(c)(4)

developed that notifies all members of the community who have demonstrated interest in this project, to be used to notify them of the availability of environmental review documents.

II.Level of environmental review is unclear.

> "An EIR for a redevelopment plan may be a Master EIR, a program EIR, or a project EIR. An EIR for a redevelopment plan must specify whether it is a Master EIR, a program EIR, or a project EIR." [3]

There appears to be some confusion or changes in the City's thinking about the level of environmental review that will be undertaken. The NOP states that the EIR will provide project-level review of the development plan and India Basin Shoreline area, and program level analysis for the India Base Shoreline Plan.[4] At the scoping session, Planning Department staff announced that that entire EIR would be programmatic.

Given the scale and many interlocking governmental decisions that comprise this Project (e.g., revision of several elements of the City's General Plan and zoning, amendments to two redevelopment plans, revision of the master plan for state parklands, at least three large scale development projects, reconfiguration of circulation patterns for the entire southeast quadrant of the city), it is premature for this EIR to attempt to provide project-level analysis for any of its components.

Instead, this EIR should be structured as a Master EIR[5] to provide an overview of the Project's combined environmental impacts, with subsequent project-level environmental review that thoroughly analyzes each of the components.

III.Non-mandatory impacts to analyze

Although CEQA does not mandate, neither does it prohibit the EIR from including an analysis of environmental justice impacts. Similarly, the economic and social impacts of the project should be thoroughly analyzed. This project is massive, and has the potential to irrevocably alter the demographics and economic base as well as the environmental conditions of the southeastern sector of the City. A holistic approach is needed.

IV.Project alternatives

Due to the unusually high level of uncertainty and public participation thus far associated with the sports stadium that is the central feature driving this Project, there is a greater than normal chance the a project alternative will ultimately be selected. The absence of public participation in the the design of the Project argues for alternatives that are the product of a community planning process. The controversy that has surrounded the proposed bridge across Yosemite Slough argues for environmental analysis of the alternative routes that have been elaborated in extensive studies over the past few years.

Since these alternatives could become preferred to the currently proposed Project, it is important that the EIR analyze them with the same level of rigor and detail as the proposed Project, instead of giving the perfunctory attention that is the fate of most EIR alternative projects.

3 PRC §15180 (a)
4 NOP page 4
5 PRC § 15176 - 15179

MEMORANDUM

SAN FRANCISCO REDEVELOPMENT AGENCY

Date: October 9, 2007

To: File

From: Stanley Muraoka

RE: Bayview Waterfront Project EIR

Call received October 4, 2007:

Brad McCrea
Acting Chief of Permits
San Francisco Bay Conservation and Development Commission
50 California Street, Suite 2600
San Francisco, CA 94111
bradm@bcdc.ca.gov
415-352-3615

Mr. McCrea left the following voicemail message:

The project area shown in the NOP is within (1) BCDC priority use areas and the (2) 100 foot jurisdiction band; these should be shown on the map. Refer to the San Francisco Bay Plan at the BCDC website, particularly the plan maps that show recreation use areas at Candlestick Point and India Basin and a port priority use area [at the Shipyard]: http://www.bcdc.ca.gov/index.php?p=633.

[BCDC] will be commenting on the Draft EIR.

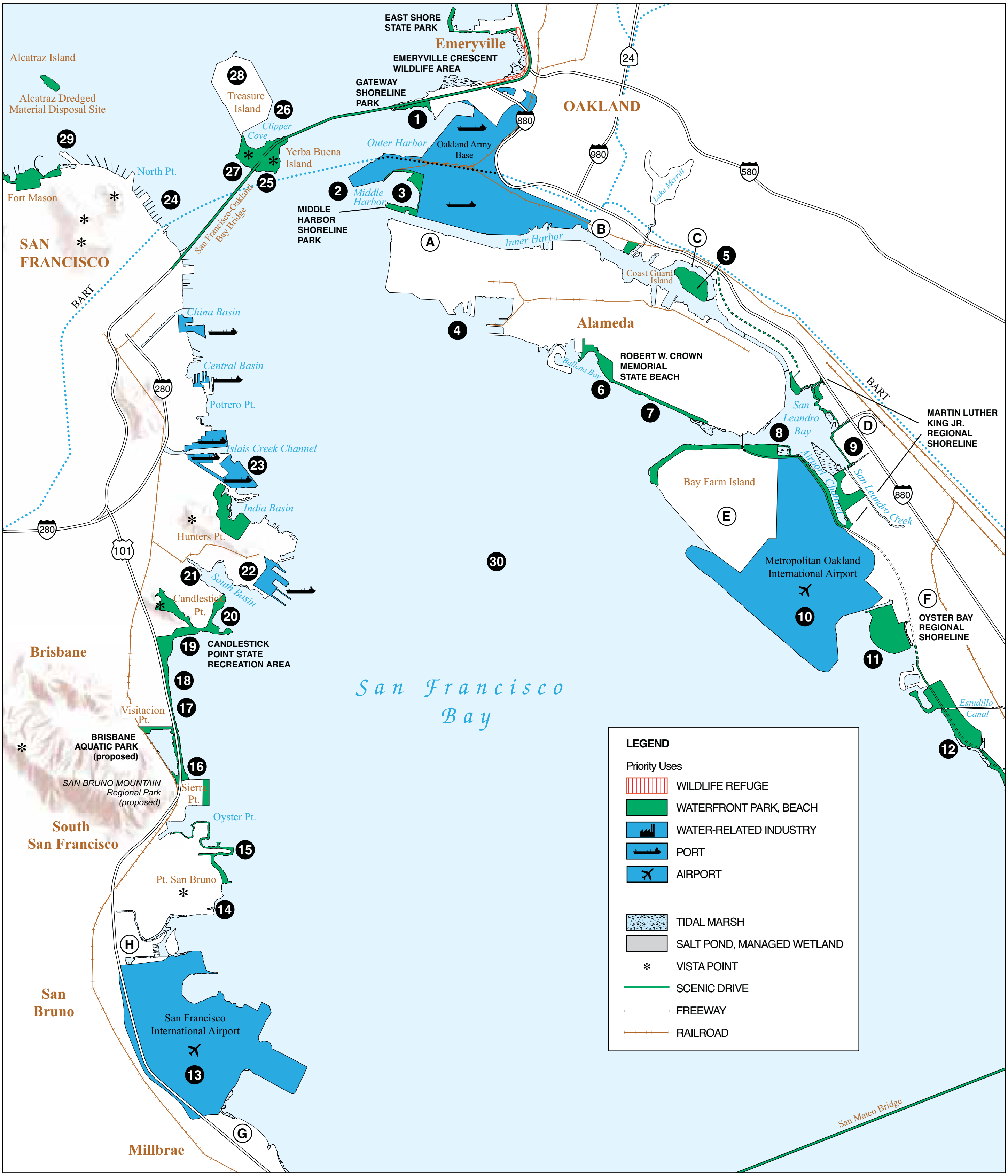
Plan Map 5

Central Bay

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

NORTH



SAN FRANCISCO BAY TRAIL

RECEIVED
SFRA
OCT 0 4 2007
1-2973-103
RECORDS DEPT.

September 27, 2007

Stanley Muraoka
San Francisco Redevelopment Authority
One South Van Ness, Fifth Floor
San Francisco, CA 94103

Subject: Bayview Waterfront Project Notice of Preparation of an EIR—Case #'s ER06.05.07 and 2007.0946E

Dear Mr. Muraoka:

Thank you for the opportunity to comment on the above referenced document. The Bay Trail Project is a nonprofit organization administered by the Association of Bay Area Governments (ABAG) that plans, promotes and advocates for the implementation of a continuous 500-mile bicycling and hiking path around San Francisco Bay. When complete, the trail will pass through 47 cities, all nine Bay Area counties, and cross seven toll bridges. To date, slightly more than half the length of the Bay Trail alignment has been developed.

Background

The Bay Trail in San Francisco is approximately 24 miles long. 12 miles are complete, with the majority of the incomplete segments located south of the Oakland-San Francisco Bay Bridge. Two main goals of the Bay Trail Project are to locate the trail as close as possible to the shoreline, and to provide a fully separated, multi-use bicycle/pedestrian facility. The redevelopment of the Hunters Point Shipyard, Candlestick Point and India Basin represent a phenomenal opportunity to provide these historically park/open space-poor neighborhoods with high-quality waterfront access.

Plans and Policies

In the DEIR, please discuss the ABAG Bay Trail Plan and its policies, and how the proposed development will address each relevant topic. We are pleased to note that the proposed Bay Trail alignment in the NOP announcement for the Hunter's Point /Candlestick areas appear to be located in large part directly adjacent to the shoreline—a key goal of the Bay Trail Plan. It is of the utmost importance that this shoreline alignment not be sacrificed or moved inland for any reason. There is only one Bay edge and the residents of southern San Francisco have been denied meaningful access to this scarce resource for decades.

Please describe in detail, through plans and/or artist rendering, the proposed width and location of the trail, and proposed trail furnishings. It appears as though there may be several opportunities for people to use existing or refurbished piers over the water—please describe these opportunities.

Administered by the Association of Bay Area Governments
P.O. Box 2050 • Oakland California 94604-2050
Joseph P. Bort MetroCenter • 101 Eighth Street • Oakland California 94607-4756
Phone: 510•464•7935
Fax: 510•464•7970

India Basin

While the Bay Trail is clearly depicted in Figure 3, "Hunters Point Shipyard Development Plan Area", Figure 2, "Bayview Waterfront Project Areas" does not show the Bay Trail alignment in any of the planning areas. The Bay Trail currently exists on the northern side of India Basin Shoreline Park, with a significant and long-standing gap along the waterfront between India Basin and India Basin Open Space Preserve where a boatyard and the paper street "Hudson" currently exist. Please review the attached map and describe how the proposed development will incorporate this alignment at India Basin.

Transportation Improvements

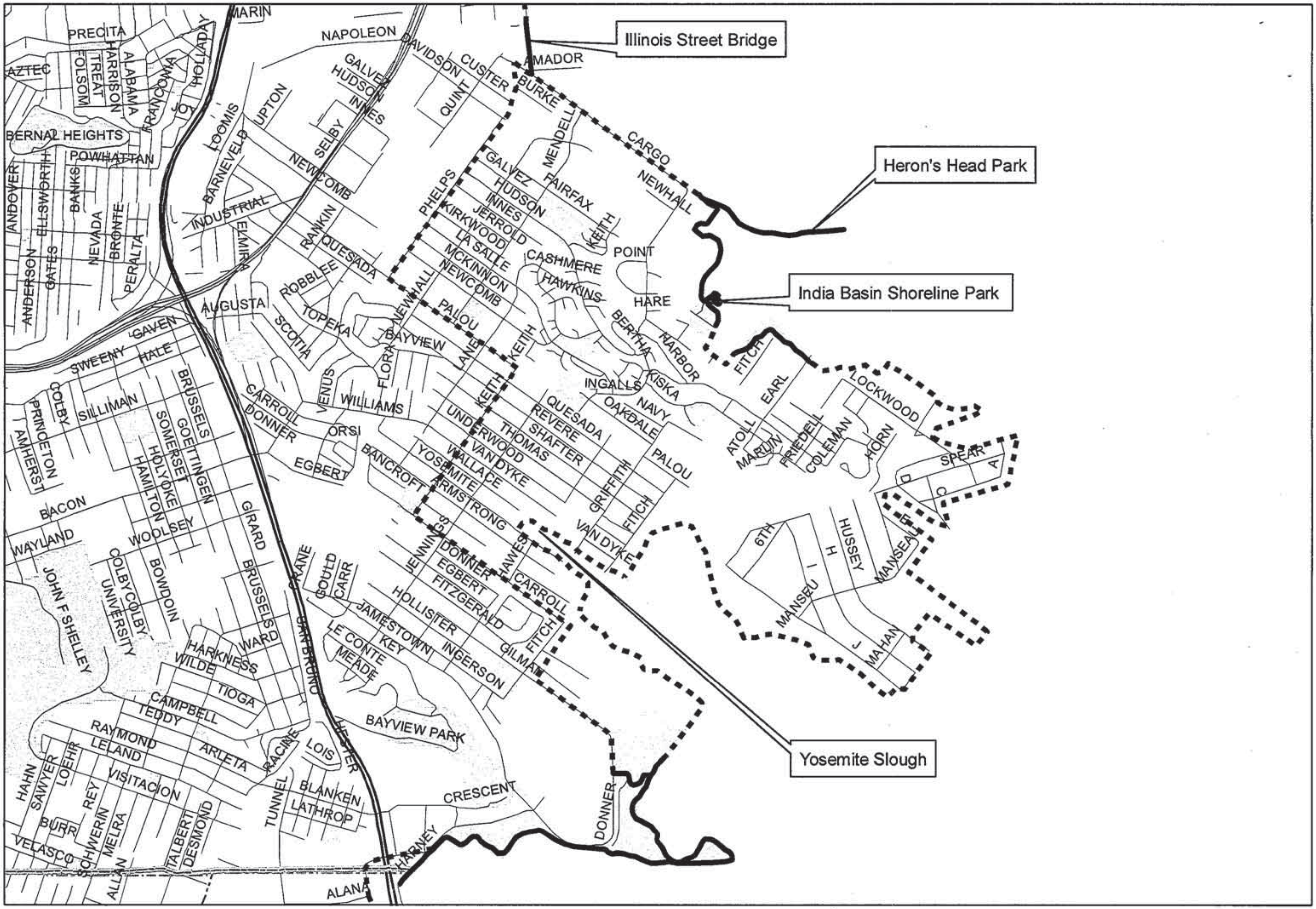
The announcement regarding the NOP references potential widening of Harney Way from US 101 to Jamestown Avenue, Carroll Avenue improvements and extension, and the possible widening of the Illinois Street Bridge. The long-term goal for the Bay Trail in this area is to secure and build a continuous, multi-use pathway directly adjacent to the shoreline and to eventually remove the on-street alignments on Keith, Phelps, Palou, Fitch, Carroll and Gilman streets. The Illinois Street Bridge and Harney Way will remain the spine alignment connecting Hunter's Point to the rest of the City to the north via Cargo Way, and to San Mateo County to the south via Harney Way. If any improvements are made to the recently-constructed Illinois Street Bridge, it will be important to ensure that bicycle and pedestrian facilities are provided as the Bay Trail recently supported the inclusion of these amenities with a $250,000 construction grant to the Port of San Francisco.

If you have any questions regarding the Bay Trail in the Bayview Hunters Point Redevelopment Area, please do not hesitate to contact me at (510) 464-7909, or by e-mail at maureeng@abag.ca.gov.

Sincerely,

Maureen Gaffney
Bay Trail Planner

Enc: 1



San Francisco Bay Trail

India Basin/Hunter's Point/Candlestick Point

Existing Bay Trail

Proposed Bay Trail

0 0.3 Miles

Bay Trail

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF TRANSPORTATION
111 GRAND AVENUE
P. O. BOX 23660
OAKLAND, CA 94623-0660
PHONE (510) 286-5505
FAX (510) 286-5559
TTY 711

Flex your power!
Be energy efficient!

October 1, 2007

Mr. Stanley Muraoko
San Francisco Redevelopment Agency
One South Van Ness Avenue
San Francisco, CA 94103

SF101173
SF-101
SCH#2007082168

Dear Mr. Muraoko:

Bayview Waterfront Project – Notice of Preparation (NOP)

Thank you for including the California Department of Transportation (Department) in the early stages of the environmental review process for the proposed project. The comments presented below are based on the NOP of an Environmental Impact Report (EIR) for the Bayview Waterfront Project. As lead agencies, the San Francisco Planning Department and the San Francisco Redevelopment Agency are responsible for all project mitigation, including improvements to state highways. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures in the EIR. Any required roadway improvements should be completed prior to the issuance of a certificate of occupancy. While an encroachment permit is only required when the project involves work in the State Right of Way (ROW), the Department will not issue an encroachment permit until our concerns are adequately addressed. Therefore, we strongly recommend that the lead agencies ensure resolution of the Department's concerns prior to submittal of an encroachment permit application. Further comments will be provided during the encroachment permit process; see the end of this letter for more information regarding encroachment permits.

Traffic Impact Study

Our primary concern with the project is the potentially significant impact it may have to traffic volume and congestion on the State Highway System.

US 101 is a critical route for regional and interregional traffic in the San Francisco Bay Area. It is vital to commuting, goods movement, and recreational traffic and is one of the most congested freeways in the region. US 101 is a significant connection between San Francisco, the San Francisco International Airport, San Mateo and Santa Clara counties, as well as the Eastbay and Sacramento metropolitan regions. Although redevelopment and economic vitality are goals, consideration should be given to the impacts of recurrent traffic based primarily on the planned employment, residential, and retail development. The residential and employment population density per square mile should be determined.

Consider developing and applying pedestrian and bicycling performance measures as a means of evaluating project impacts on pedestrians and bicyclists. These could include sidewalk crowding, intersection crossing distances, and speed of traffic. Mitigation measures resulting from this analysis could improve pedestrian and bicycle access to transit, thereby reducing traffic impacts on US 101. Also, please analyze secondary impacts on pedestrians and bicyclists that may result from any mitigation measures for traffic impacts. Please describe any pedestrian and bicycle mitigation measures that would in turn be needed as a means of maintaining and improving access to transit and reducing traffic impacts on US 101 (for example, pedestrian treatments to counteract safety impacts from widening intersections to accommodate more traffic).

The traffic impact study should also include the following:

1. Information on the project's traffic impacts in terms of trip generation, distribution, and assignment. The assumptions and methodologies used in compiling this information should be addressed.

2. Average Daily Traffic (ADT) and AM and PM peak hour volumes on all significantly affected streets and highways, including crossroads and controlling intersections.

3. Schematic illustration of the traffic conditions for: 1) existing, 2) existing plus project, and 3) cumulative for the intersections in the project area.

4. Calculation of cumulative traffic volumes should consider all traffic-generating developments, both existing and future, that would affect the State Highway facilities being evaluated.

5. Mitigation measures should consider highway and non-highway improvements and services. Special attention should be given to the development of alternate solutions to circulation problems that do not rely on increased highway construction.

6. All mitigation measures proposed should be fully discussed, including financing, scheduling, implementation responsibilities, and lead agency monitoring.

We encourage the San Francisco Planning Department and the San Francisco Redevelopment Agency to coordinate preparation of the study with our office, and we would appreciate the opportunity to review the scope of work. Please see the Caltrans' *"Guide for the Preparation of Traffic Impact Studies"* at the following website for more information: http://www.dot.ca.gov/hq/traffops/developserv/operationalsystems/reports/tisguide.pdf

Please also address the impacts to noise and air quality in the EIR. What mitigation measures will be taken to offset the impacts? Also, include a detailed program to monitor the heavy metals and volatile organic compounds, if present.

We look forward to reviewing the traffic study, including Technical Appendices, and EIR for this project. Please send two copies to the address at the top of this letterhead, marked ATTN: Lisa Carboni, Mail Stop #10D.

Encroachment Permit

Any work or traffic control within the State ROW requires an encroachment permit that is issued by the Department. Traffic-related mitigation measures will be incorporated into the construction plans during the encroachment permit process. See the following website link for more information: http://www.dot.ca.gov/hq/traffops/developserv/permits/

To apply for an encroachment permit, submit a completed encroachment permit application, environmental documentation, and five (5) sets of plans which clearly indicate State ROW to the address at the top of this letterhead, marked ATTN: Michael Condie, Mail Stop #5E.

Should you have any questions regarding this letter, please call Lisa Carboni at (510) 622-5491.

Sincerely,

Timothy C. Sable

TIMOTHY C. SABLE
District Branch Chief
IGR/CEQA

c: State Clearinghouse

STATE OF CALIFORNIA

Arnold Schwarzenegger, *Governor*

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

September 28, 2007

Stanley Muraoka
San Francisco Redevelopment Agency
One South Van Ness
San Francisco, CA 94103

RE: Bayview Waterfront Project, SCH# 2007082168

Dear Mr. Muraoka:

As the state agency responsible for rail safety within California, we recommend that any development projects planned adjacent to or near the rail corridor in the County be planned with the safety of the rail corridor in mind. New developments may increase traffic volumes not only on streets and at intersections, but also at at-grade highway-rail crossings. This includes considering pedestrian circulation patterns/destinations with respect to railroad right-of-way (ROW).

Safety factors to consider include, but not limited to, improvements to existing at-grade highway-rail crossings due to the increase in traffic volumes and appropriate fencing to limit the access of trespassers onto the railroad right-of-way. Any project that includes a modification to an existing crossing or proposes a new crossing is legally required to obtain authority from the Commission. If the project includes a new proposed crossing, the Commission will be a responsible party under CEQA and the impacts of the crossing must be discussed within the environmental documents.

Of specific concern is that the unused tracks leading to the former Hunter Pont Shipyard be removed as mitigation for any development in the area.

The above-mentioned safety improvements should be considered when approval is sought for the new development. Working with Commission staff early in the conceptual design phase will help improve the safety to motorists and pedestrians in the County.

If you have any questions in this matter, please call me at (415) 703-2795.

Very truly yours,

Kevin Boles
Environmental Specialist
Rail Crossings Engineering Section
Consumer Protection and Safety Division

Appendix A1 PBS&J, Analysis of Project Development Schedule Modifications and Environmental Impact Report, April 10, 2010

memo

PBS&J

To: San Francisco Redevelopment Agency
San Francisco Planning Department

From: Alison Rondone, Senior Project Manager

CC:

Date: 4/10/2010

Re: Analysis of Project Development Schedule Modifications and Environmental Impact Report

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Since publication of the Draft EIR, modifications have been made in the Project Development Schedule, as outlined in Section B.1 (Project Refinements) of the C&R document.

Total development remains the same as identified in the Draft EIR. Project Documents provide for the horizontal land development of the Project to be built out in four Major Phases, with vertical development occurring during that period and beyond. Specifically, Major Phase 1 (2011–2019) includes demolition and abatement between 2011 and 2015, utilities and infrastructure improvements from 2013 to 2017, and structural shoreline improvements from 2013 to 2017. The rebuilding of Alice Griffith, together with the development of 3,160 residential units, 84,000 sf of neighborhood retail, 583,000 of R&D, and 38,000 of community facilities would occur in Major Phase 1. Also, if the 49ers satisfy the Stadium Conditions, the Developer must build significant infrastructure for the new 49ers stadium in the first Major Phase. Major Phase 2 (2016–2021) would include development of 2,005 residential units, 635,000 sf of regional retail, 76,000 sf of neighborhood retail, 150,000 sf of office, 150,000 sf hotel, 842,000 sf R&D, the 10,000-seat performance venue, and 50,000 sf of community facilities in CP North, CP Center, HPS North, HPS Village Center, and the R&D District on HPS Phase II. Major Phase 3 (2020–2027) would include development of 2,505 residential units, 90,000 sf of neighborhood retail, and 1,075,000 sf in CP North, CP Center, CP South, and completion of the R&D District on HPS Phase II. Major Phase 4 would include development of 2,830 residential units and 12,000 sf of community facilities in the Jamestown District and CP South. Full build-out of HPS Phase II would occur by 2027 and full build-out of Candlestick Point would occur in 2031, with final occupancy in 2032. The following table provides a comparison of the original development schedule and the schedule as revised.

Appropriate text changes have been made throughout the EIR to correct information related to the development schedule, and a thorough review of each technical section of the EIR has been done to determine whether the schedule changes would affect the analysis contained in the EIR. The following determinations were made:

Comparison of Draft EIR and Revised Development Schedule (previous schedule shown shaded)											
		Completion Year									
Use	***Development Area***	***2017***	***2019***	***2021***	***2023***	***2025***	***2027***	***2029***	***2032***	***Subtotal***	***Total***
Residential Units	CP	795	1,000	2,680	1,515	3,220	2,505	1,155	2,830	7,850	10,500
	HPS	2,325	2,160	325	490	—	—	—	—	2,650	
Regional Retail (gsf)	CP	—	—	635,000	635,000	—	—	—	—	635,000	635,000
	HPS	—	—	—	—	—	—	—	—	—	
Neighborhood Retail (gsf)	CP	—	—	125,000	35,000	—	90,000	—	—	125,000	250,000
	HPS	60,000	84,000	65,000	41,000	—	—	—	—	125,000	
Office (gsf)	CP	—	—	150,000	150,000	—	—	—	—	150,000	150,000
	HPS	—	—	—	—	—	—	—	—	—	
Hotel (gsf)	CP	—	—	150,000	150,000	—	—	—	—	150,000	150,000
	HPS	—	—	—	—	—	—	—	—	—	
R&D (gsf)	CP	—	—	—	—	—	—	—	—	—	2,500,000
	HPS	2,278,000	583,000	222,000	842,000	—	1,075,000	—	—	2,500,000	
Community Services (gsf)	CP	—	—	50,000	50,000	—	—	—	—	50,000	100,000
	HPS	—	38,000	50,000	—	—	—	—	12,000	50,000	
Performance Venue (gsf/seats)	CP	—	—	10,000	10,000	—	—	—	—	10,000	10,000
Stadium (Seats)	HPS	69,000	69,000	—	—	—	—	—	—	69,000	69,000

SOURCE: Lennar Urban, 2010.

The impacts of a revised development schedule for both the Project and the Variants would be the same for most resource areas (Land Use and Plans, Population, Housing, and Employment, Aesthetics, Wind, Shadow, Cultural Resources and Paleontological Resources, Hazards and Hazardous Materials, Geology and Soils, Hydrology and Water Quality, Public Services, Recreation, and Utilities) as identified in the Draft EIR with respect to all construction and operational impacts, because these resource areas are dependent on intensity and types of land uses, amount of land coverage, specific areas developed, and overall size of the Project, not on when or for how long development occurs. The changes in the Development Schedule are focused on spreading development of R&D over a longer period and more equally distributing development of residential units across the phases. Generally, the order of development on the site remains the same. The first phase focuses on development of the stadium, HPS North, and rebuilding Alice Griffith Housing, the same as analyzed in the EIR. Subsequent phases follow the same general development pattern as analyzed in the EIR, including scheduling development of retail and parks to correspond with the appropriate level of residential development to support these uses. HPS Village Center development would follow the development of HPS North, and the pattern of development on Candlestick Point would remain substantially the same as analyzed, only beginning and ending two years later.

Analysis of impacts with respect to Land Use focus on division of an established community, consistency with applicable land use plans, and secondary land use effects. Land Use thresholds of significance are not time-dependent, and impacts would be the same regardless of when or over what period of time a project is constructed.

With regard to Population, Housing, & Employment, growth projections to 2030 were used in the Draft EIR. These data remain the most up-to-date growth projections available, and the analysis of the Project with full build-out at 2032 instead of 2030 would not change the significance conclusions in the EIR. In the future, citywide household sizes are expected to stay relatively constant or shrink slightly as a result of changing demographic trends.[1] Factors contributing to a decrease in household size include smaller family size and lower birth rates, a greater prevalence of single-person households, longer life spans, greater geographic mobility, and greater independence for seniors. Relative to other parts of the City, the Bayview Hunters Point neighborhood experiences a higher number of residents per habitable room.[2] As new housing varying in affordability, type, and size is developed in the area, existing crowding is expected to be alleviated. The Project would provide a range of housing sizes, including studios to 4 bedrooms, and the average housing unit would be 2.5 bedrooms. As a result, the household size at the Project site is expected to decrease to 2.33 people per unit by 2032, consistent with the 2005 citywide average and the average identified in the General Plan Housing Element. Therefore, the analysis for Population, Housing, & Employment would remain unchanged from that analyzed in the Draft EIR irrespective of the change in final build-out date or interim phasing.

Visual impacts are not time-dependent, and the impacts analyzed in the EIR would remain the same whether the Project is completed in 2032 or 2030 and, additionally, whether R&D is developed in later phases. The impacts of the Project were analyzed against existing conditions as well as cumulatively with regard to completion of the Yosemite Slough Restoration Project. Construction

[1] City and County of San Francisco, Draft General Plan Housing Element, Part 1: Data and Needs Analysis, 2009.
[2] City and County of San Francisco, General Plan Housing Element, 2004.

impacts would be temporary visual distractions regardless of when they occur. The visual impacts of full build-out of the Project also would not change with completion in 2032 versus 2030.

Similarly, impacts related to Wind and Shadow have no relationship to timing of development, but, rather, to size and placement of buildings. This remains unchanged from what was analyzed in the Draft EIR.

With regard to Cultural Resources and Paleontological Resources, Hazards and Hazardous Materials, Geology and Soils, Hydrology and Water Quality, and Biological Resources, these resources would also not be affected by the timing of development, as impacts in these areas are dependent on extent of development, types of land uses, and location of activities, which remain unchanged from that analyzed in the Draft EIR. Mitigation measures would still be implemented at the appropriate stage of development, regardless of when that occurs.

With regard to Recreation, the only area that could be affected by a change in the Development Schedule is the provision of adequate parkland at the completion of each phase of development. Section F (Draft EIR Revisions) includes changes to the parkland provided at the end of each phase of development as reflected in the modified Development Schedule. As the text changes in Section F indicate, at no time would the parkland-to-population ratio drop below the recommended threshold of 5.5 acres per 1,000 residents.

Impacts to electricity, natural gas, and telecommunications are a function of the overall intensity of development and are not time-dependent. The impact analysis would not change whether the Project is built out in 2032 or 2030.

With regard to Greenhouse Gas Emissions, because the total number of equipment hours and overall development would not change, the calendar time span over which the construction takes place is not a factor in the Greenhouse Gas calculations. Therefore, the analysis would remain unchanged from that contained in the Draft EIR. Refer to Appendix T5 (ENVIRON, Updated Greenhouse Gas Emissions Calculation for Candlestick Point–Hunters Point Shipyard Phase II Development Plan, Variants 2A and 3 [Tower Variant D], Alternative 2, and Subalternative 4A, March 12, 2010), which contains corrections to the construction GHG emissions calculations.

Technical memoranda have been prepared with regard to transportation and roadway phasing by LCW Consulting (refer to Appendix A3 [LCW Consulting, CP-HPS Phase II Development Plan Transportation Study—Revised Project Phasing, March 23, 2010]) and Fehr & Peers (refer to Appendix A4 [Fehr & Peers, Roadway and Transit Phasing Plan, March 17, 2010]) that provide a detailed analysis of the proposed schedule modifications. A memorandum from ENVIRON has also been prepared analyzing the schedule changes relative to the impacts of the Project analyzed in the Draft EIR (refer to Appendix A5 [ENVIRON, Updated Project Phasing Effect on Air Quality and Climate Change Analyses Candlestick Point–Hunters Point Shipyard Phase II Development Plan, April 26, 2010]). PBS&J staff prepared a memorandum (refer to Appendix A2 [PBS&J, Analysis of Revised Development Schedule Compared to the Noise Impacts Analyzed in the Draft EIR, March 25, 2010]) that analyzes the revised development schedule with regard to Noise.

Appendix A2 PBS&J, Analysis of Revised Development Schedule Compared to the Noise Impacts Analyzed in the Draft EIR, March 25, 2010

memo

PBS&J

To: San Francisco Redevelopment Agency
San Francisco Planning Department

From: Julian F. Capata, Associate Manager, Noise Specialist

CC:

Date: 3/25/2010

Re: Analysis of Revised Development Schedule Compared to the Noise Impacts Analyzed in the Draft EIR

Construction activities associated with the revised development phasing plan for the Project would be similar in duration, frequency and distance to existing residential neighborhoods adjacent to the site, with the construction activities beginning and ending later than was analyzed in the Draft EIR. In addition, construction would occur over a 20-year period rather than the 19-year period analyzed in the Draft EIR.

Under the revised phasing plan, construction of the R&D would occur later than as originally proposed. Thus, it is likely that a greater number of districts would be occupied by future residents at the time of construction of the R&D. The occupants of the Candlestick North district, the CP Center District, the HPS Village Center and HPS North would potentially be exposed to noise levels up to 101 dBA due to pile-driving activities, and approximately 92 dBA due to the use of heavy construction equipment. Construction activities would be required to comply with the City of San Francisco Noise Ordinance and all mitigation measures identified for the Project, which would reduce construction related noise impacts to less-than-significant levels. However, pile-driving and excavation activities would last throughout the 20-year construction phasing, and, therefore, this temporary increase in ambient noise levels would be noticeable and would likely be cause for human annoyance. Implementation of mitigation measures would reduce the noise levels associated with the loudest construction activities identified above, but not to a less-than-significant level. As such, construction-related temporary increases in ambient noise levels would be considered significant and unavoidable, which was identified in the Draft EIR.

Implementation of these measures would reduce vibration impacts, but not to a less-than-significant level, as vibration levels from pile-driving activities could be as high as 103 VdB for the residential uses within the Candlestick North District, the CP Center District, the HPS Village Center, and HPS North and South Districts when occupied. Vibration levels from construction activities would be as identified in the Draft EIR for the residential uses occupying the Project site during construction;

therefore, this impact would remain significant and unavoidable, unchanged from the previous analysis.

The noise assessment relies on the future transportation projections, which reflect the Project traffic and reasonably foreseeable background growth and development within the study area. Based upon the operational analysis contained in the March 23, 2010, CP-HPS Phase II Development Plan Transportation Study – Revised Project Phasing Memo from LCW Consulting (Appendix A3), the transportation impact analysis that was utilized for the noise assessment was conducted for future year 2030 conditions, assuming full build-out of the proposed development, roadway network, and transit operating plan. As indicated in Appendix A3, traffic volumes associated with the Project would not change as a result of the revised phasing; therefore, the Project's estimated contribution to roadway noise levels would not be different from that evaluated in the Draft EIR. As such, the Project's traffic related noise levels presented in Table III.I-14 (Modeled Noise Levels along Major Project Site Access Roads) would not change due to the revised phasing. Additionally, the Project's traffic-related noise levels would continue to contribute to cumulative increase in ambient noise levels as identified in Table III.I-18 (Modeled Cumulative Traffic Noise Levels along Major Project Site Access Roads) of the Draft EIR. After construction is complete, Project operation would create a substantial, permanent increase in traffic noise levels that would affect existing and future residential uses along all Project site access roads, the same as evaluated in the Draft EIR.

Appendix A3 LCW Consulting, CP-HPS Phase II Development Plan Transportation Study—Revised Project Phasing, March 23, 2010

LCW Consulting

Memo

To: Bill Wycko, San Francisco Planning Department, MEA

From: Luba C. Wyznyckyj, LCW Consulting
Chris Mitchell, Eric Womeldorff, Fehr & Peers

Date: March 23, 2010

Re: CP-HPS Phase II Development Plan Transportation Study – Revised Project Phasing

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This memorandum presents the changes to the transportation impact analysis contained in the *CP-HPS Phase II Development Plan Transportation Study Final Report* (November 2009) that are associated with the revised development phasing plan for the Project.

Operational Impacts

The transportation impact analysis was conducted for future year 2030 conditions, assuming full buildout of the proposed development, roadway network and transit operating plan. Therefore the changes in phasing of development would not affect the transportation impact analysis. In addition, none of the mitigation measures are affected by the changes in construction phasing.

No changes are therefore required to the transportation impact analysis discussion or mitigation measures in the EIR.

Construction Impacts

The revised development phasing schedule and the associated estimates of construction workers and construction truck trips would affect the construction assessment included in the Transportation Study and the EIR.

The revised section 6.10 Construction Impacts from the Transportation Study Final Report dated November 2009 (pages 316 to 323) reflects the updated construction worker and construction truck trip information provided by MACTEC, and the revised construction schedule for the Project, Variants and Alternatives, as presented in the Transportation Study. While the number of construction workers and truck trips changed based, the impact assessment remains unchanged, and conclusions of construction impacts as significant and unavoidable.

Edits to the EIR section to reflect these changes were provided to PBS&J under separate cover.

6.10 CONSTRUCTION IMPACTS

6.10.1 Project and Project Variants

Buildout of the Project would occur over a 20-year period between 2011 and 2032. Initial construction activities would include demolition of existing structures, utility relocation and site clearance and grading at Hunters Point Shipyard to make the land available for the new stadium. The new stadium and the Yosemite Slough bridge are anticipated to be completed by 2017 in time for the 2018 football season.

Buildout of the project would occur over about a 20-year period as part of four overlapping phases (see **Table 2** for development phasing). The duration of each phase would vary, depending on the type of development (e.g., residential, retail, office) and the amount of building space included in each phase. The majority of development would occur and be occupied by the end of the second phase, which has a scheduled completion date of 2023. The majority of the roadway network improvements would occur by 2019 (Phase I), and most transit improvements would be phased in by 2023 (within Phase I and Phase II). Construction impacts within the Project site would affect new residents, employees, and visitors to the area. Overall, throughout the construction period the addition of worker-related vehicles and transit trips would be less than those associated with Project conditions at full buildout.

During construction of the Project phases, building activities would generate traffic volumes from construction workers, truck deliveries of supplies and construction equipment, and the hauling of soils during Project grading and excavation. **Table 90** presents the phases and construction activity for the Hunters Point Shipyard and Candlestick Point development, the maximum number of construction workers that would be on-site on a daily basis, as well as the maximum number of construction truck trips that would travel to and from the sites on a daily basis. These truck trip estimates assume that approximately 40 percent of the required import fill materials would be brought onto the site via barge, with the remaining arriving by truck. **Table 91** presents the number of daily construction truck trips and construction workers, as well as the annual number of barge trips associated with improvements to the shoreline at both Hunters Point Shipyard and Candlestick Point.

The peak phases of construction activities would occur between 2013 and 2017, when grading and infrastructure improvements would be ongoing at both Candlestick Point and Hunters Point Shipyard. During this phase, there would be between 130 and 460 construction workers that would be on-site on a daily basis, and between 70 and 540 construction truck trips that would travel to and from the site on a daily basis. These truck trip estimates assume that about 40 percent of the required import fill materials would be brought onto the site via barge, with the remaining arriving by truck.

Table 90
Construction Workers and Trucks by Phase
Hunters Point Shipyard and Candlestick Point

Project Area/Construction Phase	Construction Duration	Daily Construction Workers	Daily Construction Truck Trips
Hunters Point Shipyard			
Phase 1 – Site Preparation [1]			
Abatement & Demolition	2011 – 2015	10-63	8-48
Grading and Infrastructure	2013 – 2017	25-130	8-288
Phase 1 – Building Construction [1]			
Structure/Rough In	2011 – 2016	18-100	8-32
Interior and Exterior Finishes	2011 – 2016	10-70	8-32
Phase 2 – Site Preparation			
Abatement & Demolition	2016 – 2019	13-65	8-56
Grading and Infrastructure	2018 - 2021	38-100	96-224
Phase 2 – Building Construction			
Structure/Rough In	2016 – 2019	60-80	16-32
Interior and Exterior Finishes	2016 – 2019	25-83	16-40
Phase 3 – Site Preparation			
Abatement & Demolition	2020 – 2023	13-35	8-32
Grading and Infrastructure	2022 - 2025	35-60	24-40
Phase 3 – Building Construction			
Structure/Rough In	2021 – 2024	16-20	8-16
Interior and Exterior Finishes	2021 – 2025	25-35	8-16
Phase 4 – Site Preparation			
Abatement & Demolition	2024 – 2028	13-28	8-32
Grading and Infrastructure	2026 - 2030	18-60	8-128
Phase 4 – Building Construction			
Interior and Exterior Finishes	2026 – 2031	10-50	8-40
Candlestick Point			
Phase 1 – Site Preparation			
Abatement & Demolition	2013 - 2015	10-13	8-16
Grading and Infrastructure	2013 – 2017	30-55	12-96
Phase 1 – Building Construction			
Structure/Rough In	2013 – 2016	14-18	8-16
Interior and Exterior Finishes	2013 - 2016	8-10	4-8
Phase 2 – Site Preparation			
Abatement & Demolition	2016 – 2019	13-38	8-32
Grading and Infrastructure	2018 – 2021	30-93	8-32
Phase 2 – Building Construction			
Structure/Rough In	2016 – 2021	18-35	16-32
Interior and Exterior Finishes	2016 – 2021	10-33	8-20

Table 90 (continued)
Construction Workers and Trucks by Phase
Hunters Point Shipyard and Candlestick Point

Phase 3 – Building Construction			
Structure/Rough In	2021 – 2025	40-100	16-48
Interior and Exterior Finishes	2021 – 2025	20-75	16-36
Phase 4 – Site Preparation			
Abatement & Demolition	2024 – 2028	13-43	8-32
Grading and Infrastructure	2026 - 2030	30-135	16-52
Phase 4 – Building Construction			
Structure/Rough In	2024 – 2030	40-80	16-32
Interior and Exterior Finishes	2024 – 2031	33-90	16-48
Yosemite Slough Bridge	2015 – 2016	62-78	18-24
HPS Off-site Improvements	2015 – 2017	24-30	8-12
CP Off-site Improvements	2013 – 2018	24-30	8-12

Notes:
1. Includes stadium construction.
2. Does not include trips associated with field management. Estimated to be between 5 and 20 construction workers and 4 to 8 construction truck trips per day at Hunters Point Shipyard, and between 15 and 25 construction workers and 4 to 8 construction truck trips per day at Candlestick Point.
Source: MACTEC, 2010.

Table 91
Daily Construction Workers by Phase and Yearly Barge Trips
Shoreline Improvements

Project Area/Construction Year	Construction Duration (months)	Daily Construction Workers	Yearly Barge Trips
Hunters Point Shipyard			
2015 Shoreline	9	6-7	0
2016 Shoreline	9	18-21	6
2017 Shoreline	9	45-50	80
2018 Shoreline	6	35-40	55
2022 Shoreline	5	14-16	15
2023 Shoreline	5	14-16	15
2025 Shoreline	10	14-16	10
2026 Shoreline	9	42-48	40
Candlestick Point			
2018 Shoreline	2	5-7	2
2022 Shoreline	2	5-7	2
2024 Shoreline	2	5-7	2
2026 Shoreline	4	5-7	3
2027 Shoreline	4	5-7	3
2028 Shoreline	6	5-7	4

Note:
1. Includes stadium construction.
Source: MACTEC, 2010.

Shoreline improvements at both Hunters Point Shipyard and Candlestick Point would peak in 2017, and would require an additional 45 to 50 construction workers on-site.

Construction related activities would generally occur Monday through Saturday, between 7:00 A.M. and 8:00 P.M., and the typical work shift for most construction workers would be from 7:00 A.M. to about 3:30 P.M. Construction is not anticipated to occur on Sundays or major legal holidays, but may occur on an as-needed basis. The hours of construction would be stipulated by the Department of Building Inspection, and the contractor would be required to comply with the San Francisco Noise Ordinance.[1] Delivery and removal of extra long or wide bridge construction components, equipment, or materials may occur outside theses hours on an as-needed basis.

Construction staging would mostly occur within the individual sites under construction or along existing street right-of-way. Construction staging would involve staging of construction vehicles, storage of construction materials, construction worker vehicles, delivery, and hauling trucks. Due to the large amount of vacant land in the Project site, construction staging would occur on-site, and construction-worker vehicles would likely park near construction sites in the Project site during most phases, and would not occupy spaces on neighborhood streets.

While the exact routes that construction trucks would be using would depend on the location of individual construction sites, it is expected that Harney Way, Hunters Point Expressway, Innes Avenue, Evans Avenue, Cesar Chavez Street, and Third Street would be the primary haul routes between U.S. 101 and the various components of the Project.

In general, construction related transportation impacts would include impacts in the immediate vicinity of the development project under construction, on roadways within the Project site, and cumulative construction traffic impacts along the roadways in the Bayview Hunters Point neighborhood. Since the Project includes building construction as well as construction of a new street system and transit route extensions into the Project site, all Project construction operations would include plans for the closure of traffic/parking lanes and sidewalks adjacent to construction sites. The closure of sidewalks and parking lanes could last throughout the entire construction phase for each building or group of buildings. It is possible that more than one location within the Project site could be under construction at any one time and that multiple travel lane closures may be required.

During the construction period, temporary and intermittent disruption to existing and proposed transit routes and bus stops may occur, and some bus routes may need to be temporarily rerouted (for example, the 29-Sunset on Gilman Avenue and Giants Drive, the 54-Felton on Ingalls, the 23-Monterey and 44-O'Shaughnessey on Palou Avenue, and the 19-Polk on Innes Avenue. In addition, temporary and intermittent interference to transit operations caused by increased truck

[1] The San Francisco Noise Ordinance permits construction activities seven days a week, between 7:00 A.M. and 8:00 P.M.

movements to and from the construction sites may occur. Any change in transit routes and stops would have to be coordinated and approved by the SFMTA.

Due to the reduction in travel lanes, the remaining travel lanes would become more congested with automobiles, trucks and buses, which would pose a greater challenge for bicycle travel in the area. Since bicycle traffic in the Project vicinity is relatively low, this impact is not anticipated to be significant. Existing pedestrian volumes along the key access routes and at the proposed construction sites are low and, therefore, any sidewalk closures or rerouting of the walkway would not significantly affect pedestrian circulation. In general, temporary pedestrian walkways must be maintained in order to facilitate pedestrian movements.

The construction activities associated with the Project would overlap with construction activities of other development projects in the area, notably the HPS Phase I, Executive Park site, Brisbane Baylands, Visitacion Valley, India Basin Shoreline, and the Hunters View site. In addition, the Project construction activities would also overlap with nearby proposed transportation improvement projects, such as the U.S. 101/Harney interchange improvements, and the Geneva Avenue Extension. These overlapping construction activities would increase the number of construction worker vehicles and trucks traveling to and from the project sites along Harney Way and Jamestown Avenue for the Executive Park project and for development within Candlestick Point, and on Cesar Chavez Street and Evans Avenue for the India Basin Shoreline, Hunters View project, and development within Hunters Point Shipyard. For example, construction activities of one or more projects that adversely affect roadway capacity (e.g., Harney Way widening), combined with construction vehicle traffic traveling to and from the roadway project and nearby development projects under construction (e.g., Executive Park and Candlestick Point), could result in increased delays due to traffic diversions and substantial increases in truck traffic.

Given the magnitude of development proposed for the area, the Project's prolonged construction period, and the lack of certainty about the timing of the projects in the area, significant Project-related and significant Project contributions to cumulative traffic and circulation impacts could occur on some roadways, such as U.S. 101, Cesar Chavez Street, Evans Avenue, Harney Way, and Bayshore Boulevard. Cumulative impacts would include construction detours and increased travel times, although the extent and duration of delay would vary depending on individual driver’s origin and destination, time of travel and use of alternate routes. Implementation of individual traffic control plans would minimize impacts associated with each project and reduce each project’s contribution to cumulative impacts in overlapping areas. However, some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related traffic impacts on local and regional roadways could still occur.

Project Mitigation Measure 16: The Project Applicant shall develop and implement a Candlestick Point–Hunters Point Shipyard Phase II Construction Traffic Management Program to minimize impacts of the Project and its contribution to cumulative impacts related to construction activities and construction traffic. The program shall provide necessary information to various contractors and agencies as to how to maximize the opportunities for complementing construction management measures and to minimize the possibility of conflicting impacts on the roadway system, while safely accommodating the traveling public in the area. The program shall supplement and expand, rather than modify or supersede any manual, regulations, or provisions set forth by SFMTA, DPW or other City departments and agencies.

Preparation of the Construction Management Program shall be the responsibility of the Project Applicant, and shall be reviewed and approved by SFMTA and DPW prior to initiation of construction. The Project Applicant shall update the program prior to approval of development plans for Phase 2, Phase 3 and Phase 4 of construction to reflect any change to Project development schedule, reflect transportation network changes, to update status of other development construction activities, and to reflect any changes to City requirements.

The program shall:

- Identify construction traffic management practices in San Francisco, as well as other jurisdictions that although not being implemented in the City could provide useful guidance for a project of this size and characteristics.
- Describe procedures required by different departments and/or agencies in the City for implementation of a construction management plan, such as reviewing agencies, approval process, and estimated timelines.
- Describe coordination efforts associated with the Navy remediation efforts and scheduling regarding construction vehicle routing via the Crisp gate.
- Identify construction traffic management strategies and other elements for the Project, and present a cohesive program of operational and demand management strategies designed to maintain acceptable levels of traffic flow during periods of construction activities in the Bayview Hunters Point area. These could include construction strategies, demand management strategies, alternate route strategies, and public information strategies.
- Coordinate with other projects in construction in the immediate vicinity, so that they can take an integrated approach to construction-related traffic impacts.
- Present guidelines for selection of construction traffic management strategies.

Implementation of Project Mitigation Measure 16 would help minimize the Project construction-related transportation impacts, and the Project’s contribution to cumulative-construction related transportation impacts. However, some disruption and increased delays could still occur even with implementation of Mitigation Measure 16, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable*.

Project Variants: Construction activities associated with the Variant 1 and Variant 2 would be similar to the Project. These variants do not include construction of a new stadium at Hunters Point Shipyard, instead assume an additional 2,500,000 square feet of research and development uses under Variant 1, and reallocation of 1,350 residential units from Candlestick Point to Hunters Point Shipyard under Variant 2. Depending on the phasing of the additional development, the Variants 1 and 2 may result in fewer construction traffic impacts between future years 2012 and 2017 when the new stadium is proposed to be constructed, and somewhat greater impacts in the years the additional R&D space or housing units would be constructed. Implementation of a traffic control plan would reduce the project's contribution to significant cumulative impacts of overlapping construction traffic. However, as with the Project, cumulative transportation impacts associated with construction activities would be considered *significant and unavoidable.*

Implementation of Project Mitigation Measure 16 would be applicable to Project Variants 1 and 2. A Hunters Point Shipyard – Candlestick Point Construction Traffic Management Program would help minimize the Project Variants' construction-related transportation impacts and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of the mitigation measure, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

6.10.2 Alternatives to the Project

Alternative 1 – No Project: Construction activities associated with Alternative 1 would be less than the Project. Alternative 1 assumes buildout of Hunters Point Shipyard Phase II per the Hunters Point Shipyard Redevelopment Plan and EIR (February 2000) and subsequent addendums dated November 19, 2003 and July 13, 2006. Under Alternative 1, the existing stadium would remain and no construction activities would occur within Candlestick Point. Due to the reduced level of development anticipated for Hunters Point Shipyard construction impacts associated with Alternative 1 would be *less than significant*.

Alternative 2 – No Bridge: The Alternative 2 development program is the same as the Project; however, Alternative 2 would not include construction of the Yosemite Slough bridge. Therefore, Alternative 2 would not include the construction impacts associated with the bridge and access roads (proposed to occur between 2015 and 2017). All other construction activities and impacts would be the same as described for the Project above. As with the Project, cumulative traffic impacts during construction would be considered *significant.*

Project Mitigation Measure 16 would be applicable to Alternative 2. Implementation of this measure would help minimize Alternative 2's construction-related transportation impacts, and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

Alternative 3 – 49ers stay at Candlestick: Construction activities associated with Alternative 3 would be less than for the Project within the Candlestick Point area. Construction within Hunters Point Shipyard would be similar to the Project; however, 1,350 residential units would be developed within Hunters Point Shipyard. Within Candlestick Point the existing stadium would remain, and only 1,210 residential units would be constructed. Overall construction activities and impacts would be somewhat less than identified for the Project, however, as with the Project cumulative traffic impacts during construction would be *significant*.

Project Mitigation Measure 16 would be applicable to Alternative 3. Implementation of this measure would help minimize Alternative 3's construction-related transportation impacts, and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

Alternative 4 – Lesser Build: Alternative 4 assumes a general reduction in development as compared to the Project (approximately a 30 percent reduction), and therefore construction activities and impacts would be similar to the Project, however, the extent and duration would likely be somewhat less than identified for the Project. As with the Project, cumulative traffic impacts during construction would be *significant*.

Project Mitigation Measure 16 would be applicable to Alternative 4. Implementation of this measure would help minimize Alternative 4's construction-related transportation impacts, and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

Alternative 5 – Park Agreement: The Alternative 5 development program is similar to Project Variant 2, which assumes 1,350 more residential units in Hunters Point Shipyard rather than in Candlestick Point. Alternative 5 does not include construction of a new stadium or a Yosemite Slough bridge, and therefore construction activities associated with these elements would not occur. As with the Project, cumulative traffic impacts during construction would be *significant.* As with the Project, cumulative traffic impacts during construction would be considered *significant.*

Project Mitigation Measure 16 would be applicable to Alternative 5. Implementation of this measure would help minimize Alternative 5's construction-related transportation impacts, and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

Appendix A4 Fehr & Peers, Roadway and Transit Phasing Plan, March 17, 2010

FEHR & PEERS
TRANSPORTATION CONSULTANTS

MEMORANDUM

Date: March 17, 2010

To: Candlestick Point / Hunters Point Shipyard Phase II Development Plan Team

From: Chris Mitchell, PE

Subject: Roadway and Transit Phasing Plan

SF08-0407

This memorandum is intended to summarize the roadway and transit service improvement phasing plan previously developed as part of the Project's Draft Infrastructure Plan. Further, this memo demonstrates the flexibility of the phasing plan to accommodate reasonable changes without creating a mis-match between the level of roadway and transit improvements constructed and the amount of development provided.

ROADWAY IMPROVEMENTS

The overall phasing plan calls for certain on- and off-site improvements to be constructed based on certain levels of development. First, specific auto trip generation rates were derived for each land use proposed by the Project, based on the forecasts in the *Candlestick Point – Hunters Point Shipyard Phase II Development Plan Transportation Study (LCW Consulting, Fehr & Peers, and CHS Consulting Group, November 2009)* ("Transportation Study"). **Tables 1 and 2** below present the effective automobile trip generation rates for each of the major land uses within the Candlestick Point and Hunters Point Shipyard development sites, respectively.

For those improvements that are required to increase capacity to accommodate Project traffic, the amount of traffic generated by the Project (and a proportional share of background traffic growth based on the Project's Transportation Study) that would cause facilities to deteriorate from acceptable levels of service (LOS D or better) to unacceptable levels of service (LOS E or F) was identified. That amount of traffic was deemed the "trigger" point at which improvements would be required to be implemented. Other improvements, such as streetscape enhancements and bicycle/pedestrian improvements would be implemented roughly at the same time as nearby development parcels were constructed, or based on the "Adjacency Principle" as described in the project's Infrastructure Plan.

Tables 3 and 4 present the implementation "triggers" for intersection and roadway segment improvements, respectively, for the Candlestick Point site. **Tables 5 and 6** present similar information for the Hunters Point Shipyard site. As shown, the key triggers for most improvements are construction of certain parcels, such as the Hunters Point Stadium. In other cases, the improvements are required based on a certain level and type of development that is forecasted to produce a certain amount of auto demand. As a result of this approach, the infrastructure improvements will be timed to match the appropriate level of development, regardless of whether changes are made to the current phasing plan.

Table 1
Effective PM Peak Hour Vehicle Trip Generation Rates – Candlestick Point

Land Use	Amount Provided	Unit	Effective PM Peak Hour Trip Generation Rate (Auto Trips Per Unit of Development)[a]
Residential	7,594	Dwelling Units	0.28
Retail	760	Ksf	3.22
Hotel	220	Rooms	0.32
Office	150	Ksf	1.25
Park	105	Acres	0.04
Community Services	50	Ksf	1.42

SOURCE: Fehr & Peers, 2009.

a. The effective rates are the total number of person trips forecasted to be generated by each use, with the mode split forecasts developed as part of the project's transportation impact study. Overall, the site was projected to experience a reduction, compared to standard rates from *Trip Generation* (ITE, 2007), of 32 percent based on the scale of development, the mix of uses, and the bicycle- and pedestrian-oriented design. For purposes of developing this table, the reduction was applied evenly to each use. Further, the number of auto trips generated per unit of development is dependent on both the size of development and the mix of uses proposed. As the project uses change, the vehicle trip generation rates per unit of development may not be constant. Thus, the rates presented in this table should be used cautiously.

Table 2
Effective PM Peak Hour Vehicle Trip Generation Rates – Hunters Point Shipyard

Land Use	Amount Provided	Unit	Effective PM Peak Hour Trip Generation Rate (Auto Trips Per Unit of Development)[a]
Residential	2,650	Dwelling Units	0.28
Retail	125	Ksf	2.57
R&D	2,500	Ksf	0.38
Stadium/Artists	--	--	--
Park	232	Acres	0.03
Community Services	50	Ksf	1.42

SOURCE: Fehr & Peers, 2009.

a. The effective rates are the total number of person trips forecasted to be generated by each use, with the mode split forecasts developed as part of the project's transportation impact study. Overall, the site was projected to experience a reduction, compared to standard rates from *Trip Generation* (ITE, 2007), of 32 percent based on the scale of development, the mix of uses, and the bicycle- and pedestrian-oriented design. For purposes of developing this table, the reduction was applied evenly to each use. Further, the number of auto trips generated per unit of development is dependent on both the size of development and the mix of uses proposed. As the project uses change, the vehicle trip generation rates per unit of development may not be constant. Thus, the rates presented in this table should be used cautiously.

Table 3 - Project Intersection Improvements – Candlestick Point

Intersection	Improvement	Stadium Option		Non-Stadium Option	
		Traffic Volume Trigger?[c]	Trigger	Traffic Volume Trigger? [c]	Trigger
Project Improvements					
Arelious Walker Drive / Harney Way / P Street	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Arelious Walker Drive / Jamestown Avenue	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Arelious Walker Drive / Bill Walsh Way	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Arelious Walker Drive / Ingerson Avenue	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Arelious Walker Drive / Gilman Avenue	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Arelious Walker Drive / Egbert Avenue	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Arelious Walker Drive / Carroll Avenue	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Harney Way / 8 Street	New Traffic Signal	No	Adjacency	No	Adjacency
Harney Way / Ingerson Avenue	New Traffic Signal	No	Construction of 4th Intersection Leg/Adjacency	No	Construction of 4th Intersection Leg/Adjacency
West Harney Way / Ingerson Avenue	New Traffic Signal	No	Adjacency	No	Adjacency
West Harney Way / Gilman Avenue	New Traffic Signal	No	Construction of 3rd and 4th Legs/Adjacency	No	Construction of 3rd and 4th Legs/Adjacency
West Harney Way / Egbert Avenue	New Traffic Signal	No	Adjacency	No	Adjacency
Earl Street / Egbert Avenue	New Traffic Signal	No	Adjacency	No	Adjacency
Harney Way / Executive Park East	New Traffic Signal, Reconfiguration[a]	No	Construction of HPS Stadium	Yes	Harney Way widening (3,537 PM Peak Hour Vehicle Trips)
Harney Way / Thomas Mellon Drive	New Traffic Signal, Reconfiguration[a]	No	Construction of HPS Stadium	Yes	Harney Way widening (3,537 PM Peak Hour Vehicle Trips)
Mitigation Measures					
Tunnel Avenue / Blanken Avenue	Reconfiguration[b]	Yes	4,377 PM Peak Hour Vehicle Trips	Yes	4,377 PM Peak Hour Vehicle Trips

SOURCE: Fehr & Peers, 2009.

a. Reconfiguration of Harney Way intersections with Executive Park East and Thomas Mellon Drive to be completed based on separate and currently ongoing study of proposed Executive Park Project transportation impacts.

b. Reconfigure the northbound and southbound approaches to the intersection of Tunnel Avenue / Blanken Avenue to provide dedicated left-turn lanes adjacent to shared through/right-turn lanes.

c. Assumes other background traffic increases as same rate as buildout of the Project.

Table 4 - Project Street Segment Improvements - Candlestick Point

Intersection	Improvement	Stadium Option		Non-Stadium Option	
		Traffic Volume Trigger?[c]	Trigger	Traffic Volume Trigger?[c]	Trigger
Project Improvements					
Arelious Walker Drive, Shafter Avenue to Carroll Avenue	Construct Yosemite Slough Bridge[a]	No	Construction of HPS Stadium or Implementation of BRT	No	Implementation of BRT
Arelious Walker Drive, Carroll Avenue to Gilman Avenue	See Figures 2.1.2A – 2.1.2G	No	Construction of HPS Stadium or Implementation of BRT	No	Implementation of BRT
Arelious Walker Drive, Gilman Avenue to Harney Way	See Figures 2.1.2A – 2.1.2G	No	Construction of HPS Stadium or Implementation of BRT	No	Implementation of BRT
Harney Way Widening (Near Term), Arelious Walker Drive to Thomas Mellon Drive	See Figure 2.13	No	Construction of HPS Stadium or Implementation of BRT	Yes	3,537 PM Peak Hour Vehicle Trips or Implementation of BRT
Harney Way Widening (Long-Term), Arelious Walker Drive to Thomas Mellon Drive	See Figure 2.14	TBD[1]	Study Determines LOS Conditions Warrant	TBD[1]	Study Determines LOS Conditions Warrant
Jamestown Avenue, Arelious Walker Drive to Third Street	Resurface and Restripe	No	Demolition of Candlestick Park	No	Demolition of Candlestick Park
Ingerson Avenue, Arelious Walker Drive to Third Street	Resurface and Restripe	No	Demolition of Candlestick Park	No	Demolition of Candlestick Park
Gilman Avenue, Arelious Walker Drive to Third Street	Reconstruct or Resurface and Restripe	No	TBD	No	TBD
Carroll Avenue, Arelious Walker Drive to Ingalls Street	See Figures 2.1.2A – 2.1.2G	No	Construction of HPS Stadium	Yes	3,131 PM Peak Hour Vehicle Trips (CP & HP)[2]
Ingalls Street, Carroll Avenue to Thomas Avenue	See Figures 2.1.2A – 2.1.2G	No	Construction of HPS Stadium	Yes	3,131 PM Peak Hour Vehicle Trips (CP & HP)[2]
Mitigation Measures					
San Bruno Avenue, Mansell Street to Silver Avenue	Signal Priority Treatments	No	Supplemental study Determines Transit Travel Times Have Degraded	No	Supplemental study Determines Transit Travel Times Have Degraded
Gilman Avenue, Arelious Walker Drive to Third Street	Full-time WB transit only lane and PM peak hour EB transit-only lane	No	Supplemental study Determines Transit Travel Times Have Degraded	No	Supplemental study Determines Transit Travel Times Have Degraded
Paul Avenue, Third Street to Bayshore Boulevard	Full-time WB transit only lane	No	Supplemental study Determines Transit Travel Times Have Degraded	No	Supplemental study Determines Transit Travel Times Have Degraded

SOURCE: Fehr & Peers, 2009

a. Refer to Figure 2.1.2A and 5.4.1 for configuration of Yosemite Slough Bridge.

b. The isolated intersection analysis conducted for this study shows that the two intersections along Harney Way would operate acceptably with the near-term configuration even with full buildout of the project. However, because Harney Way is part of a complex series of roadway improvements and due to the inherent uncertainty in traffic forecasts, a study will be conducted prior to construction of each development phase to determine whether conditions are better or worse than projected. The results of that study will indicate whether additional development can be accommodated under the near-term configuration while maintaining acceptable LOS or whether widening is required.

Table 5 - Project Intersection Improvements – Hunters Point Shipyard Phase II

Intersection	Improvement	Stadium Option		Non-Stadium Option	
		Traffic Volume Trigger?[f]	Trigger	Traffic Volume Trigger?[f]	Trigger
Project Improvements					
Crisp Road / Arelious Walker Drive	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Crisp Road / Outer Ring Road (West)	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Crisp Road / Inner Ring Road (West)	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Crisp Road / Inner Ring Road (East)	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Crisp Road / Outer Ring Road (East)	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Robinson Street / Fisher Street	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Robinson Street / Donahue Street	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Innes Avenue / Donahue Street	New Traffic Signal	No	Construction of HPS Stadium	No	Adjacency
Palou Avenue / Griffith Street / Crisp Avenue	New Traffic Signal / Reconfiguration[a]	No	Construction of HPS Stadium	No	Adjacency
Palou Avenue / Hawes Street	New Traffic Signal	No	Construction of HPS Stadium	Yes	TBD - Based on Transit Phasing
Palou Avenue / Ingalls Street	New Traffic Signal	No	Construction of HPS Stadium	Yes	TBD - Based on Transit Phasing
Palou Avenue / Jennings Street	New Traffic Signal	No	Construction of HPS Stadium	Yes	TBD - Based on Transit Phasing
Palou Avenue / Keith Street	New Traffic Signal	No	Construction of HPS Stadium	Yes	TBD - Based on Transit Phasing
Palou Avenue / Lane Street	New Traffic Signal	No	Construction of HPS Stadium	Yes	TBD - Based on Transit Phasing
Ingalls Street / Carroll Avenue	New Traffic Signal / Reconfiguration[b]	No	Construction of HPS Stadium	Yes	3,131 PM Peak Hour Vehicle Trips (CP & HP)[g]
Ingalls Street / Thomas Avenue	New Traffic Signal / Reconfiguration[c]	No	Construction of HPS Stadium	Yes	3,131 PM Peak Hour Vehicle Trips (CP & HP)[g]
Hunters Point Boulevard / Evans Avenue / Jennings Street	New Traffic Signal / Reconfiguration[d]	Yes	1,515 PM Peak Hour Vehicle Trips	Yes	1,515 PM Peak Hour Vehicle Trips
Pennsylvania Avenue / 25th Street	New Traffic Signal	Yes	1,926 PM Peak Hour Vehicle Trips	Yes	1,926 PM Peak Hour Vehicle Trips

Table 5 - Project Intersection Improvements – Hunters Point Shipyard Phase II

Intersection	Improvement	Stadium Option		Non-Stadium Option	
		Traffic Volume Trigger?[f]	Trigger	Traffic Volume Trigger? [f]	Trigger
Mitigation Measures					
Amador/Cargo/Illinois	Reconfiguration[e]	Yes	2,121 PM Peak Hour Vehicle Trips	Yes	2,121 PM Peak Hour Vehicle Trips

SOURCE: Fehr & Peers, 2009.

a. The Project will reconfigure the intersection by removing the southwest leg of Crisp Avenue and creating limited access for the eastern block of Palou Avenue. The Crisp Avenue westbound approach, which is a Project roadway, would be restriped to provide two approach lanes, a left turn lane and a shared left/through/right lane. The Project will also reconfigure the northbound Griffith Street approach to provide two lanes, a shared left/through/right turn lane and a dedicated right turn lane. The Project will also reconfigure the eastbound approach on Palou Avenue to provide two approach lanes, a left turn lane and a shared through/right turn lane.

b. The Project will reconfigure Carroll Avenue to provide two travel lanes and a bicycle lane in each direction. This will allow for a shared left turn and through lane, and a shared through and right turn lane at both the east- and westbound approaches. The southbound approach will be reconfigured to allow for two approach lanes: a left turn lane, and a shared through and right turn lane. The reconfiguration of the southbound approach will require displacement of about 200 feet of on-street parking/loading on the west side of Ingalls Street.

c. The Project will reconfigure the westbound approach of Thomas Avenue to Ingalls Street to provide two lanes, a left turn lane, and a shared through and right turn lane. Thomas Avenue will be reconfigured to provide two travel lanes in each direction and on-street parking on both sides of the street.

d. The Project will reconfigure the existing three travel lanes on Evans Avenue in both the eastbound and westbound approaches to provide a shared through/left turn lane, a through lane, and a right turn lane. The Project will also reconfigure the southbound approach on Jennings Street to provide a southbound left turn pocket, a shared southbound through lane, and a right turn lane.

e. Reconfigure the southbound approach to the intersection to provide one dedicated left-turn lane and one dedicated right turn lane. City is currently evaluating the feasibility of this mitigation measure.

f. Assumes other background traffic increases as same rate as buildout of the Project.

g. Combined total from CP and HP

Table 6 - Project Street Segment Improvements – Hunters Point Shipyard Phase II					
Intersection	**Improvement**	**Stadium Option**		**Non-Stadium Option**	
		Traffic Volume Trigger?[a]	**Trigger**	**Traffic Volume Trigger?[a]**	**Trigger**
<u>Project Improvements</u>					
Palou Avenue, Griffith Avenue to Third Street	Resurface and Restripe, Streetscape Amenities See Figure 2.1.4	No	Construction of HPS Stadium	Yes	TBD - Based on Transit Phasing
Thomas Avenue, Ingalls Street to Griffith Street	See Figures 2.1.2A – 2.1.2E	No	Construction of HPS Stadium	Yes	3,131 PM Peak Hour Vehicle Trips (CP & HP)[b]
Griffith Street, Thomas Street to Palou Street	See Figures 2.1.2A – 2.1.2E	No	Construction of HPS Stadium	Yes	Reconstruction of Crisp Avenue
Innes Avenue, Donahue Street to Earl Street	See Figures 2.1.2A – 2.1.2E	No	Construction of HPS Stadium	Yes	1,000 PM Peak Hour Vehicle Trips
Innes Avenue/Hunters Point Boulevard/Evans Street, Earl Street to Jennings Street	See Figure 2.1.3	No	Construction of HPS Stadium	Yes	1,000 PM Peak Hour Vehicle Trips
<u>Mitigation Measures</u>					
Palou Avenue, Crisp Avenue to Third Street	Narrow sidewalks to 12-feet, transit only lane in both directions	TBD	Supplemental study Determines Transit Travel Times Have Degraded	TBD	Supplemental study Determines Transit Travel Times Have Degraded
Evans Street, Jennings Street to Napoleon Street	Convert one lane in each direction to transit only	TBD	Supplemental study Determines Transit Travel Times Have Degraded	TBD	Supplemental study Determines Transit Travel Times Have Degraded
Third Street, Thomas Avenue to Kirkwood Avenue	Provide exclusive LRT right of way, remove parking as needed	TBD	Supplemental study Determines Transit Travel Times Have Degraded	TBD	Supplemental study Determines Transit Travel Times Have Degraded

SOURCE: Fehr & Peers, 2009
a. Assumes other background traffic increases as same rate as buildout of the Project.
b. Combined total from CP and HP

TRANSIT PHASING

The transit phasing plan has been developed using a similar approach to the roadway phasing plan. However, in contrast to the roadway plan, which was designed to ensure that roadway facilities projected to operate at LOS D or better in the Project's Transportation Study remained at acceptable levels of service throughout the development process, the transit phasing has been designed to ensure that the level of transit service provided is generally substantially greater than the Project's transit demand. This will ensure that the Project maintains its "transit orientation" throughout the development horizon. Tables 7 and 8 present the effective transit trip generation rates per unit of land use for the Candlestick Point and Hunters Point Shipyard sites, respectively.

Table 7 Effective PM Peak Hour Transit Trip Generation Rates – Candlestick Point			
Land Use	**Amount Provided**	**Unit**	**Effective PM Peak Hour Trip Generation Rate (Transit Trips Per Unit of Development)**
Residential	7,594	Dwelling Units	0.13
Retail	760	Ksf	0.95
Hotel	220	Rooms	0.15
Office	150	Ksf	0.64
Park	105	Acres	0.02
Community Services	50	Ksf	0.72

Table 8 Effective PM Peak Hour Transit Trip Generation Rates - Hunters Point Shipyard Phase II			
Land Use	**Amount Provided**	**Unit**	**Effective PM Peak Hour Trip Generation Rate (Transit Trips Per Unit of Development)**
Residential	2,650	Dwelling Units	0.13
Retail	125	Ksf	0.75
R&D	2,500	Ksf	0.19
Stadium/Artists	--	--	--
Park	232	Acres	0.02
Community Services	50	Ksf	0.72

Table 9 presents the various levels of transit service expected to be provided at the site throughout various points of development, and the associated transit trip generation expected to "trigger" those levels of transit service. As shown, generally, each transit route would be extended into the site at approximately 20 percent buildout of Major Phase 1 (for routes serving Hunters Point Shipyard) or Major Phase 2 (for routes serving Candlestick Point). Service would be gradually increased until routes reach their maximum expected service frequencies at 50 percent buildout of the respective Major Phases in most cases.

SUMMARY

Based on this approach, the roadway and transit phasing would be tied to specific levels of development, such that if development happened more quickly or slowly than predicted, or if uses that generate more trips were initiated sooner than expected, the appropriate roadway infrastructure and transit service would be in place to accommodate the associated travel demand.

We hope this has clarified the approach to phasing, and demonstrated the flexibility of the phasing plan to accommodate reasonable modifications to development timing. Please note that this information has been included in the Project's Draft Infrastructure Plan, which is currently under review by various City agencies. As a result, based on comments from the City, some of the triggers in this plan may be revised; however, we do not expect the underlying principle of triggers based on expected travel demand (as opposed to specific years) to be modified.

Table 9 - Transit Improvement Phasing

Improvement	Headway (min.)	One-Way Capacity Serving Project Site (pax/hr)	Stadium Option		Non-Stadium Option	
			Major Phase	Trigger (PM Peak Hour Transit Trips)	Major Phase	Trigger (PM Peak Hour Transit Trips)
Begin Hunters Point Express (HPX)	20	192	1	115 [1]	1	115 [1]
	12	320	1	288 [2]	1	288 [2]
Begin Candlestick Point Express (CPX)	20	192	2	164 [3]	2	164 [3]
	15	256	2	838 [2]	2	838 [2]
	10	384	3	1514 [3]	3	1514 [3]
Extend 23-Monterey	15	256	1	115 [1]	1	115 [1]
Extend 24-Divisadero	7.5	512	2	643 [1]	2	643 [1]
	6	640	2	744 [2]	2	744 [2]
Extend 48-Quintara	15	256	1	1 [3]	1	1 [3]
	10	384	1	288 [2]	1	288 [2]
Extend 44-O'Shaughnessy	7.5	512	1	115 [1]	1	115 [1]
	6.5	591	1	288 [2]	1	288 [2]
Begin/Extend 28L/BRT	8	480	2	1075 [1, 4]	2	1075 [1, 4]
	5	768	2	1582 [2, 4]	2	1582 [2, 4]
Extend 29-Sunset	10	384	2	433 [1]	2	433 [1]
	5	768	2	838 [2]	2	838 [2]
Construct Hunters Point Shipyard Transit Center	N/A	N/A	1	Construction of HPS Stadium	1	288 [5]

Notes:

General: Note that triggers are based on total site transit trip generation; only a fraction of the "trigger" amount will travel on each transit route.

1. Initial route extensions based on 20% of buildout of Major Phase (based on Stadium Option land uses)

2. Based on 50% buildout of Major Phase (based on Stadium Option land uses)

3. Based on initiation of Major Phase. In the case of the CPX, this is because completion of Major Phase 1 will include some residential development that could be served by the CPX, but not likely enough until full buildout of Major Phase 1. In the case of the 48-Quintara, the route would be extended as part of the TEP. Initial route will depend on which streets are constructed.

4. Includes total of trips generated by CP and HP. In the case of the 28L, this means 20% buildout of Major Phase II.

5. Under Non-Stadium Option, implementation of Hunters Point Transit Center based on service improvements to HPX, 48-Quintara, and 44-O'Shaughnessy.

Appendix A5 ENVIRON, Updated Project Phasing Effect on Air Quality and Climate Change Analyses Candlestick Point–Hunters Point Shipyard Phase II Development Plan, April 26, 2010

ENVIRON

April 26, 2010

MEMORANDUM

To: Alison Rondone, PBS&J
Michael Rice, PBS&J
Kimberly Avila, PBS&J

Cc: Therese Brekke, Lennar Urban

From: Michael Keinath, ENVIRON
Elizabeth Miesner, ENVIRON
Shari Libicki, ENVIRON
Jennifer Schulte, ENVIRON

Subject: Updated Project Phasing Effect on Air Quality and Climate Change Analyses
Candlestick Point-Hunter's Point Shipyard Phase II Development Plan

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On March 22, 2010, MACTEC, on behalf of Lennar Urban, provided ENVIRON with a comparison of phasing for construction activities on each sub-phase of the Candlestick Point-Hunter's Point Shipyard Phase II Development Plan ("Project"), included here as Attachment 1. Per your request, we have evaluated the impacts of the revised phasing on the air quality and climate change analyses we conducted as part of the Project's Draft Environmental Impact Report (DEIR).

Under the revised phasing schedule virtually all sub-phases start at the same time or later than that designated in the DEIR and in most cases, construction activities on each sub-phase will start later than what was evaluated under the DEIR. Based on the March 22 comparison, the only exceptions are Building 101 Artist Studios, a subset of the original HP-07 sub-phase, and a portion of the original CP-11 sub-phase known as the "Last Port" on the far eastern end of Candlestick Point. As shown in the attached phasing map (Attachment 2), Building 101 is located on the central portion of the Hunter's Point Shipyard (HPS), to the northeast of the stadium site. The Last Port is located on the eastern shore of Candlestick Point (CP),

Under the DEIR, construction activities for HP-07 were scheduled to commence in 2012; however, under the current phasing, construction activities at Building 101 are anticipated to start in 2011, one year earlier. Construction activities at the Last Port were scheduled to commence in 2022; however, under the current phasing, construction activities at the Last Port are anticipated to start in 2021, one year earlier. We also understand that while the phasing may shift, there will be no changes to the number of equipment resources required to complete horizontal and vertical construction for each subparcel area of the Project.

DPM emissions (as compared to the DEIR) would occur earlier as a result of construction activities at Building 101, and at the Last Port, however as both of these locations on HPS and CP are to the east (and therefore downwind) of the maximally exposed individual residents and workers identified in App. H1-I, the DPM associated with the construction activities, at these sites contribute little, if any, to the overall impacts at the maximally exposed receptors.

As discussed in the analysis we conducted as part of the DEIR (DEIR Appendix H1, Attachment I: Human Health Risk Assessment of Construction-Related Diesel Particulate Matter, herein referred to as “App. H1-I”), the California Resources Board (CARB) is currently in the process of implementing an In-Use Off-Road Diesel Vehicle Rule which sets increasingly stringent fleet-average emission rates year-by-year through 2021. Additionally, mitigation measure AQ-2.1 requires the Project to utilize construction equipment with emission control technology such that 50% of the fleet will meet USEPA Tier 2 standards outfitted with California ARB Level 3 VDECS (Verified Diesel Emission Control Strategies) for particulate matter control (or equivalent) during the first two years of construction activities, increasing to 75% of fleet in the third year and 100% of the fleet starting in the fourth year and for the duration of the Project. Because of the CARB rule and mitigation measure AQ-2.1, any delay in the onset in construction activities will result in lower diesel particulate matter (DPM) emissions than if the Project had started construction activities on the schedule initially considered in the DEIR. Because the duration of the project has been extended, there will be additional field management workers providing construction oversight and an increase in the use of small trucks because of these activities, however, construction oversight does not include the use of diesel fueled equipment and therefore will not result in any additional DPM emissions.

As such, the carcinogenic and noncarcinogenic health risks posed by DPM emissions during construction activities associated with development of Project with mitigation will continue to be below the risk thresholds, this impact will continue to be less than significant with mitigation.

Some of the hauling truck trips listed in the DEIR were not included in the original construction calculations. Attachment 3 shows the revised GHG construction emissions incorporating these trips along with the revised phasing information. This revised calculation shows an increase of 23,687 tonnes of GHG emissions compared to what had previously been reported. There is no threshold for construction emissions and the increase would continue to be insignificant in relation to the amount of construction GHG emissions that occur annually in the state and San Francisco Bay Area. Therefore, the conclusions reached in the DEIR with respect to climate change impacts remain valid.

In summary, as the equipment resources will not increase and the phasing of all sub-phases has generally been shifted to later years when lower emission construction equipment are available, the overall impacts from the revised phasing will be the <u>same as or negligibly higher</u> (for greenhouse gas emissions) or <u>lower</u> (for DPM) than those considered in the DEIR.

Attachments:

Attachment 1: CPHP II Phasing Comparison (DEIR vs. Current) 3/22/2010
Attachment 2: Stadium Option Phasing Map, 3/23/2010
Attachment 3: Revised Construction GHG Emission Tables (note tables are numbered to correspond to ENVIRON’s original technical report {*Climate Change Technical Report Candlestick Point–Hunters Point Shipyard Phase II Development Plan,* October 2009} which is Appendix S of the DEIR.

Attachment 1:

CPHP II Phasing Comparison (DEIR vs. Current) 3/22/2010

CPHP II Phasing Comparison (DEIR vs. Current) 3/22/2010

Previous DEIR Phasing Map			Current Phasing Map		
DEIR Subphase ID	Horizontal Duration	Vertical Duration	Equivalent Revised Subphase ID	Horizontal Duration	Vertical Duration
Hunters Point					
HP-01	2010 - 2012	2013 - 2014	75% HP-01 50% Northside Park/African	2012-2014 2014-2015	2014-2016 2016-2019
HP-02	2012	NA	25% HP-01	2012-2014	NA
HP-03	2010-2013	2014-2015	HP-02 MP-1 Promenade 1 50% Northside Park/African	2014-2016	2016-2019
HP-04	2010-2014	2015-2016	HP-03 MP-1 Promenade 2	2015-2018	2017-2019
HP-05	2014	NA	35% HP-06	2014-2015	NA
HP-06	2012 - 2014	2015-2016	90% HP-12	2012-2014	2015-2017
HP-07	2012-2015	2016-2017	Bldg 101 Artist	2011 - 2017	2011-2019
			HP-04 30% HP-05	2016-2019	2018-2021
			HP-07, 08, 09, 10, 11	2019-2024	2021-2026
			MP-1 Heritage Park MP-2 Heritage Park MP-2 Promenade 1 MP-2 Promenade 2	2016-2024	2019-2027
			50% HP-14	2029-2030	2031-2032
HP-08	2014-2016	2017	HP-13	2014-2017	2017
			Urban Rec Area Corp Yard 50% HP-14	2025-2030	2026-2032
HP-09	2016	NA	35% HP-06	2014-2015	NA
HP-10	2012-2016	2017-2018	10% HP-12	2012-2014	2015-2017
			70% HP-05	2016-2019	2018-2022
HP-11	2015-2017	2017-2018	Grasslands Ecology Park North Grasslands Ecology Park South	2025-2026	2025-2028

Notes:

1. The equipment resources required to complete horizontal and vertical construction of the project for each subparcel area have not changed.

2. While the quantity of construction workers required to complete horizontal and vertical construction for each subphase remains the same; the overall number of workers for the project has gone up due to the extended length of the project. With additional years of work comes more field management workers and more mobilizations and demobilizations. Even though this results in more workers the average length of time that they will be working each year has decreased.

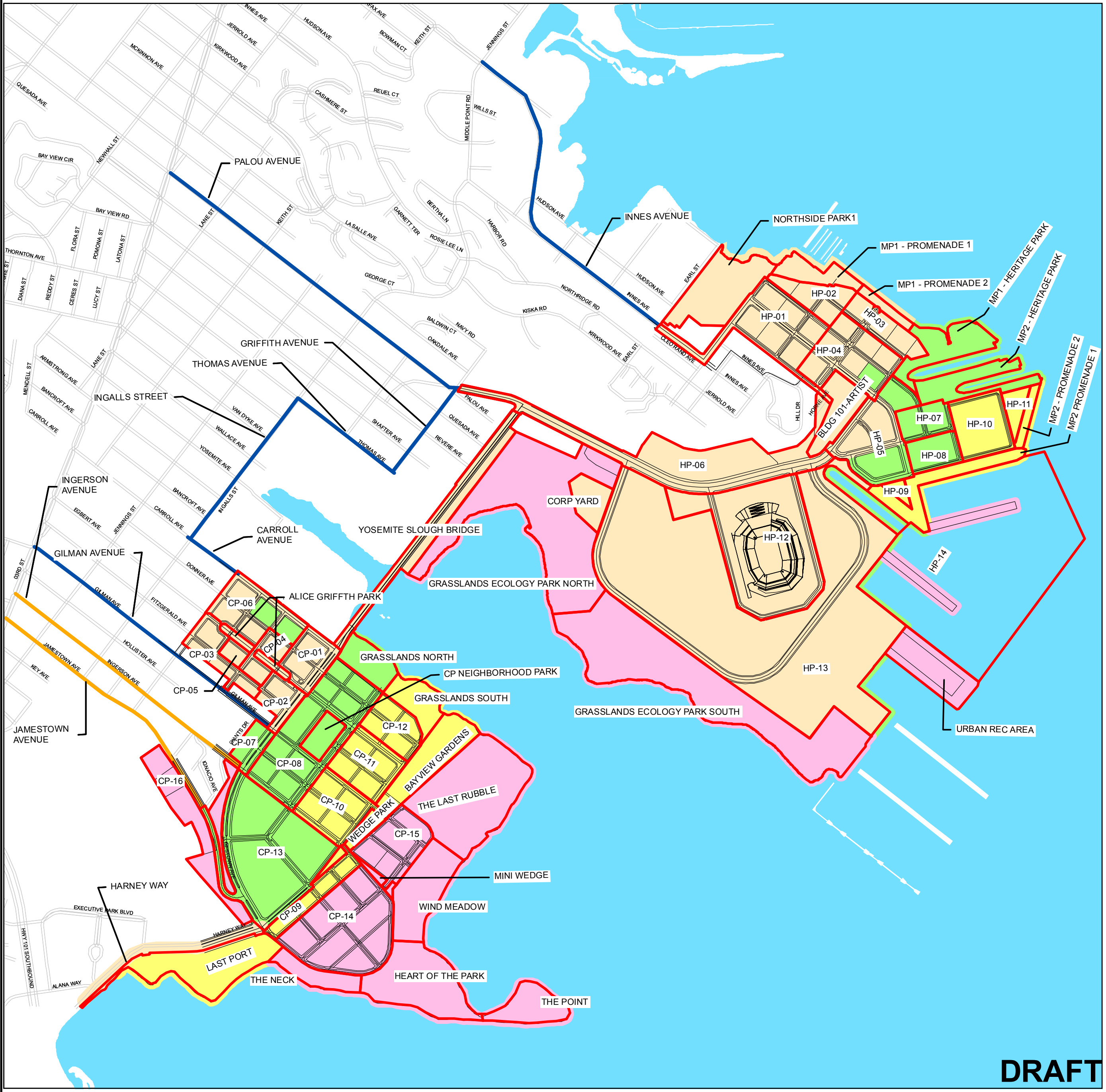
CPHP II Phasing Comparison (DEIR vs. Current) 3/22/2010

Previous DEIR Phasing Map			Current Phasing Map		
DEIR Subphase ID	Horizontal Duration	Vertical Duration	Equivalent Revised Subphase ID	Horizontal Duration	Vertical Duration
Candlestick Point					
CP-01	2011-2012	2012-2013	90% CP-01	2012-2013	2014-2015
CP-02	2011-2013	2013-2014	5% CP-01 95% CP-02	2012-2014	2014-2016
CP-03	2013-2014	2015-2016	CP-03	2014-2015	2016-2017
CP-04	2014-2015	2016-2017	CP-04 CP-05 Alice Griffith Park CP-07	2015-2020	2017-2022
			5% CP-01	2012-2013	2014-2015
CP-05	2015-2016	2017-2018	60% CP-06	2016-2019	2018-2021
CP-06	2016-2017	2018-2019	40% CP-06	2016-2019	2018-2021
CP-07	2017-2018	2019-2020	CP-08 CP-Neighborhood Park 50% CP-09 95% CP-13	2019-2023	2021-2025
CP-08	2019	2020-2021	50% CP-09 CP-10	2021-2023	2023-2025
CP-09	2020	2021-2022	50% CP-11 Bayview Gardens Wedge Park	2021-2024	2024-2026
CP-10	2021	2022-2023	50% CP-11 CP-12	2022-2025	2024-2027
CP-11	2022	2023-2024	45% CP-14	2025-2028	2029-2030
			Last Port	2021-2023	2024-2025
CP-12	2023	2024-2025	30% CP-14 40% CP-15 Mini Wedge Wind Meadow The Last Rubble	2024-2028	2025-2030
CP-13	2024	2025-2026	60% CP-15 25% CP-14 CP-16 The Neck Heart Of The Park The Point	2025-2029	2027-2031
			5% CP-13	2019-2021	2021-2023
Grasslands North	2012	2013-2014	Grasslands North	2019-2020	2022-2023
Grasslands South	2016	2017-2018	Grasslands South	2024-2025	2025-2026
Roads					
Innes Palou Griffith Thomas Ingalls Carrol Gilman	2015-2016 2013-2014 2015 2015 2016 2013 2013-2015	NA	Innes Palou Griffith Thomas Ingalls Carrol Gilman	2013-2017	NA
Ingerson Jamestown	2020 2021		Ingerson Jamestown	2018	NA
Harney	2016		Harney Phase 1	2016-2017	NA
			Harney Phase 2	2024	NA

Attachment 2:

Stadium Option Phasing Map

PROPOSED SITE PREPARATION SCHEDULE (PROJECT)



LEGEND

PHASE 1: DEMOLITION & ABATEMENT 2011-2015
UTILITIES & INFRASTRUCTURE 2013-2017
STRUCTURAL SHORELINE IMPROVEMENTS 2013-2017

PHASE 2: DEMOLITION & ABATEMENT 2016 - 2019
UTILITIES & INFRASTRUCTURE 2018 - 2021
STRUCTURAL SHORELINE IMPROVEMENTS 2018 - 2021

PHASE 3: DEMOLITION & ABATEMENT 2020-2023
UTILITIES & INFRASTRUCTURE 2022-2025
STRUCTURAL SHORELINE IMPROVEMENTS 2022-2025

PHASE 4: DEMOLITION & ABATEMENT 2024-2028
UTILITIES & INRASTRUCTURE 2026-2030
STRUCTURAL SHORELINE IMPROVEMENTS 2026-2030

OFFSITE TRANSPORTATION PHASE 1: MAJOR ACCESS IMPROVEMENTS COMPLETION BY 2017

OFFSITE TRANSPORTATION PHASE 2: MAJOR ACCESS IMPROVEMENTS COMPLETION BY 2018

ONSITE CONSTRUCTION PHASING BOUNDARY

STRUCTURAL SHORELINE IMPROVEMENTS (COLOR BASED ON PHASE OF COMPLETION)

NOTES:

1. PARK LANDSCAPING AND VERTICAL DEVELOPMENT IS NOT INCLUDED IN THE PHASING PLAN BUT IS TYPICALLY CONSTRUCTED WITHIN 2-3 YEARS OF THE HORIZONTAL INFRASTRUCTURE COMPLETION.
2. THE EQUIPMENT RESOURCES REQUIRED TO COMPLETE HORIZONTAL AND VERTICAL CONSTRUCTION OF THE PROJECT FOR EACH SUBPARCEL AREA HAVE NOT CHANGED.
3. WHILE THE QUANTITY OF CONSTRUCTION WORKERS REQUIRED TO COMPLETE HORIZONTAL AND VERTICAL CONSTRUCTION FOR EACH SUBPHASE REMAINS THE SAME; THE OVERALL NUMBER OF WORKERS FOR THE PROJECT HAS GONE UP DUE TO THE EXTENDED LENGTH OF THE PROJECT. WITH ADDITIONAL YEARS OF WORK COMES MORE FIELD MANAGEMENT WORKERS AND MORE MOBILIZATIONS AND DEMOBILIZATIONS. EVEN THOUGH THIS RESULTS IN MORE WORKERS THE AVERAGE LENGTH OF TIME THAT THEY WILL BE WORKING EACH YEAR HAS DECREASED.

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NO.	DATE	REVISIONS	DRAWN: RR	PROJECT NO: 4096097772
			ENGINEER: JHD/DR	SCALE: AS SHOWN
			CHECKED:	APPROVED:
			DATE: 03-23-10	DATE: 03-23-10

MACTEC

HUNTERS POINT / CANDLESTICK POINT
INTEGRATED PROJECT
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

ABATEMENT/DEMOLITION / HORIZONTAL INFRASTRUCTURE PROPOSED SITE PREPARTION SCHEDULE (PROJECT)

FIGURE: --

Attachment 3:

Revised Construction GHG Emission Tables

Note: tables are numbered to correspond to ENVIRON's original technical report (*Climate Change Technical Report Candlestick Point–Hunters Point Shipyard Phase II Development Plan, October 2009*) which is Appendix S of the DEIR

Table 3-3
GHG Emissions from Worker Commutes
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Location	Worker Round Trips[1]	Trip Length [2]	EF^3_{LDA}		EF_{LDT2}		CO_2 Emissions[4]		Total CO_2 Emissions	Total CO_2e Emissions[5,6]
			Running	Startup	Running	Startup	Running	Startup		
		(miles)	(g/mile)	(g/trip)	(g/mile)	(g/trip)	(tonne)			
Candlestick Point	233,513	29.8	340	209	424	259	2,658	109	2,768	2,913
Hunter's Point Shipyard	219,130	29.8	340	209	424	259	2,494	103	2,597	2,734
Total									**5,365**	**5,647**

Notes:
1. Worker trips were calculated based on the average number of workers and duration of each project phase as provided by Mactech.
2. The roundtrip length is 29.8 miles based on the Home-Work trip lenth for San Francisco provided by Fehr and Peers.
3. The running emission factor depends on the speed of the vehicle. The emission factor used in this calculation refers to the URBEMIS 9.2.4 default vehicle speed: 30 MPH.
The startup emission factor depends on the settling period before driving. The startup emissions were conservatively calculated based on a 12 hour wait before each engine startup.
4. GHG Running Emission calculation formula: GHG Emission = Roundtrips x Trip Length x $(0.5 \times EF_{LDA} + 0.5 \times EF_{LDT2})_{Running}$
GHG Startup Emission calculation formula: GHG Emission = Worker Trips x $(0.5 \times EF_{LDA} + 0.5 \times EF_{LDT2})_{Startup}$
URBEMIS 9.2.4 assumes that LDA and LDT have a 50:50 mixing ratio.
5. $CO_2e = CO_2 / 0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their global warming potentials.
6. The emission factor values of calendar year 2011, the anticipated start date of the project, were used for all calculations.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
EF - Emission Factor
HFC - hydro fluorocarbons
hr - hour
LDA - Light Duty Auto
LDT - Light Duty Truck
MPH - Miles per hour
URBEMIS - Urban Emissions Model

Table 3-4
GHG Emissions from Hauling Trips
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Location	Hauling Round Trips[1]	Trip Length[2]	EF^{3}_{HHD}		CO_2 Emissions[4]		Total CO_2 Emissions	Total CO_2e Emissions[5,6]
			Running	Startup	Running	Startup		
		(miles)	(g/mile)	(g/trip)	(tonne)			
Candlestick Point	121,319	14.6	1,610	389	5,703	94	5,798	6,103
Hunter's Point Shipyard	362,306	14.6	1,610	389	17,033	282	17,314.6	18,226

Notes:
1. Hauling trips are calculated based on information provided by Mactech.
2. Trip length is based on URBEMIS default for San Francisco consumer non-work of 7.3 miles one way.
3. The running emission factor depends on the speed of the vehicle. The emission factor used in this calculation refers to the URBEMIS 9.2.4 default vehicle speed: 30 MPH.
   The startup emission factor depends on the settling period before driving. The startup emissions are conservatively calculated based on a 12 hour wait before each engine startup.
4. URBEMIS 9.2.4 assumes that all haulers drive heavy-heavy-duty trucks.
   CO_2 Running Emission calculation formula: CO_2 Emission = trips x trip length x $EF_{HHD\text{-}Running}$
   CO_2 Startup Emission calculation formula: CO_2 Emission = Hauler Trips x $EF_{HHD\text{-}Startup}$
5. $CO_2e = CO_2 / 0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their global warming potentials.
6. The emission factor values of calendar year 2011, the anticipated start date of the project, are used for all calculations.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
EF - Emission Factor
GVW - Gross Vehicle Weight
HFC - Hydro Fluorocarbons
HHD - Heavy-Heavy Duty
hr - hour
MPH - Miles per hour
URBEMIS - Urban Emissions model

Table 3-5
Overall Construction GHG Emissions
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Location	Construction Equipment	Worker Commuting	Hauling	Total GHG Emissions
	(tonnes CO_2e)			
Candlestick Point	56,403	2,913	6103	**65,419**
Hunter's Point Shipyard	42,895	2,734	18226	**63,854**
Total	**99,298**	**5,647**	**24,329**	**129,274**

Notes:
1. See previous tables for calculation detail. The table includes emissions from construction equipment, worker commuting and hauling.

Abbreviations:
CO_2e - carbon dioxide equivalent
GHG - Greenhouse Gas

Appendix B Bayview Jobs, Parks, and Housing Initiative (Proposition G), November 20, 2007

SAN FRANCISCO
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DEPARTMENT OF ELECTIONS

BAYVIEW JOBS, PARKS AND HOUSING INITIATIVE

Section 1. Title.

This Initiative shall be known and may be cited as the "Bayview Jobs, Parks and Housing Initiative."

Section 2. Findings.

The People of the City and County of San Francisco (the "City") make the following findings:

(a) Improving the quality of life of the residents of the Bayview Hunters Point community (the "Bayview") is one of the City's highest priorities. Expediting the revitalization of the Bayview will provide long overdue improvements that also will benefit the City as a whole. Both the Hunters Point Shipyard (the "Shipyard") and Candlestick Point are part of the Bayview and together make up the largest area of underused land in the City. Combining planning and development for the remainder of the Shipyard that is not already underway (the "Shipyard Property") and Candlestick Point as an integrated revitalization project will provide hundreds of acres of much needed public parks and public open space, significant jobs and economic development opportunities, particularly for residents and businesses of the Bayview, and a substantial number of new affordable and market-rate housing units, including a mix of rental and for-sale units. Integrated development of these areas can also provide a world-class site for a new stadium for the San Francisco Forty Niners (the "49ers"), including improvements in transportation and other infrastructure. The Shipyard Property and Candlestick Point, subject to any final adjustments as described in Section 9, are referred to in this Initiative as the "Project Site." A map of these two areas is attached for reference as Exhibit A.

(b) The Shipyard was once a thriving, major maritime industrial center that employed generations of Bayview residents. Following World War II, the Shipyard was a leading hub of employment for the Bayview, providing logistics support, construction and maintenance for U.S. naval operations. At its peak, the Shipyard employed more than 17,000 civilian and military personnel, many of whom lived in the adjacent Bayview neighborhood. In 1974, the United States Department of the Navy (the "Navy") ceased operation of the Shipyard. The closure of the Shipyard had profoundly negative impacts on the economic base of the Bayview. In 1993, the United States Congress passed special legislation that gave the Navy authority to convey the Shipyard to the City.

(c) Candlestick Point includes: (i) the Alice Griffith Housing Development, also known as Double Rock ("Alice Griffith Housing"), which, although in need of repair or replacement for its residents, has few governmental resources for those repairs; (ii) the Candlestick Point State Recreation Area, much of which is severely under-improved, under-utilized and under-funded, and the restoration and improvement of which has been a long-term goal of the Bayview, the City and the State; and (iii) the City-owned stadium, named Monster Park, that is nearing the end of its useful life.

(d) The Yosemite Slough, which lies between Candlestick Point and the Shipyard Property, was once a pristine wetland area but has been subject to environmental distress caused by illegal dumping and neglect. The California State Parks Foundation and California State Parks are in the process of implementing the Yosemite Slough Restoration plan, which will reopen the Yosemite Slough to public access, create the largest contiguous wetland area in the City and make the wetlands pristine again.

(e) The City's lease of Monster Park to the 49ers is scheduled to expire in May 2013, although the 49ers have the right to extend that date by exercising certain extension options. In the fall of 2006, the 49ers announced their intention to explore relocating to Santa Clara. Since then, the 49ers have continued to evaluate the feasibility of building a new stadium both there and in San Francisco. Regardless of the 49ers' final decision, the City would like to proceed with the integrated revitalization of the Project Site, with or without a new stadium.

(f) Community and elected officials and San Francisco voters have consistently expressed their support for revitalizing the Project Site and demanded accountability from the federal government to clean up the Shipyard. In July 1997, the Board of Supervisors adopted and the Mayor approved a redevelopment plan for the Shipyard (the "Shipyard Redevelopment Plan"), and in June 2006, after a ten-year planning process, the Board of Supervisors adopted and the Mayor approved a redevelopment plan covering large portions of the Bayview, including most of Candlestick Point (the "Bayview Redevelopment Plan"). Both those redevelopment plans are designed to create economic development, affordable housing, parks and open space and other community benefits by developing underused lands like those comprising the Project Site. More recently, in May 2007 the Board of Supervisors and the Mayor approved a resolution endorsing a Conceptual Framework for the integrated development of the Project Site with a major mixed-use project, including hundreds of acres of new waterfront parks and open space, thousands of new units of housing, a robust affordable housing program, extensive job-generating retail and research and development space, permanent space for the artist colony that exists in the Shipyard and a site for a new stadium for the 49ers on the Shipyard Property.

(g) In furtherance of the Board's May 2007 resolution and in compliance with the California Environmental Quality Act ("CEQA"), on August 31, 2007 the Redevelopment

Agency of the City and County of San Francisco (the "Agency") and the San Francisco Planning Department published a Notice of Preparation of an Environmental Impact Report (the "NOP") and solicited public participation in determining the scope of an Environmental Impact Report ("EIR") for the development of the Project Site. Both the NOP and the Conceptual Framework contemplate that integrated development of the Project Site should proceed whether or not the 49ers elect to build a new stadium on the Project Site and contemplate that, if a new 49ers' stadium is not constructed because the 49ers move to Santa Clara or elsewhere, other uses, including additional green office, science and technology, research and development and industrial space or housing–or a combination of those uses–will be developed on the Project Site instead of the stadium and associated parking.

Section 3. Purpose.

In light of the findings set forth in Section 2 above, the purpose of this Initiative is to express the voters' intent that the City and other applicable agencies move forward with the revitalization of the Project Site to provide tangible benefits for the Bayview in particular and the City generally and a new stadium site for the 49ers. Toward that end, the voters wish to repeal Propositions D and F, establish policies to guide the revitalization planning efforts, authorize the lease or conveyance of City-owned park land at Candlestick Point under certain conditions and encourage all local, state and federal agencies with applicable jurisdiction to take all steps necessary to proceed with the development of the Project Site consistent with this Initiative.

More specifically, the People of the City declare their purposes in enacting this Initiative to be as follows:

(a) Improving and creating additional public parks and public open space in the Bayview, particularly along the waterfront. This Initiative will permit the City's park property at Candlestick Point, including land currently used for Monster Park and associated surface parking, to be transferred for development consistent with the objectives described in Section 4 below. At the same time, this Initiative requires that any park property transferred by the City be replaced with other public park and public open space property of at least the same size in the Project Site, all as provided in Section 6 below. It also encourages the improvement of the Candlestick Point State Recreation Area and the extension of the Bay Trail along the Project Site's waterfront.

(b) Improving the quality, availability and affordability of housing in the Bayview. This Initiative encourages the development of new housing in the Project Site with a mix of rental and for-sale units, both affordable and market-rate.

(c) Improving the quality of Alice Griffith Housing. This Initiative encourages the rebuilding of Alice Griffith Housing as a part of the development of the Project Site, subject to consultation with the residents of Alice Griffith Housing and to approval by applicable government agencies. If such approvals are obtained and Alice Griffith Housing is included in the integrated development project, such development must be consistent with the objectives in subsection (3) of Section 4 below that relate to Alice Griffith Housing.

(d) Elevating the Project Site into a regional center for green development and the use of green technology. This Initiative encourages the use of green building construction practices and the incorporation of environmental sustainability principles in the design and development of the Project Site, including the use of renewable energy. In addition, this Initiative encourages the inclusion of green development projects on the Project Site, such as green office, research and development or industrial projects, including a green office, science and technology, biotechnology or digital media campus.

(e) Providing commercial opportunities and jobs for the residents of the Bayview. This Initiative encourages and anticipates construction and permanent jobs for local economically disadvantaged residents, particularly in the Bayview, and a range of economic development opportunities, including retail and commercial space.

(f) Encouraging the 49ers to remain in San Francisco. The 49ers are an important source of civic pride and have contributed to the Bayview. They are closely identified with San Francisco, having played in San Francisco since the 1940s and in Candlestick Point since the 1970s. This Initiative encourages the 49ers to remain in San Francisco by providing a world-class site for a new stadium on the Shipyard Property, together with supporting infrastructure.

(g) Repealing the earlier stadium mall framework and financing propositions. In June 1997, the City's voters adopted two ballot measures—Proposition D and Proposition F—relating to stadium and mall development at Candlestick Point. Proposition D authorized the City to use lease financing to borrow up to $100 million toward building a new stadium at Candlestick Point. Proposition F changed various City zoning and other laws so that a new stadium, an entertainment and regional shopping center and new residential developments could be built. In the fall of 2006 the 49ers decided that the proposed stadium did not meet their needs. The plan envisioned by Propositions D and F for a stadium and adjoining retail and entertainment center partially financed through the use of a $100 million bond issuance by the City is no longer viable. Accordingly, this Initiative repeals both Propositions D and F.

Section 4. Policies.

It is the Policy of the People of the City that, consistent with the objectives set forth in this Section 4 and subject to the public review process generally described in Sections 5 and 9 below, the City shall encourage the timely development of the Project Site with a mixed-use project that includes the following major uses, together with supporting transportation and other infrastructure improvements (collectively, the "Project"): (i) over 300 acres of public park and public open space improvements, including the improvement of the existing Candlestick Point State Recreation Area, the establishment of a new State park area on the Shipyard Property, the creation of a number of recreation facilities, sports fields and neighborhood-oriented parks and the extension of the Bay Trail along the waterfront of the Project Site; (ii) between about 8,500 and 10,000 residential housing units across the Project Site, including a mix of rental and for-sale units, both affordable and market-rate; (iii) about 600,000 square feet of regional retail on Candlestick Point and about 100,000 square feet of neighborhood-serving retail on the Shipyard Property; (iv) about 2,000,000 square feet of green office, science and technology, biotechnology or digital media office, research and development and industrial uses on the Shipyard Property and about 150,000 square feet on Candlestick Point, with more of such uses on the Project Site if the stadium is not built on the Shipyard Property; (v) if practicable, a site for an arena or other public performance venue; (vi) if the 49ers and the City determine it is feasible to build a new stadium for the 49ers and the 49ers elect in a timely manner to do so, a site on the Shipyard Property for a new National Football League stadium for the 49ers, including green parking surfaces that would both accommodate parking for stadium events and serve as public playing fields at other times; and (vii) if a new stadium is not built, then additional green office, science and technology, research and development and industrial space, or housing–or a combination of those uses–instead of the stadium and associated parking. Development of the Project Site shall be consistent with the following objectives:

(1) **The integrated development should produce tangible community benefits for the Bayview and the City**, and in so doing should:

- Improve the Candlestick Point State Recreation Area to enhance public access to the waterfront and enjoyment of the Bay.
- Create new public recreational and public open spaces in the Project Site.
- Preserve the shoreline of the Project Site primarily for public park and public open space uses, including an extension of the Bay Trail along the Project Site's waterfront.
- Afford a range of job and economic development opportunities for local, economically disadvantaged individuals and business enterprises, particularly for residents and businesses located in the Bayview.
- Include neighborhood-serving retail.
- Subsidize the creation of permanent space on the Shipyard Property for the existing artists.
- Transform the contaminated portions of the Shipyard Property into economically productive uses or public open space, as appropriate.

- Encourage the timely development of the Project Site and its public benefits, whether or not the 49ers decide to remain in San Francisco, including developing alternate uses for the stadium site on the Shipyard Property that are consistent with the other objectives set forth in this Section 4, but recognizing that the overall financial feasibility of the development of the Project Site and the phasing of the integrated development depends on the 49ers' vacating the current site of Monster Park, whether to a new stadium on the Shipyard Property or elsewhere outside of the Project Site.

(2) **The integrated development should reunify the Project Site with the Bayview and should protect the character of the Bayview for its existing residents**, and in so doing should:

- Foster the creation of strong commercial, institutional, cultural and urban design ties between the development in the Project Site and the Bayview in particular and the City in general.

- Provide automobile, public transportation and pedestrian connections between the Shipyard Property and Candlestick Point to facilitate the integration of the Project Site and reunification with the Bayview.

- Afford substantial affordable housing, jobs and commercial opportunities for existing Bayview residents and businesses.

- Prohibit, in implementing the Project, the use of eminent domain to acquire any property that is currently residentially zoned, is improved with a building that contains one or more legally occupied dwelling units, is a church or other religious institution, or is publicly owned, including, without limitation, property owned by the Housing Authority of the City and County of San Francisco.

(3) **The integrated development should include substantial new housing in a mix of rental and for-sale units, both affordable and market-rate, and encourage the rebuilding of Alice Griffith Housing**, and in so doing should:

- Provide substantial opportunities for new affordable housing that is targeted to the lower income levels of the Bayview population, including new units that are suitable for families, seniors and young adults.

- Include housing at levels dense enough to: create a distinctive urban form and at levels sufficient to make the development of the Project Site financially viable, consistent with the objectives stated in subsection (6) below; attract and sustain neighborhood retail services and cultural amenities; create an appealing walkable urban environment served by transit; help pay for transportation and other infrastructure improvements; and achieve economic and public benefits for the Bayview in particular and the City generally.

- Subject to consultation with Alice Griffith Housing residents and the receipt of all required governmental approvals, rebuild Alice Griffith Housing to provide at least one-for-one replacement units targeted to the same income levels as those of the existing residents and ensure that eligible Alice Griffith Housing residents have the opportunity to move to the new, upgraded units directly from their existing Alice Griffith Housing units without having to relocate to any other area.

- Include a mix of stacked flats, attached town homes and–in appropriately selected locations–low-rise, mid-rise and high-rise towers, to help assure the economic feasibility of the development and provide a varied urban design.

(4) **The integrated development should incorporate environmental sustainability concepts and practices**, and in so doing should:

- Apply sustainability principles in the design and development of public open spaces, recreation facilities and infrastructure, including wastewater, storm water, utility and transportation systems.

- Apply green building construction practices.

- Include energy efficiency and the use of renewable energy.

- Encourage green development projects, such as green office, research and development or industrial projects, including a green technology, biotechnology or digital media campus.

(5) **The integrated development should encourage the 49ers—an important source of civic pride—to remain in San Francisco by providing a world-class site for a new waterfront stadium and supporting infrastructure**, and in so doing should:

- Provide parking, transportation, transit and other infrastructure necessary for the operation of the stadium, including automobile, public transit and pedestrian connections between the Shipyard Property and Candlestick Point in order to facilitate the efficient handling of game day traffic.

- Prohibit the issuance by the City of lease revenue bonds or other debt that will be secured by or repaid from revenues on deposit in the City's General Fund to finance development of the new stadium.

(6) **The integrated development should be fiscally prudent, with or without a new stadium**, and in so doing should:

- Minimize any adverse impact on the City's General Fund relating to the development of the Project Site by relying to the extent feasible on the development to be self-sufficient.

- Promote financial self-sufficiency by: encouraging substantial private capital investment; leveraging land value created through the entitlement process for the Project Site; allowing the City or the Agency, subject to the review process generally described in Section 5 below, to contribute real property in the Project Site, so long as the contribution is linked to the provision of public benefits consistent with the objectives in this Section 4 or to the grant of rights to the City or the Agency to share in surplus revenues from development of the Project Site; and permitting the use of certain tax exempt financing tools such as the allocation of property tax-increment from the Project Site, the issuance of tax allocation bonds based on such increment and the issuance of community facilities (Mello-Roos) bonds secured by private property in the Project Site.

- Allow the Agency to use its city-wide Affordable Housing Fund to help finance affordable housing projects in the Project Site.

- Except as provided immediately above, prohibit the use of property tax increment from any part of a redevelopment area outside of the

Project Site to finance construction of improvements in the Project Site.

- To the extent feasible, use state and federal funds to pay for environmental remediation on the Project Site and help pay for transportation and other infrastructure improvements, and provide ways for other development projects outside the Project Site to pay their fair share for new infrastructure improvements.

Section 5. Governmental and Public Review of Development Plan.

Any development plan proposed for the Project Site, including the Project, will be subject to extensive public review and input. For example, any development plan will require public approvals from the City and the Agency, including conforming amendments to the City's General Plan and the existing Bayview Redevelopment Plan and Shipyard Redevelopment Plan, following environmental review under CEQA. Further, under federal and state laws, aspects of the development plan may also be reviewed by various regional, state and federal agencies, which may include the State Department of Parks and Recreation, the San Francisco Bay Conservation and Development Commission, the State Lands Commission, the State Regional Water Quality Control Board and the Navy.

Section 6. Disposition of City Land at Candlestick Point.

Under San Francisco Charter Section 4.113, the voters of the City approve the following (each a "Permitted Transfer"): (1) the sale, conveyance or lease for non-recreational purposes of any of the park land that is under the jurisdiction of the San Francisco Recreation and Park Commission and located within the boundary of Candlestick Point, including the property currently used in connection with the existing stadium and related parking areas; and (2) the construction, maintenance and use for non-recreational purposes of any structure on such property. Each Permitted Transfer may be free from any restriction that the affected real property be used for park or recreation purposes, so long as: (a) the City's approval of such Permitted Transfer requires a binding obligation to create new public park or public open space land areas, at least equal in size to the real property subject to the Permitted Transfer, that are located in the Project Site; and (b) the Board of Supervisors finds in approving a Permitted Transfer at the conclusion of the review process generally described in Section 5 above, that: (i) new land areas are suitable for public park or public open space and will be dedicated for such uses; and (ii) the Permitted Transfer furthers development of the Project Site consistent with the objectives set forth in Section 4 above. The voters' approvals granted under this Section 6 are not intended to modify or abrogate any existing legal commitment of the City or to limit any other authority to sell, convey, lease or otherwise transfer any other City-owned land in the Project Site or to build, maintain or use any such land or structures on such land under any City ordinance or other applicable law.

Section 7. Repeal of Proposition D.

The approval of the voters to lease-finance a stadium development at Candlestick Point, in principal amount not exceeding $100 million, as more particularly set forth in Proposition D adopted in June 1997, a copy of which is attached for reference as Exhibit B, is repealed in its entirety. Accordingly, the City no longer has voter authority as required under its Charter to issue lease revenue bonds under Proposition D for a stadium development.

Section 8. Repeal of Proposition F.

Proposition F, adopted by the voters on June 3, 1997, a copy of which is attached for reference as Exhibit C, is repealed in its entirety.

Section 9. Implementing Actions.

The People of the City encourage the City, the Agency and other public agencies with applicable jurisdiction to proceed as expeditiously as possible to implement this Initiative, including, but not limited to, adopting land use controls for the Project Site consistent with the objectives set forth in Section 4 above and subject to the review process generally described in Section 5 above.

As a result of the public process generally described in Section 5 above and certain variables, including, for example and without limitation, market changes, economic feasibility and the timing of the 49ers departure from Monster Park, the final development plan for the Project Site may be materially different from the Project and the boundaries of the Project Site may be materially different from those identified on Exhibit A. The People of the City encourage the Board of Supervisors and other public agencies with applicable jurisdiction to approve such final development plans at the conclusion of the review process generally described in Section 5 above, so long as the Board of Supervisors and the Mayor then determine that such plans are generally consistent with the objectives set forth in Section 4 above.

Section 10. Interpretation.

The title of this Initiative and the captions preceding the sections of this Initiative are for convenience of reference only. Such title and captions shall not define or limit the scope or purpose of any provision of this Initiative. The use of the terms "including," "such as" or words of similar import when following any general term, statement or matter shall not be construed to limit such term, statement or matter to the specific items or matters, whether or not language of non-limitation is used. Rather, such terms shall be deemed to refer to all other items or matters that could reasonably fall within the broadest possible scope of such statement, term or matter. The use of the term "or" shall be construed to mean and/or.

Section 11. Severability.

If any provision of this Initiative or any application thereof to any person or circumstance is held invalid, such invalidity shall not affect any provision or application of this Initiative that can be given effect without the invalid provision or application. To this end, the provisions of this Initiative are severable.

Attachments:

Exhibit A	Map of the Shipyard Property and Candlestick Point
Exhibit B	Proposition D (June 1997)
Exhibit C	Proposition F (June 1997)

EXHIBIT A

Map of the the Shipyard Property and Candlestick Point

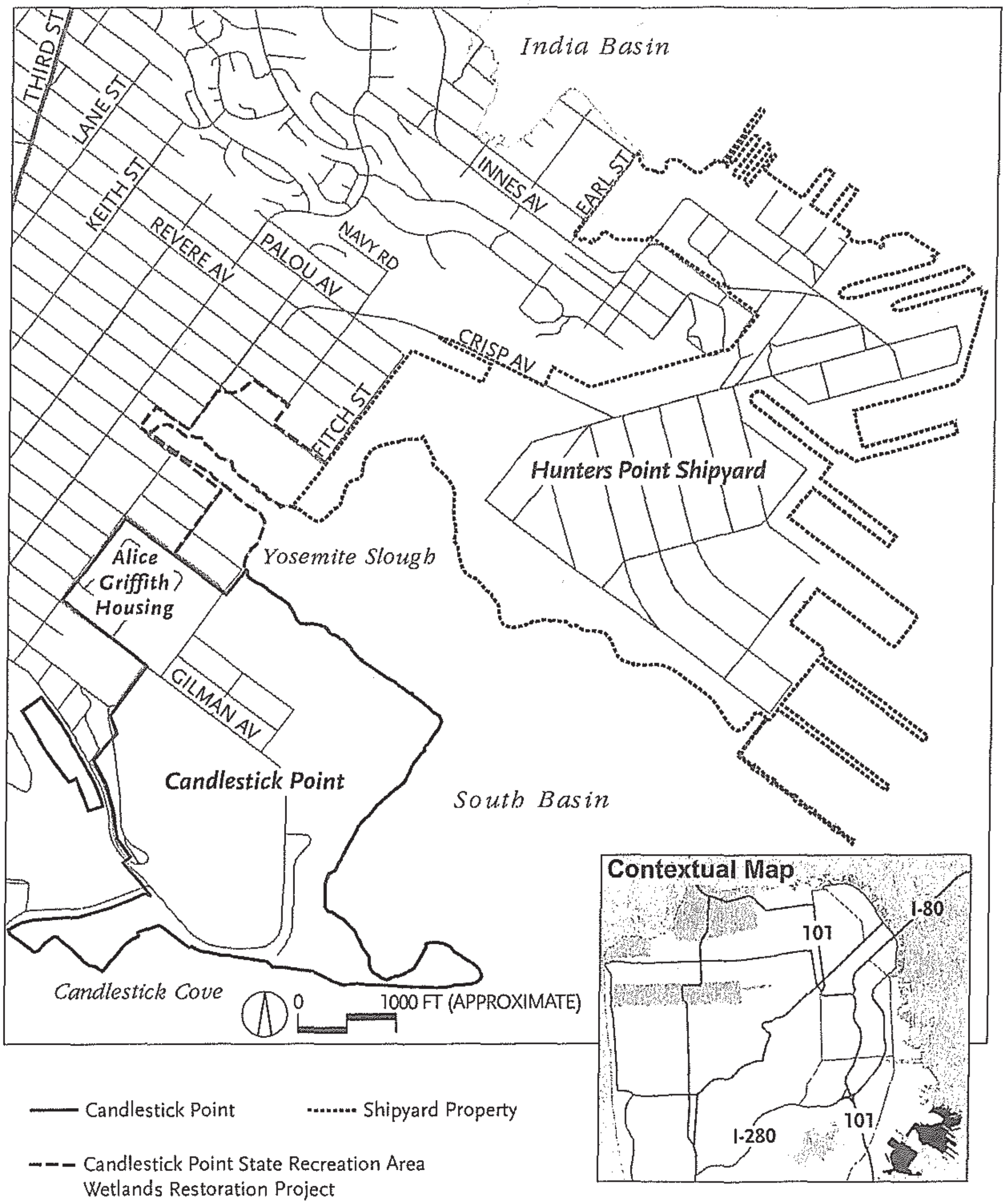


EXHIBIT B

PROPOSITION D

SUBMITTING A BALLOT PROPOSITION FOR THIS YEAR'S JUNE 3RD SPECIAL ELECTION, AUTHORIZING THE CITY TO LEASE-FINANCE A STADIUM DEVELOPMENT AT CANDLESTICK POINT, IN PRINCIPAL AMOUNT NOT EXCEEDING $100,000,000, PROVIDED NO CITY TAXES ARE INCREASED OR NEWLY IMPOSED WITHOUT PROPOSITION 218 VOTER APPROVAL; AND FINDING THE LEASE-REVENUE BOND PROPOSITION IS IN CONFORMITY WITH THE EIGHT PRIORITY POLICIES OF PLANNING CODE SECTION 101.1 AND THE CITY'S GENERAL PLAN.

- RESOLVED, That pursuant to Charter Section 9.108, the Board of Supervisors hereby submits to the electorate of the City and County of San Francisco the following proposition:

Shall the City lease-finance a stadium development at Candlestick Point, in principal amount not exceeding $100,000,000, provided no City taxes are increased or newly imposed without Proposition 218 voter approval.

The proposition shall be submitted to the electorate at the Special Election to be held on June 3, 1997. The proposition shall be placed on the ballot as a separate proposition in the form set forth above; and, be it

- FURTHER RESOLVED, That the stadium development shall consist of the development, acquisition and/or construction of the stadium and related infrastructure, facilities, structures, equipment and furnishings, in whole or in part (collectively, the **"Stadium Development"**); and, be it

- FURTHER RESOLVED, That the term "infrastructure" shall mean the physical systems and services which support, in whole or in part, the Stadium Development and its users, including, but not limited to, parking, streets, highways, water systems and sewer systems; and, be it

- FURTHER RESOLVED, That the term "Candlestick Point" shall mean Candlestick Point, the adjacent land and any other lands deemed necessary by the Board of Supervisors for the completion of the Stadium Development; and, be it

- FURTHER RESOLVED, That the authorized principal amount of $100,000,000 shall be used to finance (1) a portion of the total cost of the Stadium Development; (2) cost of issuance; (3) capitalized interest; (4) reserve accounts; and (5) any other related cost designated by the Board of Supervisors; and, be it

- FURTHER RESOLVED, That the City shall not impose any new taxes or increase or extend any existing taxes for the Stadium Development without voter approval to the extent required by Proposition 218 passed by the voters on November 5, 1996; and, be it

• FURTHER RESOLVED, That the Board of Supervisors having reviewed the proposed legislature, finds and declares that the proposed lease-revenue bond proposition is, on balance, in conformity with the General Plan and is consistent with the Eight Priority Policies of the Planning Code Section 101.1 and hereby adopts the findings of the City Planning Department, as set forth in Planning Commission Resolution No. 14295, adopted February 6, 1997 and incorporates said finding by reference; and, be it

• FURTHER RESOLVED, That the City shall not issue the bonds until the following conditions have been negotiated and concluded with the Mayor's Office:

1. The Forty-Niners shall provide a written commitment to the City that it will play all of its home games in the stadium until the retirement of the City's bonds for the Stadium Development.

2. A certification from the Controller that the total net proceeds of bonds available for construction shall not exceed $100,000,000. The City's contribution for construction shall be reduced by any net proceeds received from any tax allocation bonds that the Redevelopment Agency elects to issue based on tax increment generated by the Project.

3. The City determines, through the Mayor's office, that sufficient financial commitments are in place to construct an adjacent retail shopping center.

4. A written commitment to comply with all the requirements of Administrative Code Sections 12B and 12C that are applicable to the Stadium Development, including nondiscrimination in benefits based on domestic partner status.

5. A written commitment to provide an opportunity for 1000 permanent jobs at the Project to recipients of general assistance who become eligible through a training program.

6. A written commitment to use good faith efforts to provide that 50% of the construction jobs will be held by residents of the Bay-View Hunters Point-South Bayshore Community and 25% of permanent jobs available at the Project will be held by the community residents.

7. A written commitment that the City will only be responsible for no more than 50% of football related operations and maintenance expenses of the stadium, based on a budget approved by the City and the Forty-Niners.

8. A written commitment that there will be adequate provision for labor union representation at the project, including a card check neutrality agreement.

9. A written commitment to pay any reduction in property tax revenues due to a reassessment to the extent necessary to service any tax allocation bonds issued for the Stadium Development.

10. The City, through the Mayor's office, has determined that the City's contribution towards construction of the Project will be provided on a 20/80 prorata basis.

11. For purposes of these conditions, Project shall be defined to mean both the Stadium Development and the proposed shopping retail center to be located at Candlestick Point. The Mayor shall deliver a certificate to the Board of Supervisors that the foregoing conditions have been met. Upon the Board of Supervisors approving the issuance of the bonds, such certificate shall be final and conclusive in all respects as to the satisfaction of all the foregoing conditions. Bonds includes bonds, lease-financing arrangements, and certificates of participation.

EXHIBIT C

PROPOSITION F

Be it ordained by the People of the City and County of San Francisco:

Section 1. [Policy, Purpose]

It shall be the Policy of the People that a new professional football stadium, retail shopping and entertainment center, and related open space and parking be constructed, developed and operated at Candlestick Point consistent with the following principles:

The San Francisco Forty Niners are an invaluable source of civic pride and an integral part of San Francisco's image as a world-class city. The City and County of San Francisco must take immediate action to ensure that the Forty Niners have a suitable stadium in which to play their home games after the current lease at the existing stadium known as 3COM Park at Candlestick Point (formerly known as Candlestick Park) expires.

The City and County of San Francisco should have a state-of-the-art professional football stadium suitable for hosting the National Football League's Super Bowl on a regular basis.

Candlestick Point and the surrounding area is the most suitable location within San Francisco for the construction of a new professional football stadium for the San Francisco Forty Niners and retail shopping and entertainment center that will assist in revitalizing the economy of the Bayview-Hunters Point-South Bayshore area and provide jobs.

The stadium shall be designed and constructed by the San Francisco Forty Niners, or an affiliate thereof, or a developer selected by the San Francisco Forty Niners or an affiliate thereof, through a combination of public and private financing.

The stadium shall be constructed in conjunction with the retail shopping and entertainment center.

The City and County of San Francisco shall retain ownership of the land upon which the stadium and retail shopping and entertainment center shall be built.

The City and County of San Francisco shall enter into one or more ground leases with the San Francisco Forty Niners, or an affiliate thereof, or the developer of the stadium and/or retail shopping and entertainment center, selected by the San Francisco Forty Niners or its affiliate, for the stadium and retail shopping and entertainment center site.

Development of the stadium and retail and entertainment center shall incorporate open space and shall be consistent with the purposes of the Candlestick Point State Recreation Area and the recreational opportunities presently available in that area, including shoreline trails and shoreline access to San Francisco Bay.

The existing stadium shall be demolished once the new stadium is completed and ready for occupancy, provided that the Giants baseball team has relocated to a new facility.

The stadium and retail stopping and entertainment center will produce substantial economic and public benefits for San Francisco residents generally and for the residents and business owners of the Bayview-Hunters Point-South Bayshore community specifically.

The stadium and retail shopping and entertainment center, and all related parking, will satisfy any public trust requirements and restrictions applicable to any portion of the site consisting of former tidelands and submerged lands.

Section 2. [Implementation]

Promptly following the effective date of this ordinance, the City and County of San Francisco, through the Board of Supervisors, the Planning Commission, Redevelopment Agency and other appropriate officials, boards or commissions, shall proceed to cooperate with the San Francisco Forty Niners, or its affiliate, in taking all action necessary to achieve the purposes of this ordinance, including but not limited to assisting in the negotiations for property acquisition and applying for conforming amendments to all applicable state and regional plans and regulations.

Section 3. [Election Under Charter Section 4.113]

Pursuant to San Francisco Charter Section 4.113, the electors of the City and County of San Francisco hereby approve the lease for non-recreational purposes of, and the construction, development, operation, maintenance, repair and replacement of structures for non-recreational purposes on, any and all of the park land presently under the jurisdiction of the City's Recreation and Park Commission and located within the boundaries of the Candlestick Point Special Use District as defined in this ordinance, including the property currently used for the existing stadium and paved stadium parking.

Section 4. [General Plan; Amendment]

The General Plan of the City and County of San Francisco is hereby amended as follows:

(a) Figure 3 ("Generalized Land Use and Density") of the South Bayshore Area Plan Element shall be amended to redesignate the property generally bounded by Jamestown Avenue Extension, Giants Drive, Gilman Avenue, Arelious Walker Drive (Fitch Street), Carroll Avenue, Griffith Street, and San Francisco Bay, as the "Candlestick Point Special Use District."

(b) Figure 4 ("Candlestick Point Perimeter Proposed Revitalization Area") of the South Bayshore Area Plan Element shall be amended to indicate that the property within the Candlestick Point Special Use District shall be devoted to "Stadium, Commercial, Parking and Open Space" uses.

(c) New Policy 7.4 shall be added to the South Bayshore Area Plan Element to read as follows:

POLICY 7.4

Encourage commercial development within the Candlestick Point Special Use District that will complement a new sports stadium and the other commercial areas within the South Bayshore Area and the City, and that will create job opportunities for South Bayshore residents.

The existing sports stadium within this district may be replaced with a new professional football stadium of a size and character suitable for hosting the National Football League's Super Bowl on a regular basis. The construction of a new football stadium should be accompanied by development of retail and entertainment uses complementary to the stadium that will assist in revitalizing the economy of the area and create employment opportunities for South Bayshore residents. The City should require developers of new uses within the district to make good faith efforts to provide both construction and permanent jobs to South Bayshore residents.

Commercial development within the district should consist primarily of destination-oriented uses that will supplement, and not substitute for, neighborhood-serving retail services within the South Bayshore area and particularly in the Third Street core commercial area. Structures to house retail and entertainment uses within the Candlestick Point Special Use District should be integrally linked to, and should be planned and developed as a comprehensive unit with, the stadium complex. The existing shoreline trail should be retained and enhanced. In addition, commercial development within the district should incorporate open space areas to the extent feasible. Transportation and transit improvements should be made in conjunction with development within the district. The City, with public input, should coordinate development within the Candlestick Point Special Use District with on-going revitalization efforts for the South Bayshore area.

(d) Map 1 of the Recreation and Open Space Element shall be amended so that all property within the Candlestick Point Special Use District that is shown as property owned by the "Recreation and Park Department" shall be shown instead as property owned by "Other City Departments".

(e) Maps 2, 4, 8 and 9 of the Recreation and Open Space Element shall be amended by deleting all property within the Candlestick Point Special Use District from the "Existing Public Open Space" designation on Maps 2 and 4; the "Public Open Space" designation on Map 8; and the "Public Recreation and Open Space" designation on Map 9.

(f) Map 2 of the Commerce and Industry Element shall be amended to add a notation for all property within the Candlestick Point Special Use District that states, "Candlestick Point Special Use District; see applicable Planning Code provisions."

(g) Map 4 of the Urban Design Element shall be amended to add a notation for all property within the Candlestick Point Special Use District that states, "Candlestick Point Special Use District; see applicable Planning Code provisions."

(h) The Land Use Index shall be amended to conform to the amendments made above in subsections (a) through (g) in this Section 4.

Section 5. [Special Use District].

Part II, Chapter II of the San Francisco Municipal Code (City Planning Code) is hereby amended by adding Section 249.19 to read as follows:

"Section 249.19 Candlestick Point Special Use District.

A Special Use District entitled the "Candlestick Point Special Use District," the boundaries of which are designated on Sectional Map No. 10 SU of the Zoning Maps of the City and County of San Francisco, and which is generally bounded by Jamestown Avenue Extension, Giants Drive, Gilman Avenue, Arelious Walker Drive (Fitch Street), Carroll Avenue, Griffith Street, and San Francisco Bay, is hereby established for the purposes set forth below. The following provisions shall apply within the Candlestick Point Special Use District:

(a) Purposes. The following controls, imposed in the Candlestick Point Special Use District, shall accommodate the development of a stadium suitable for professional football and the National Football League's Super Bowl ("Stadium") and a retail shopping and entertainment center ("Retail/Entertainment Center"), together with open space and related parking facilities (collectively, the "Combined Project"), as principal uses, and other uses as conditional uses.

(b) Controls. The specific controls set forth herein shall apply only to the principal uses and conditional uses described in this Section 249.19(b). Any other development not described herein shall be governed by the underlying zoning controls.

(1) Principal Uses. The following uses shall be permitted as principal uses in this Special Use District:

(i) Stadium: A stadium, primarily to be used for professional football, but which may also be used for other sporting events or outdoor entertainment events, and which may include other assembly and entertainment uses, and other uses related to the stadium, including retail sales and personal service uses, sports clubs, restaurants and office uses accessory to the stadium (which shall not be deemed an "office development" subject to the provisions of Planning Code Sections 309 through 325 et seq.).

(ii) Retail/Entertainment Center: A Retail/Entertainment Center which may include any type or size of retail establishment, restaurant, bar, entertainment use (including but not limited to movie theaters), amusement enterprise (including but not limited to arcades, nightclubs, bowling alleys, and skating rinks), and amusement park. Principal uses allowed under this subsection (ii) shall be limited to a total of 1,400,000 square feet of occupied floor area.

(iii) Open Space: Areas devoted to landscaping, shoreline access, shoreline trails, and active or passive recreational uses. The areas used for passive or active recreational uses may also be used as temporary parking areas to support stadium events, provided that such areas shall not be paved and shall include drainage and other improvements appropriate for both open space and temporary parking uses.

(iv) Parking: Off-street vehicle parking, provided by surface parking lots or underground or above ground parking garages to serve the Stadium and Retail/Entertainment Center.

(2) Conditional Uses. The Planning Commission may authorize the following uses within the Special Use District as a conditional use:

(i) Any principally permitted uses allowed under Section 249.19(b)(1)(ii) which exceed a total of 1,400,000 square feet of occupied floor area.

(ii) Any use not specified in subsection (b)(1) above and permitted in any C District, as that term is defined in Planning Code Section 102.5.

(3) Prohibited Uses. Adult entertainment establishments, as defined in Planning Code Section 790.36, massage establishments as defined in Planning Code Section 790.60 and any type of gaming, wagering or gambling establishment, shall not be permitted within the Special Use District.

(4) Floor Area Ratio. There shall be no floor area ratio limitation for the Combined Project or any approved conditional use.

(5) Design Review By Planning Commission. Any application for a new structure, or major alteration of an existing structure, to house a use permitted by this section as a principal use under Section 249.19(b)(1) shall be subject to design review and approval by the Planning Commission. The Planning Commission shall approve such application if it finds that the proposed development meets the applicable height, bulk, floor area limitation and parking standards of this Section 249.19(b), and is consistent with the Priority Policies set forth in Planning Code Section 101.1, and that the architectural design of the structures, the landscaping, and the quantity and design of usable open space are appropriate for the intended use, location and purpose of the structure(s). The Planning Commission shall take final action on any completed application for a development permitted by this section within 60 days of its first public hearing on the application. The procedures and criteria in this subsection shall govern in lieu of the discretionary review process set forth in Section 26 of Part III of the San Francisco Municipal Code. The fee for review of any application under this subsection shall be based on the cost of the time and materials (calculated at a rate of $77/hour as may be adjusted by the Consumer Price Index) up to a maximum fee of $14,800.

(6) Parking. Parking shall be governed by Article 1.5 of the Planning Code unless otherwise specified in this subsection.

(i) Planning Code Section 159 and subsections (a), (b), (h) and (p) of Planning Code Section 155 shall not apply to parking provided within the Special Use District. Planning Code Sections 155(i) and (j) shall apply only to the amount of parking required under Section 151.

(ii) For the purposes of calculating minimum required parking under Planning Code Section 151, in no case shall the total number of required parking spaces for the

Combined Project exceed the greater of either the parking spaces calculated for the Stadium or the parking spaces calculated for the Retail/Entertainment Center, standing alone.

(7) Appeal. The Planning Commission's determination on the design of the Combined Project pursuant to Section 249.19(b)(5) shall be a final determination on all design issues, except that the Arts Commission shall review the design, if required by Charter Section 5.103. Notwithstanding the provisions of Section 26 of Part III of the San Francisco Municipal Code, review by the Board of Appeals on the issuance of any demolition permit, building or site permit in this Special Use District shall be limited to compliance with the San Francisco Building Code, Health Code and Fire Code.

(c) State Park Land. To the extent any land owned or otherwise under the jurisdiction or control of the California Department of Parks and Recreation is included within the boundaries of the Special Use District, any development on such land shall be consistent with the purpose of the Candlestick Point State Recreation Area and shall continue to make available to the people the recreational opportunities that are offered by the shoreline, waters and environment of San Francisco Bay. To this end, no development shall be permitted within 120 feet of the shoreline of the San Francisco Bay, as measured at mean low tide.

Section 6. [Height Limit; Exceptions]

(a) Part II, Chapter II of the San Francisco Municipal Code (City Planning Code) is hereby amended by adding Section 263.14 to read as follows:

"Section 263.14. Height Restrictions for Candlestick Point Special Use District.

In the 60/150-200-X Height and Bulk District as designated on Sectional Map No. 10H of the Zoning Map, the height limit shall be 60 feet, except that heights up to 200 feet shall be permitted for any stadium use permitted within the Candlestick Point Special Use District. An exception to the 60 foot height limit may be granted by the Planning Commission as a conditional use within the Candlestick Point Special Use District, up to a maximum height of 150 feet. In the event any stadium constructed within the Special Use District is integrated into a retail shopping center or other structure, any transitional structures which connect or otherwise attach the stadium to the other structure shall be considered part of the stadium for purposes of determining the permissible height of the transitional structure. All structures within the Candlestick Point Special Use District shall be exempt from the provisions of Planning Code Section 295.

(b) Part II, Chapter II of the San Francisco Municipal Code (City Planning Code) is hereby amended by adding subsection (L) to Section 260(b)(1) to enact the following exemption from height limits otherwise established by the City Planning Code:

"(L) In the Candlestick Point Special Use District, light standards for the purpose of the lighting the stadium, scoreboards associated with the stadium, and flagpoles and other ornamentation associated with the stadium."

Section 7. [Signs]

Part II, Chapter II of the San Francisco Municipal Code (City Planning Code) is hereby amended by adding Section 608.51 to read as follows:

"Section 608.4A. Signs for Uses Within the Candlestick Point Special Use District.

Any sign that directs attention to a business, commodity, service, industry or other activity that is or will be sold, offered or conducted within the Candlestick Point Special Use District and that either is greater than 200 square feet in area or extends above the roofline of the building upon which the sign is located ("SUD Sign") shall be permitted within the Candlestick Park Special Sign District if approved by the Planning Commission as a conditional use. Planning Code Sections 608.4, 608.5 and 609.2, or any other regulation applicable to signs within the Candlestick Park Special Sign District, shall not apply to SUD Signs. SUD Signs shall conform to the restrictions set forth in Planning Code Section 607 for signs in C-3 Districts, except that there shall be no height limit for SUD Signs. The Planning Commission may authorize an SUD Sign as a conditional use if the design of the sign and any associated sign structure is appropriate for the intended use and location. This criterion shall be in lieu of the criteria set forth in Planning Code Section 303(c)(1) through (4). Any scoreboard or sign within a stadium located in the Candlestick Point Special Use District shall be exempt from regulation under Article 6 of the Planning Code. Principally permitted signs within the Special Use District shall be consistent with a sign program submitted and approved by the Planning Commission as part of the design review process for the Candlestick Point Special Use District.

Section 8. [Special Use District Boundaries; Zoning Maps]

(a) The boundaries of the Candlestick Point Special Use District created by this Ordinance are shown in Figure 1 attached hereto, which is provided for general orientation purposes only.

(b) Special Use Map. Part II, Chapter II of the San Francisco Municipal Code (City Planning Code) is hereby amended by amending Sectional Map No. 10 SU of the Zoning Maps of the City and County of San Francisco to include the Candlestick Point Special Use District, the boundaries of which are hereinafter described.

The Special Use District shall include property bounded as follows, with street boundaries following the centerline of the referenced streets: Beginning at the point which is the intersection of Giants Drive and Gilman Avenue (the point of beginning), along Gilman Avenue to Arelious Walker Drive (also known as Fitch Street), along Arelious Walker Drive to Carroll Avenue, along Carroll Avenue to Griffith Street (a mapped but unconstructed street), along Griffith Street to the San Francisco Bay shoreline, then continuing south along the San Francisco Bay shoreline to Alvord Street (a mapped but unconstructed street), then continuing south and west along a line extending from Alvord Street to the San Francisco Bay shoreline, continuing east along the San Francisco Bay shoreline to Coleman Street (a mapped but unconstructed street), then north and east along Coleman Street to Jamestown Avenue Extension, then along the Jamestown Avenue Extension to the farthest west point of Assessor's Block No. 5000, then along the north west border of Assessor's Block No. 5000 to Giants Drive, then along Giants Drive to the intersection of Giants Drive and Gilman Avenue (the point of beginning).

Existing Use Districts	Use District Hereby Approved
P, M-1, M-2, RH-2	To Existing Use Districts Add the Candlestick Point Special Use District Overlay

(c) Height and Bulk. Part II, Chapter II of the San Francisco Municipal Code (City Planning Code) is hereby amended by amending Sectional Map No. 10 H of the Zoning Maps to enact the following changes in the height and bulk classifications for the property within the Candlestick Point Special Use District, as more particularly described in subsection (b) in this Section 8.

Height and Bulk Districts to be Superseded	Height and Bulk District Hereby Approved
OS; 40-X	60/150-200-X

Section 9. [Waterfront Plan]

Chapter 61 of the San Francisco Administrative Code ("Waterfront Land Use"), adopted by the People of the City and County of San Francisco pursuant to Proposition H, is hereby amended as follows:

(a) Section 61.2(d) shall be amended by adding the following subsection:

"(3) This provision shall not be applicable to any new development within the Candlestick Point Special Use District."

(b) Section 61.4 shall be amended by adding the following subsection:

"(i) Within the Candlestick Point Special Use District, any use that is permitted as a principal or conditional use under Planning Code Section 249.19."

Section 10. [Public Contracting Provisions]

Notwithstanding any provision of the San Francisco Municipal Code (the "Municipal Code") or any other ordinance or regulation of the City and County of San Francisco to the contrary, the Stadium, Retail/Entertainment Center and related physical improvements and infrastructure to be constructed in the Candlestick Point Special Use District shall not be deemed to be a "public work or improvement" as that term or any similar term is used in any provision of the Municipal Code or any other ordinance or regulation of the City and County of San Francisco, including but not limited to, Chapter 6 of the San Francisco Administrative Code. No provision of the Municipal Code, nor any other ordinance or regulation of the City and County of San Francisco shall be deemed to require the person or entities, including the City and County of San Francisco, constructing any portion or all of the Stadium, Retail/Entertainment Center and related improvements and infrastructure, to follow any particular procedure, comply with any bidding or advertising requirements, or otherwise engage in any particular practice with respect to the selection of contractors or sub-contractors for the award of contracts or subcontracts for the design, construction, purchase of materials, management or operation of any portion or all of the stadium, retail shopping and entertainment center and associated improvements; provided, however, the design and construction of the Stadium, Retail/Entertainment Center and related improvements and infrastructure shall be subject to the applicable provisions of Chapter 12B, 12C and 12D of the San Francisco Administrative Code and to the terms and conditions of any public financing and the ground lease or leases. It is the intent of the people of the City and County of San Francisco, in adopting this section of this Ordinance, that the design and construction of the Stadium, Retail/Entertainment Center and related improvements and infrastructure shall be done in an expeditious manner, and shall not be undertaken as if such design and construction were the design and construction of conventional public work or improvement. This section shall be liberally construed to fulfill this intent.

Section 11. [Redevelopment Agency]

The Candlestick Point Special Use District is within the South Bayshore Redevelopment Survey Area. In the event that a Redevelopment Project Area is adopted which includes the Combined Project, the Combined Project shall be subject to the authority of the Redevelopment Agency of the City and County of San Francisco authority pursuant to state law.

Section 12. [Compliance With Laws]

Except as otherwise specified herein, the construction of the Combined Project shall be subject to all federal, state and local laws, ordinances and regulations (as the same may be amended), including but not limited to the California Environmental Quality Act (Public Resources Code Section 21000, et seq.).

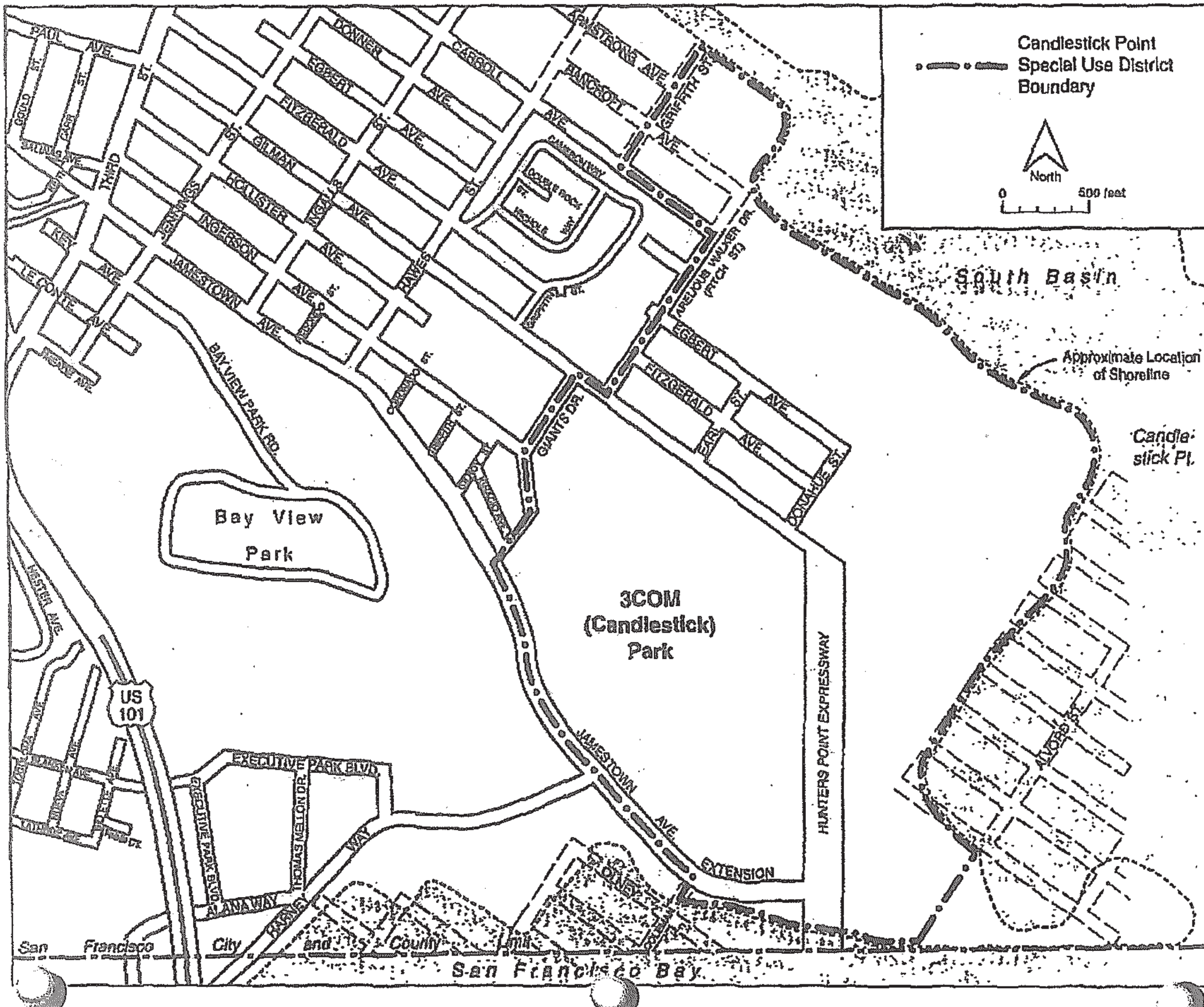
Section 13. [Amendment]

Any provision of this ordinance may be amended by the Board of Supervisors and shall not require the vote of the electors of the City and County of San Francisco, provided that such amendments are consistent with the purpose and intent of this ordinance.

Section 14. [Severability]

If any provision of this ordinance, or any application thereof to any person or circumstance, is held invalid, such invalidity shall not affect any provision or application of this ordinance that can be given effect without the invalid provision or application. To this end, the provisions of this ordinance are severable.

Figure



Candlestick Point Special Use District Boundary
North
0
500 feet
South Basin
Approximate Location of Shoreline
Candlestick Pt.
Bay View Park
3COM (Candlestick) Park
US 101
HUNTERS POINT EXPRESSWAY
JAMESTOWN AVE. EXTENSION
GIANTS DR.
BAY VIEW PARK RD.
EXECUTIVE PARK BLVD.
THOMAS MELLON DR.
ALANA WAY
HARNEY WAY
ALVORD ST.
THIRD ST.
PAUL AVE.
JENNINGS ST.
INGERSON AVE.
HOLLISTER AVE.
GILMAN AVE.
FITZGERALD AVE.
EGBERT AVE.
DONNER AVE.
CARROLL AVE.
BANCROFT AVE.
ARMSTRONG AVE.
GRIFFITH ST.
INGALLS ST.
HAWES ST.
ARELIOUS WALKER DR. (FITCH ST.)
EARL ST.
DONAHUE ST.
LE CONTE AVE.
KEY AVE.
SALINAS AVE.
GOULD ST.
CARR ST.
San Francisco City and County Limit
San Francisco Bay

Appendix C1 PBS&J Environmental Justice Report, November 2009

Appendix C1 Environmental Justice

A. INTRODUCTION

This Environmental Justice section discusses existing Environmental Justice (EJ) communities within and surrounding the Project site and examines the potential for construction or operation of the Project to result in disproportionately high and adverse human health or environmental effects on minority populations or low-income populations. Environmental Justice is not a required area of study under the *California Environmental Quality Act*. This analysis is being provided for informational purposes only and for Navy use in their supplemental Environmental Impact Statement for the Hunters Point Shipyard Base Reuse.

Environmental Justice

Executive Order (EO) 12898 (1994), "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." (Council of Environmental Quality [CEQ] 1997)

Federal agencies should consider the composition of the affected area to determine whether minority populations, low-income populations, or Indian tribes are present in the area affected by the proposed action, and if so whether there may be disproportionately high and adverse human health or environmental effects on minority populations, low-income populations, or Indian tribes (CEQ 1997).

An EJ community is defined when one or more of the following three criteria are met:

1. The minority population in the community is equal to or greater than 50 percent
2. The minority population in the community is 10 or more basis points higher than that of the "base" community (city or county, depending on location)
3. The poverty level in the community is 10 or more basis points higher than the "base" community

Protection of Children

EO 13045 (2007), "Protection of Children from Environmental Health Risks and Safety Risks" requires that "each Federal agency *(a)* shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children: and *(b)* shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risk or safety risks."

B. SETTING

Minority Populations

Ethnicity data were obtained from Claritas (2008), a company specializing in demographic data, United States Census Bureau (US Census) (2000) data, and from the California Department of Finance (DOF) (2007).

The study area for the Project includes 28 Block Groups within the Bayview neighborhood, as illustrated by Figure 1 (Environmental Justice Communities). As the name implies, Block Groups are a combination of census blocks. Census blocks are a subdivision of a census tract or block numbering area and are the smallest geographic entity for which the decennial census tabulates and publishes sample data.

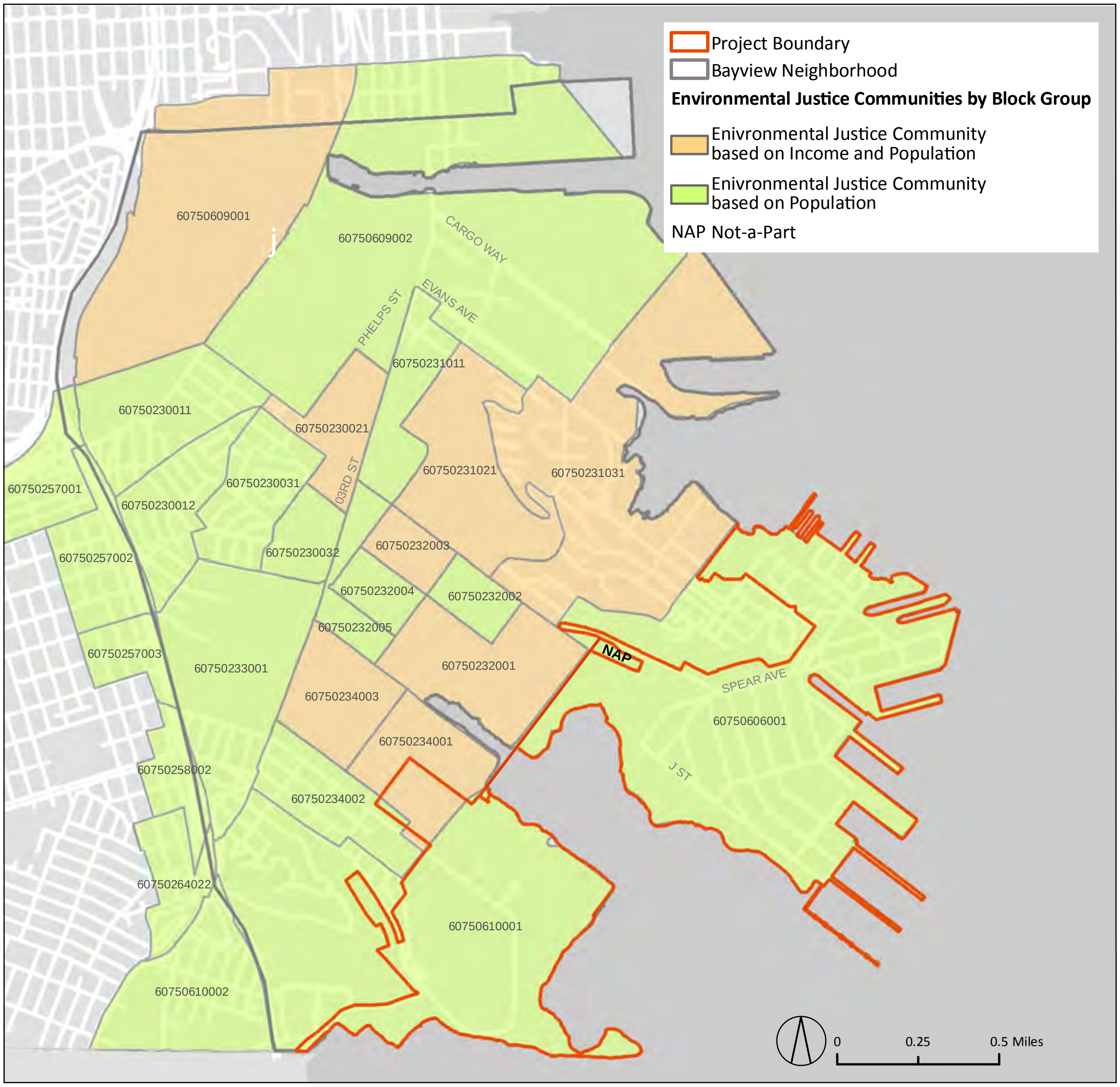
The proportion of ethnic minorities were estimated for each community by dividing the total number of Black, Indian/Alaskan, Asian, Hawaiian/Pacific Islander, and Hispanic persons by the total number of persons per block group. Statistics for San Francisco, the San Francisco-Oakland-Fremont Metropolitan Statistical Area (MSA), and the State of California were included in this study for comparison purposes and to be used as the base community. Refer to Table 1 (Study Area Ethnic Profile) for a breakdown of ethnicity by block group and base community.

On average there is a larger percentage of ethnic minorities in the study area than in the larger base communities that consist of San Francisco, the San Francisco–Oakland-Fremont MSA, and the State of California. With respect to the Project site, the HPS Phase II site consists of the majority of Block Group 60750606001, which has a total minority population of 92 percent. The Candlestick Point site is made up predominantly of almost all of Block Group 60750610001, which has a total minority population of 84.3 percent, a portion of Block Group 60750234001, which has total minority population of 89.2 percent, and a sliver of Block Group 60750234002, which has a total minority population of 89.3 percent, as shown in Table 1.

The Block Groups in the study area combined have almost a 90 percent total minority population; only one Block Group in the study area has a total minority population less than 50 percent (Block Group 60750251003).The minority population of the study area and the Project site are well over 10 percentage points higher when compared to any of the base communities, which range from 54.3 percent to 57.0 percent minority population, as reflected in Table 1, and all but one Block Group is also equal to or greater than 50 percent minority. Therefore, the entire study area, including the Project site, is an EJ community based upon the minority population.

Child Population

Population data were obtained from Claritas (2008), for the child population by Block Group in 2004. The Claritas data contained a breakdown of population by age; all residents under the age of 18 years were counted to derive the child population in both the study area and Project site.



SOURCE: Claritas, Novemeber 2008.

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FIGURE 1

Candlestick Point — Hunters Point Shipyard Phase II EIR

ENVIRONMENTAL JUSTICE COMMUNITIES

Table 1 Study Area Ethnic Profile

Area Block Groups (Key to Figure 1)	Population	Percent White	Percent African American	Percent American Indian/ Alaska Native	Percent Asian	Percent Hawaiian/ Pacific Islander	Percent Hispanic	Percent Minority Races (all) (Total Pop minus White)
Project Site								
60750234001 (Candlestick Point)	986	10.8%	54.4%	0.3%	1.8%	13.5%	26.9%	89.2%
60750610001 (Candlestick Point)	971	15.7%	31.3%	0.0%	31.7%	0.3%	27.4%	84.3%
60750234002 (Candlestick Point)*	2,182	10.7%	25.9%	0.1%	23.9%	3.8%	40.9%	89.3%
60750606001 (Hunters Point Shipyard)	678	8.0%	60.8%	0.9%	20.5%	1.6%	13.4%	92.0%
Average percentage of the Project Site Block Groups	***4,817***	***11.3%***	***43.1%***	***0.3%***	***19.5%***	***4.8%***	***27.1%***	***88.7%***
Study Area (Includes Project Site)								
60750230011	2,182	9.9%	16.3%	0.7%	56.3%	0.6%	20.9%	90.1%
60750230012	2,972	8.4%	18.6%	0.2%	62.7%	1.2%	10.4%	91.6%
60750230021	2,587	12.5%	36.6%	0.4%	15.7%	0.1%	37.6%	87.5%
60750230031	2,758	10.1%	23.3%	0.0%	53.0%	1.3%	14.5%	89.9%
60750230032	1,243	7.7%	42.1%	0.5%	22.1%	2.2%	29.6%	92.3%
60750231011	1,268	16.1%	33.4%	0.5%	30.8%	0.6%	25.9%	83.9%
60750231021	3,314	7.9%	67.3%	0.2%	13.1%	0.8%	12.5%	92.1%
60750231031	4,397	3.6%	73.0%	0.2%	2.4%	13.5%	6.1%	96.4%
60750232001	546	4.6%	45.4%	0.0%	11.5%	2.0%	37.7%	95.4%
60750232002	1,056	5.0%	51.0%	0.9%	17.0%	3.5%	24.2%	95.0%
60750232003	1,044	7.3%	53.1%	0.3%	4.1%	0.5%	37.5%	92.7%
60750232004	1,084	14.7%	39.7%	3.1%	11.1%	1.0%	37.6%	85.3%
60750232005	672	10.1%	37.8%	1.3%	27.1%	0.7%	22.2%	89.9%
60750233001	2,740	6.8%	12.4%	0.5%	65.3%	1.2%	15.4%	93.2%
60750234003	251	12.7%	57.0%	0.0%	12.0%	2.8%	11.2%	87.3%
60750251003	798	51.8%	7.8%	0.1%	18.3%	0.1%	25.7%	48.2%
60750257001	2,254	15.0%	3.0%	0.2%	67.5%	0.0%	18.2%	85.0%

Table 1 Study Area Ethnic Profile

Area Block Groups (Key to Figure 1)	*Population*	*Percent White*	*Percent African American*	*Percent American Indian/ Alaska Native*	*Percent Asian*	*Percent Hawaiian/ Pacific Islander*	*Percent Hispanic*	*Percent Minority Races (all) (Total Pop minus White)*
60750257002	1,729	12.3%	2.7%	0.3%	62.3%	1.8%	22.3%	87.7%
60750257003	1,193	14.2%	4.4%	0.6%	55.0%	0.3%	26.8%	85.8%
60750258002	812	14.7%	14.9%	0.1%	50.6%	0.0%	22.9%	85.3%
60750264022	1,534	11.8%	9.9%	0.2%	60.9%	0.9%	17.3%	88.2%
60750609001	260	28.5%	43.8%	0.0%	10.0%	3.1%	25.0%	71.5%
60750609002	353	44.5%	38.0%	0.3%	0.8%	0.0%	20.4%	55.5%
60750610002	1,846	11.2%	5.3%	0.0%	75.6%	1.3%	6.8%	88.8%
Average percentage Total of the Study Area Block Groups	***43,710***	***11.0%***	***32.2%***	***0.4%***	***36.0%***	***2.7%***	***20.4%***	***89.0%***
Base Communities								
San Francisco City/County	810,078	45.1%	6.7%	0.3%	31.1%	0.5%	13.5%	54.9%
San Francisco-Oakland-Fremont Metropolitan Area	4,379,449	45.7%	8.3%	0.4%	21.2%	0.7%	21.0%	54.3%
California State	38,246,598	43.0%	5.9%	0.8%	11.4%	0.6%	36.2%	57.0%

SOURCE: Claritas 2008. State of California, Department of Finance 2007.
* Minority Environmental Justice Community
a. Total population of Project Site/Study Area Block Groups

The HPS Phase II site, which consists of the majority of Block Group 60750606001 has a total child population of 27.1 percent, while the three block groups that make up the Candlestick Point site; 60750610001, 60750234001 and 60750234002, has a child population 25.6 percent, 45.0 percent, and 21.9 percent respectively in 2004 (Clarita 2008). Overall, the child population in the study area in 2004 was 27.6 percent of the total population of 44,220 residents. Although children do not constitute a substantial percentage of the population within the study area, children are present in residential and recreational areas, and in certain institutions (e.g., schools, daycares, private schools). A substantial number of schools and daycares, as well as parks and playgrounds where children typically congregate, can be found in the study area.

Poverty Levels

Economic data were also obtained from Claritas (2008). The Claritas data contained household and poverty estimates by block group within the study area. City and county level data was obtained from the US Census (2008a and 2008b).

The US Census defines the average poverty level in the United States for a family of four as a maximum annual income of $21,203 or less for the year 2007 (US Census 2008b). Table 2 (Study Area Poverty Statistics) shows the percentage of the total number of households within the given Block Group that are below the poverty level. With respect to the criteria that determines whether a Block Group would be considered an EJ community, it must have a poverty level (in this case, expressed as a percent of total households below the poverty level) that is 10 or more basis points higher than the base community.

Table 2 Study Area Poverty Statistics

Area Block Groups (Key to Figure 1)	*Percent of Households Below Poverty Level*	*Environmental Justice Community*
60750234001 (Candlestick Point)	40.1%	Yes
60750610001 (Candlestick Point)	3.9%	
60750234002 (Candlestick Point)	15.9%	
60750606001 (Hunters Point Shipyard Phase II)	16.7%	
Average of the Project Site Block Groups	***23.1%***	
60750230011	8.5%	
60750230012	11.8%	
60750230021	24.8%	Yes
60750230031	3.5%	
60750230032	16.3%	
60750231011	15.9%	
60750231021	25.2%	Yes
60750231031	53.4%	Yes
60750232001	19.2%	
60750232002	15.0%	

Table 2 Study Area Poverty Statistics

Area Block Groups (Key to Figure 1)	*Percent of Households Below Poverty Level*	*Environmental Justice Community*
60750232003	20.1%	
60750232004	8.7%	
60750232005	4.1%	
60750233001	10.7%	
60750234003	48.0%	Yes
60750251003	6.8%	
60750257001	15.1%	
60750257002	12.8%	
60750257003	2.4%	
60750258002	1.8%	
60750264022	1.3%	
60750609001	24.2%	Yes
60750609002	0.0%	
60750610002	11.1%	
Average of the Study Area Block Groups	***15.6%***	
Base Communities		
City and County of San Francisco	10.6%	
San Francisco-Oakland-Fremont Metropolitan Area	9.0%	
California State	12.4%	

SOURCE: Claritas 2008.

The poverty populations of the Block Groups in the study area range from zero to 53.4 percent. Using the City and County of San Francisco as the base community, any Block Group on Table 2 that reflects at least 20.6 percent of the total households below the poverty level (which is 10 percentage points above the percentage reflected for the City and County) would be considered an EJ community from the perspective of income. As shown in Table 2, there are six Block Groups identified as low-income EJ communities based on the percentage of households below the poverty level that are 10 or more basis points higher than the base community.

The HPS Phase II site, which consists of the majority of Block Group 60750606001, is not an EJ community based upon income because it has a poverty population level of only 16.7 percent, which is less than 10 percentage points higher than the base communities. Candlestick Point is made up of almost all of Block Group 60750610001, which has a poverty population level of 3.9 percent, a portion of Block Group 60750234001, which has a poverty population level of 40.1 percent, and a sliver of Block Group 60750234002, which has a poverty population level of 15.9 percent. As such, only a portion of Candlestick Point (Block Group 60750234001) is considered an EJ community based on income (refer to Table 2).

For informational purposes, the median household income of the Block Groups in the study area ranges from $14,537 to $91,146. The median household incomes of the base communities range from $59,928 for the State of California to $75,747 for the San Francisco-Oakland-Fremont MSA.

Indian Tribes and Trust Assets

There are 564 Indian Tribes recognized by the federal government.[1] This recognition establishes a tribe as an entity with the capacity to engage in government-to-government relations with the United States or individual states, and also as one eligible to receive federal services. Federal recognition is established as a result of historical and continued existence of a tribal government by EO or legislation, and through the federal recognition process recently established by Congress.

The relationship between the United States government and those tribes is characterized as one between sovereigns (i.e., between a government and a government). The federal government is obligated under the Federal-Tribal Trust to protect Tribal interests, a duty that is referred to as trust responsibility. This trust doctrine is further defined through laws, EOs, judicial decisions, and agreements (Bureau of Indian Affairs [BIA] 2009).

Indian trust assets (ITAs) are legal interests in assets that are held in trust by the United States Government for federally recognized Indian tribes or individuals. The trust relationship usually stems from a treaty, EO, or act of Congress. The Secretary of the interior is the trustee for the United States on behalf of federally recognized Indian tribes. "Assets" are anything owned that holds monetary value. "Legal interests" means there is a property interest for which there is a legal remedy, such a compensation or injunction, if there is improper interference. Assets can be real property, physical assets, or intangible property rights, such as a lease, or right to use something. Indian trust assets cannot be sold, leased, or otherwise alienated without United States' approval (Department of the Interior [DOI] 2007). Trust assets may include lands, minerals, and natural resources, as well as hunting, fishing, and water rights, Indian reservations, rancherias, and public domain. The Native American Heritage Commission (NAHC) did not indicate that ITAs exist in the vicinity of the project or study areas, as further discussed in Section III.J (Cultural Resources and Paleontological Resources) of the EIR.

No Native American tribes, groups, or individuals have identified any specific ITAs during the public participation process for this project. Refer to Section III.J for an extensive discussion of the history of Native Americans in the study area and steps taken to coordinate with local Indian Tribes.

C. IMPACTS

Significance Criteria

The purpose of EO 12898 and EO 13045 is to avoid placing a disproportionately high share of the adverse environmental or economic effects resulting from federal policies and actions on minority and low-income populations or children.

[1] Department of the Interior. www.doi.gov/bia (accessed on October 12, 2009).

The purpose of an EJ analysis is to determine whether adverse environmental impacts would disproportionately affect minority and low-income communities or children compared to other communities in the project area. Impacts related to EJ would be significant if a project-related activity would have a disproportionate effect on EJ populations. A disproportionate effect is defined as an effect that is predominantly borne, more severe, or of a greater magnitude in areas with EJ populations than in other areas (CEQ 1997).

Analytic Method

This section was prepared primarily by compiling and evaluating existing information, obtained from Claritas, the US Census, and DOF. An EJ community is defined when (1) the minority population in the community is equal to or greater than 50 percent; (2) the minority population in the community is 10 or more basis points higher than that of the base community (city or county, depending on location); or (3) the poverty level in the community is 10 or more basis points higher than the base community. Using this criteria it was determined that the entire study area, including the Project site, is an EJ community based upon the minority population and a portion of the study area is an EJ community based upon income levels. A review of the potential effects of the Project was conducted to identify if significant effects could disproportionately fall on minorities, low-income populations, or children.

Project Impacts

■ No Action

Under the No Action Alternative, the Project would not be constructed and no disturbance to populations in any of the Block Groups would occur. Therefore, no direct or indirect impacts to any of the populations within the Study Area Block Groups would occur. However, none of the beneficial impacts associated with the Project, as decribed in Chapter II (Project Description), such as the revilatization of the Bayview Hunters Point community through increased business and employment opportunities; housing options at a range of affordability levels; improved public recreation and open space amenities; an integrated transportation, transit, and infrastructure plan; and other economic and public benefits would occur. Blighted and impoverished conditions in the Bayview area would remain and the community could deteriorate further due to the lack of job opportunities, which can contribute to high unemployment rates and a high concentration of low-income residents. The lack of quality open space and recreation opportunities in the area, as well as the limited public transportation providing connections through the area, and the City as a whole, and the diminishing quality of affordable housing in the area would continue. Moreover, the improvements to the public recreation and open space amenities would not occur and the community would not benefit from the improvements to be constructed by the Project, such as the extension and enhancmenet of the Bay Trail. Similarly, the community would continue to have disconnected public transportation and pedestrian connectivity. In short, the Block Groups would continue to be disadvantaged.

Proposed Action

The Project proposes development of 10,500 residential units with an associated population of 24,465 residents; 885,000 gross square feet (gsf) of retail; 150,000 gsf of office; 2.5 million gsf of Research & Development uses; a 220-room, 150,000-gsf hotel; 255,000 gsf of artist/art center space; 100,000 gsf of community services; 240 acres of new parks, sports fields, and waterfront recreation areas, as well as 96.7 acres of new and improved State parkland; a 69,000-seat 49ers stadium; and a 75,000 gsf performance arena. The permanent employee population associated with the Project would be 10,730. Development would occur on two sites: Candlestick Point and HPS Phase II. Development on Candlestick Point would include demolition (and replacement on a 1:1 basis) of 256 public housing units, demolition of the 70,207-seat 49ers stadium, and a net reduction of CPSRA land. However, 96.7 acres of the 120.2-acre CPSRA would remain and the Project would provide significant funding for park improvements and ongoing operation and maintenance as described in Section III.P (Recreation). There is no existing housing in HPS Phase II. In addition, all of the vacant, and some leased, Navy buildings would be demolished, except for Buildings 140, 203, 204, and 205, which would be rehabilitated, and Drydocks 2 and 3.

According to EO 12898 an EJ analysis should identify whether a proposed federal action would result in "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Similarly, EO 13045 states federal agencies must make it a priority to determine whether a proposed federal action would result in "environmental health risks and safety risks that may disproportionately affect children."

Chapter III (Environmental Setting, Impacts, and Mitigation Measures) of the EIR analyzes and discloses all of the adverse impacts of the Project. The environmental topics that could result in human health or environmental effects and are addressed in this EJ analysis include Section III.H (Air Quality), Section III.K (Hazards and Hazardous Materials), Section III.I (Noise), and Section III.M (Hydrology and Water Quality). Additional issues areas that could affect quality of life, and are also addressed in this EJ analysis, include: Section III.C (Population, Housing, and Employment), Section III.E (Aesthetics), and Section III.O (Public Services). The following paragraphs summarize the findings of the EIR with regard to these topics.

I.A AIR QUALITY (TOXIC AIR CONTAMINANTS)

The Project would include sources of hazardous or toxic air emissions including processes; vehicle use; and proximity to existing or relocated sources of diesel or other toxic air emissions, such as freeways and railroads and off-site industries and businesses, as discussed extensively in Section III.H of the EIR (and the associated air quality technical appendix). The Health Risk Assessment prepared for the Project estimated the cumulative excess lifetime cancer risk and chronic noncancer Hazard Index (HI)2 due to toxic air contaminants emissions and determined that the maximum estimated cumulative excess lifetime cancer risks and HIs within areas designated for residential use were found not to exceed the Bay Area Air Quality Management District current or proposed significance thresholds for carcinogenic and

[2] The Hazard Index reflects that standard or criteria above which an impact would occur. The specific HI assumed in the HRA for this Project is defined and described in Section III.H (Air Quality).

noncarcinogenic health risks. The HRA also concluded that during construction of the Project the maximum non-cancer hazard index (HI) would be below the BAAQMD's significance threshold of 1.0 and the proposed revised HI threshold of 0.5, and the Project would not result in the exposure of people to diesel particulate matter of airborne concentrations of contaminated dust In addition, the Project would not expose receptors to concentrations of $PM_{2.5}$, associated with increased vehicle trips and vehicle emissions along local roadways, in excess of the San Francisco Department of Public Health threshold. Implementation mitigation measure MM AQ-1.1 would reduce potentially significant impacts to a less-than-significant level.

One significant and unavoidable impact relating to air quality was identified. As a result of increased external motor vehicle trips, Project emissions of ROG, NO_X, PM_{10}, and $PM_{2.5}$ would exceed the BAAQMD thresholds. Although no feasible mitigation is available to reduce this impact, the Project would incorporate features intended to reduce motor vehicle trips, and would be designed as a dense, compact development with mixed land uses that would facilitate pedestrian, bicycle, and transit travel. Increased vehicle traffic is a direct result of increased development and densities in the area, as well as the increased availability of housing and employment opportunities, and is necessary for the revitilization of the Project site; these impacts would not fall disproportionately high or adversely on the EJ communities in the study area. Any development that would occur in the study area would result in similar impacts, which are not unique to this particular Project and would not disproportionately affect residents. As such, although this impact is considered significant and unavoidable, it would not disproportionately affect EJ communities located in the Bayview community. Refer to Section III.H for a greater discussion of air quality impacts.

I.B HAZARDS AND HAZARDOUS MATERIALS

Potentially adverse effects relating to hazardous materials and waste have been reduced through implementation of mitigation measures MM HZ-1 through MM HZ-23, which are identified in Section III.K of the EIR. The Project does not propose any uses that would require the handling of acutely hazardous materials. In the event that hazardous materials or previously unknown contamination are discovered during construction, implementation of the proposed mitigation measures, as well as adherence to applicable regulations would reduce the likelihood of contaminants being conveyed to people or near shore and aquatic habitats and associated species. Remediation of the HPS Phase II site is ongoing due to the presence of chemicals and radioactive materials in various locations, and would continue to be implementation with or without the Project. No significant and unavoidable impacts relating to hazards would occur. Therefore, no disproportionate impacts on the EJ populations would occur.

I.C NOISE

Construction of the Project would result in a significant and unavoidable impact relating to ground-borne vibration levels in residential neighborhoods; however, this is a temporary impact. Operation of the Project would result in an increase in local traffic volumes that would cause a substantial permanent increase in ambient noise levels in existing residential areas, as described in Section III.I of the EIR (and the associated stadium noise technical appendix). This impact is a direct consequence of increased development and densities, and would occur in any area targeted for growth and redevelopment. Although this impact is considered significant and unavoidable, it would not be considered a disproportionate effect on EJ communities located in the Bayview community, as the Project site was not selected in order to avoid impacts in other areas, but rather to improve the conditions of the Project site through revitalization and development. All other noise impacts have been reduced to a less than significant level through implementation of mitigation measures MM NO-1 through MM NO-5, which are identified in Section III.I of the EIR.

I.D HYDROLOGY AND WATER QUALITY

No significant and unavoidable impacts relating to hydrology and water quality would occur as a result of the proposed project, as discussed in Section III.M of the EIR. The Project would result in the introduction of additional impervious surfaces on the Project site causing more contaminates to flow through the sewer and stormwater system; however, through implementation of MM HY-1 through MM HY-14, which are identified in Section III.M, and compliance with all applicable regulations, all impacts would be reduced a less-than-significant level. Therefore, no disproportionate impacts on the EJ populations would occur.

I.E EMPLOYMENT

Development at the Project site would create approximately 10,730 permanent jobs by 2030 (refer to Table III.C-7 provided in Section III.C of the EIR). The increased availability of jobs in the Bayview community would address the needs of the community and would contribute to the revitalization of the neighborhood. Anticipated growth would not exceed the City's population projections, and would not result in any adverse impacts. Instead, the creation of jobs could be considered a beneficial impact for EJ communities and those households living below the poverty level. Therefore, no disproportionate impacts on the EJ populations would occur.

I.F AESTHETICS

The Project would not result in any significant impacts relating to the visual quality of the Project site or the Bayview area, as described in Section III.E of the EIR. The Project would replace degraded urban areas, vacant parcels, expanses of asphalt and dirt, and outdated residential development with new, well-designed urban development. The Project would improve the existing quality of the site by providing new areas of open space, enhanced connectivity to the shoreline, and pedestrian amenities such as outdoor plazas, walking paths, outdoor eating areas, sidewalks, street-side landscapes, and improved lighting. Therefore, the Project would not substantially degrade the visual character or quality of the Project site or its surroundings, rather the Project would improve the visual quality of the Project site, which contains vacant properties, expanses of parking lot, deteriorated structures, and piles of rubble. Therefore, no disproportionate impacts on the EJ populations would occur.

I.G POLICE AND FIRE SERVICES

The level of service provided by both the San Francisco Police Department and San Francisco Fire Department would not be reduced as a result of the Project, as described in Section III.O of the EIR. As part of the Project, up to 100,000 gsf divided equally between Candlestick Point and HPS Phase II would be designated for community serving uses, such as fire, police, healthcare, daycare, places of worship, senior centers, library, recreation center, community center, and/or performance center uses. A portion of the designated community serving uses could be utilized for a new SFPD facility (counter, storefront, or other configuration) and/or a new SFFP station to address increased demands created by the Project. Potential impacts associated with the construction of these facilities have been addressed and would not require further environmental review beyond the review provided in the Candlestick Point-Hunters Point Shipyard Phase II EIR. As such, the quality and level of police and fire services provided to the Project site would not be degraded, and the EJ communities would not be disproportionately affected as a result of the Project.

Conclusion

As described above under the Air Quality and Noise discussions, three significant and unavoidable impacts would occur. Temporary construction impacts associated with noise would occur; however, these effects are short-term in nature and effects would not fall disproportionately on an EJ community because they are a consequence of development intended to revitalize that community. Significant and unavoidable air quality and noise impacts occuring during operation of the Project are a result of increased vehicle traffic in the area due to the proposed increase in both residential and commercial development. As increased vehicle traffic is a direct result of increased development and densities in the area, as well as the increased availability of housing and employment opportunities, and is necessary for the revitilization of the Project site, these impacts would not fall disproportionately high or adversely on the EJ communities in the study area. Any development that would occur in the study area would result in similar impacts, which are not unique to this particular Project and would not disproportionately affect residents. Because the Project would meet the Project objectives, thereby beneficially affecting EJ communities in the study area and improving the quality of life for the residents, implementation of the Project would not pose disproportionately high or adverse impacts to minority or low-income populations or environmental health and safety risks to children.

■ Project Objectives/Proposition G

In May 2007, the Board of Supervisors and the Mayor approved a resolution endorsing a Conceptual Framework for the integrated planning of both Hunters Point Shipyard and Candlestick Point. The City's overarching goal for the Project is to revitalize the Bayview Hunters Point community by providing economic and public benefits. Subsequent to the Conceptual Framework, the San Francsico Redevelopment Agency and the Bayview Hunters Point Project Area Committee afforded the public and the local communities numerous opportunities to provide comments and be involved in the revitilization of the community via notices, meetings, internet website, and workshops. The Proposed Action was developed through extensive community involvement and input, which led to the creation of the

Bayview Jobs, Parks and Housing Intiative. Objectives of the Initiative (also known as Proposition G) have been incorporated into this EIR as the Project's objectives.

The redevelopment of Candlestick Point and HPS Phase II would be consistent with the following Project objectives, which would have beneficial effects to the EJ communities because it would:

- Create a range of job and economic development opportunities for local, economically disadvantaged individuals and business enterprises, particularly for residents and businesses located in the Bayview.
- Provide automobile, public transportation, and pedestrian connections between the Shipyard, Candlestick Point, and the larger Bayview neighborhood.
- Create substantial affordable housing, jobs, and commercial opportunities for existing Bayview residents and businesses.
- Provide new affordable housing that is targeted to the lower income levels of the Bayview population, including new units that are suitable for families, seniors, and young adults.
- Include housing at levels dense enough to create a distinctive urban form and at levels sufficient to make the CP-HPS Development Plan financially viable; attract and sustain neighborhood retail services and cultural amenities; create an appealing walkable urban environment served by transit; help pay for transportation and other infrastructure improvements; and achieve economic and public benefits for the Bayview in particular and the City generally.
- Upon consultation with Alice Griffith Housing residents and the receipt of all required governmental approvals, rebuild Alice Griffith Housing to provide one-for-one replacement units targeted to the same income levels as those of the existing residents and ensure that eligible Alice Griffith Housing residents have the opportunity to move to the new, upgraded units directly from their existing Alice Griffith Housing units without having to relocate to any other area.
- Create new public recreational and public open spaces in the CP-HPS Development Plan.
- Transform the contaminated portions of the Shipyard Property into economically productive uses or public open space, as appropriate.

In addition to creating job and economic development opportunities in the Bayview area, providing affordable housing, providing significant new and improved open space and recreational areas,and improving transportation and pedestrian connnectivity in the community, the Project would redevelop the SFHA's Alice Griffith site. The Project has committed to replacing the 256 existing units on the Alice Griffith site, with a total of about 1,210 units in the same area, consisting of one-for-one replacement of public housing (256 units) with for-sale and rental units of varying affordability levels. In addition, a total of 3,345 affordable and below-market units would be provided throughout the Project site. This would provide affordable housing to the current low-income residents, and create new housing opportunities for those eligible. The Alice Griffith public housing would be rebuilt to provide at least one-for-one replacement units targeted to the same income levels as those of the existing residents and ensure that eligible Alice Griffith Housing residents have the opportunity to move to the new, upgraded units directly from their existing Alice Griffith public housing units without having to relocate to any other area. The Proposed Action would also improve the neighborhood services, infrastructure, amenities, recreation opportunities, and aesthetics to the local communities.

D. REFERENCES

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Appendix C2 Rahaim, John, SF Planning Director to Carlin, Michael, SFPUC: Projections of Growth by 2030, July 9, 2009

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July 9, 2009

Michael P. Carlin
Deputy General Manager, SFPUC
1155 Market St, 11th Floor
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Subject: Projections of growth by 2030

Dear Michael:

Thank you for your letter dated March 11, 2009 requesting the Planning Department's projections of growth by 2030 in order to satisfy your mandates in connection with assessing water supply and demand in the years to come, and more specifically for preparing water supply assessments for individual projects moving forward.

The Planning Department routinely prepares projections for the purposes of analyzing impacts of plans and projects undergoing the environmental review process. While the assumptions of these sets may vary depending on the circumstances surrounding a specific project, the Department recently completed a citywide projection capturing citywide growth expectations by 2030 designed to closely match the recently adopted ABAG Projections 2009 target, but taking into account local knowledge of projects currently in various stages of the entitlement process, commonly referred to as the development pipeline. Table 1 shows the projections for 2030.

Table 1 Development Projections

	2000	2005	2030	Growth 2000-2030	Growth 2005-2030
Households	329,700	341,478	403,292	73,592	61,814
HH Population	756,976	783,441	916,800	159,824	133,359
Jobs	642,500	553,090	748,100	105,600	195,010

Source: ABAG, San Francisco Planning Department

As the question may arise whether particular projects were included, the Planning Department for the purposes of these numbers assumed full buildout over the course of the forecast period of three large development programs currently undergoing environmental review, namely Treasure Island, Bayview Waterfront, and Park Merced projects.

More generally, we included entitled pipeline projects, and projects larger than 500 units, or large commercial projects per criteria set forth in California Water Code §10912(a) as these are the projects for which individual water supply assessments would otherwise need to be made in the near future.

We are looking forward to continuing the larger regional growth dialogue with PUC and other regional stakeholders.

Sincerely,

John Rahaim
Director of Planning

CC: Aksel Olsen
Teresa Ojeda
File

Appendix D CHS Consulting, Fehr & Peers, LCW Consulting Candlestick Point–Hunters Point Shipyard Phase II Development Plan Transportation Study, November 4, 2009

Candlestick Point – Hunters Point Shipyard Phase II Development Plan Transportation Study

SFRA File No. ER06.05.07
Planning Dept Case No. 2007.0946E

Final Report

Prepared for:
City and County of San Francisco
Planning Department

Prepared by:
CHS Consulting Group
Fehr & Peers
LCW Consulting

November 9, 2009

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Chapter 1
INTRODUCTION

This report documents the process and findings of the transportation analysis conducted for the Candlestick Point–Hunters Point Shipyard Phase II (CP-HPS Phase II) Development Plan (herein referred to as the "Project") in the City and County of San Francisco. The report includes a description of the Project, Project Variants and Alternatives to the Project, describes existing traffic, transit, pedestrian, bicycle and parking conditions in the study area, presents future year 2030 cumulative conditions without and with the Project and alternatives, and presents a transportation impact analysis of the various scenarios.

The following transportation elements are addressed in this study:

- Traffic impacts
- Transit impacts
- Parking impacts
- Pedestrian impacts
- Bicycle impacts
- Loading impacts
- Emergency vehicle access impacts
- Construction impacts

1.1 PROJECT OVERVIEW AND LOCATION

The CP-HPS Phase II Development Plan encompasses an approximately 702-acre area east of U.S. 101 in the southeast area of the City and occupies the waterfront area from south of India Basin to Candlestick Cove. The Project location is shown on **Figure 1.**

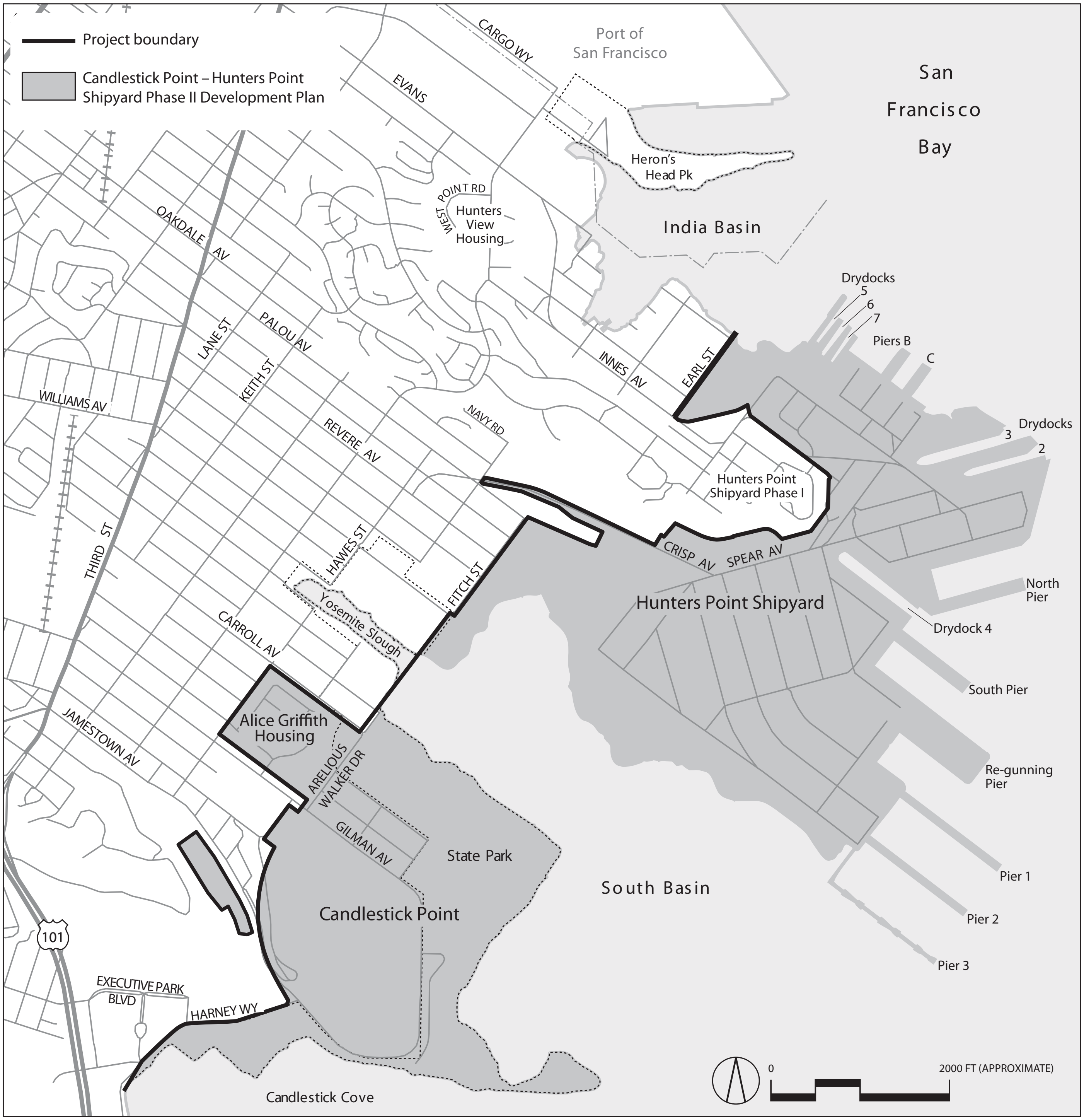
Candlestick Point and Hunters Point Shipyard comprise the southeasternmost portion of San Francisco; taken together, they are bordered by Heron's Head Park on the north, the San Mateo County line on the south, Bayview Hill, Yosemite Slough, and Hunters Point Hill on the west, and San Francisco Bay on the east. The Development Plan would comprise approximately 702 acres, with 281 in Candlestick Point and 421 in Hunters Point Shipyard Phase II. **Figure 2** presents the boundaries of the Project.

1.2 SCOPE OF ANALYSIS

The transportation study was conducted based on the scope of work developed by the Planning Department, which is included in Transportation Study Appendix A.

SOURCE: Fehr & Peers; AECOM

FIGURE 1: PROJECT LOCATION



SOURCE: San Francisco Redevelopment Agency, Lennar, 2008.

FIGURE 2: PROJECT SITE AND CONTEXT

The transportation study presents an assessment of the existing conditions within the defined transportation study area, as well as an assessment of future year 2030 conditions without and with the Project. Project impacts were determined by comparing the future year 2030 conditions with the Project, to those without the Project (i.e., 2030 No Project conditions).

Since the stadium is a special trip generator where football games do not affect typical weekday commute period traffic, Sunday conditions were also included for assessment of football game impacts[1].

1.3 REPORT ORGANIZATION

The remainder of the report is divided into six chapters that present the Project, the transportation analysis methodology, and the existing and future conditions.

- Chapter 2 presents the description of the Project, Project Variants and Alternatives to the Project.
- Chapter 3 presents the existing transportation network and operating conditions.
- Chapter 4 presents the analysis methods and assumption used in determining future travel demand and criteria for impact assessment.
- Chapter 5 presents the future baseline (No Project) conditions for year 2030.
- Chapter 6 presents the impact analysis for the Project, Project Variants and Alternatives to the Project.
- Chapter 7 summarizes the impacts and proposed mitigation measures.

The Transportation Study Appendix, included in the attached compact disc, includes additional transportation system descriptions, and analysis calculations. It also includes the May 2009 Fehr and Peers memorandum documenting the 4D Travel Demand Methodology used in Project trip generation, mode split and trip distribution, as well as the memoranda documenting the Muni operating plan for the Project.

[1] In rare circumstances, football games are played on Monday or Thursday nights; however, since this typically occurs no more than twice per season at most, the analysis of the football stadium impacts was conducted for more typical Sunday afternoon conditions.

Chapter 2
PROJECT DESCRIPTION

This chapter briefly presents the existing setting within Candlestick Point and Hunters Point Shipyard, and presents the land use program by area and the proposed transportation network improvements. This chapter summarizes the Transportation Plan as part of the CP-HPS Phase II Development Plan. Project Variants and Alternatives to the Project analyzed in this transportation study are also presented. A detailed Project description is included in Transportation Study Appendix B.

2.1 PROJECT SETTING

The Candlestick Point area is approximately 267 acres including the Alice Griffith Public Housing development. Current land uses in the Candlestick Point area include Candlestick Park stadium owned by the City and County, and used by the San Francisco 49ers National Football League team, and associated parking lots and access roadways. The stadium and parking lot areas are under the jurisdiction of the San Francisco Recreation and Park Department. The area includes several privately owned parcels near Gilman Avenue and Arelious Walker Drive, north of the stadium. That area is primarily vacant and used for stadium parking. A recreational vehicle park occupies a portion of the site on Gilman Avenue. The Candlestick Point area also includes the Alice Griffith public housing site, which is bounded by Gilman Avenue on its southwest, Hawes Street on the northwest, Carroll Avenue on the northeast and Arelious Walker Drive on the southeast (see **Figure 2**).

The existing Candlestick Park stadium typically hosts up to 12 games per year, including eight regular season games, two pre-season games, and for teams that qualify for playoffs, two post-season games. Professional football games on the west coast are typically scheduled for 1:00 p.m. on Sundays, from September through early December. The post-season runs into January and games can be played on either Saturday or Sunday. At the conclusion of the college football season in late November, a few NFL games are played on Saturdays, as are some pre-season games. Successful teams typically play at least one Monday night (6:00 p.m.) game, and the 49ers have had at least one such home game in each of the past several seasons. Occasionally (no more than once per year), Sunday games are held at 5:00 p.m.

HPS Phase II comprises 421 acres (dry-land) and includes many structures associated with ship repair, piers, dry-docks, ancillary storage, administrative, and other former U.S. Navy uses largely from the World War II era. Several former Navy buildings are currently leased and occupied as artist studios. The HPS Phase II area primarily consists of Navy Parcels B, C, D and E. The entire HPS Phase II development area is currently under the jurisdiction of the U.S. Navy.

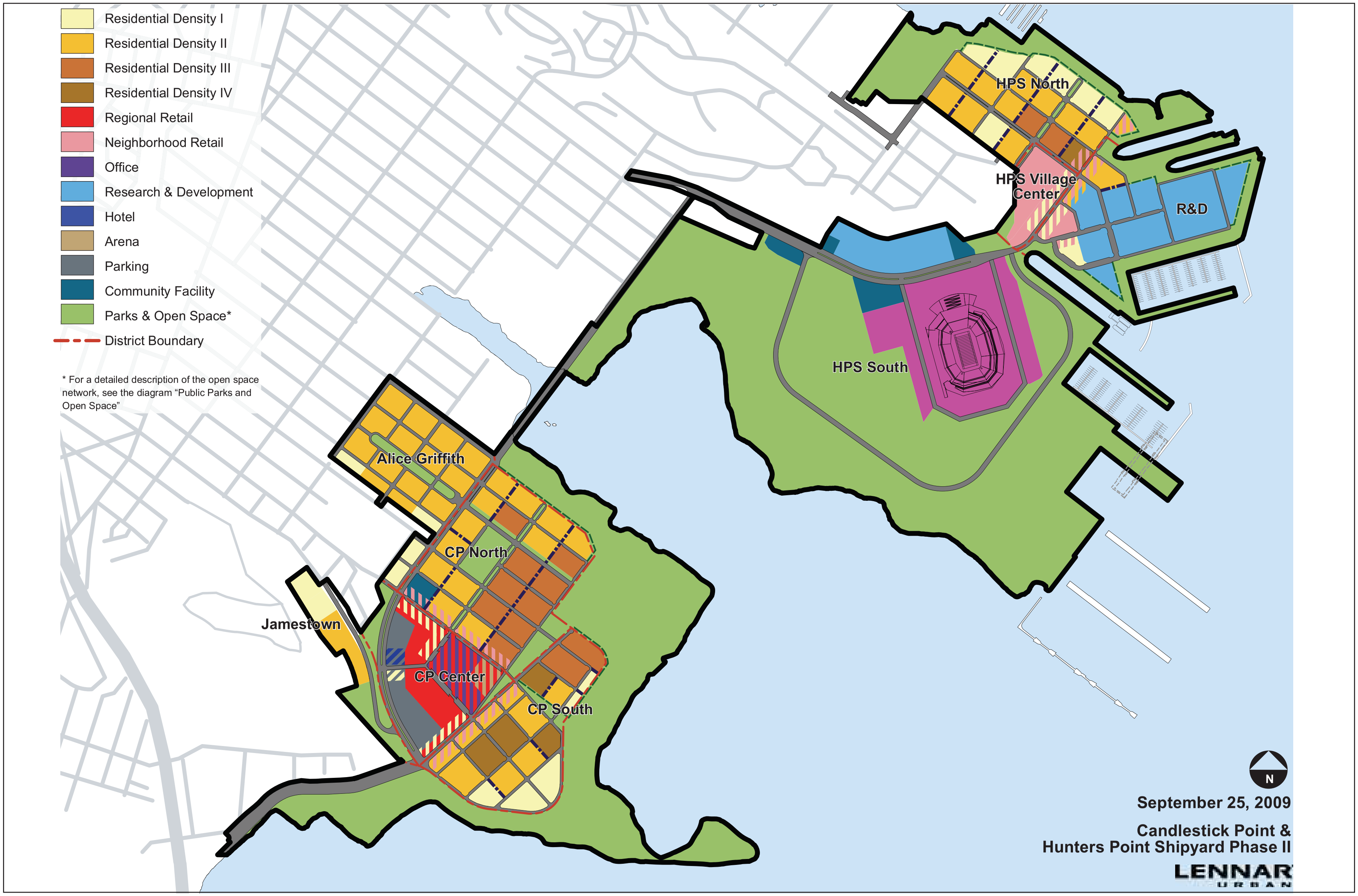
2.2 PROJECT LAND USE PROGRAM

The CP-HPS Phase II Development Plan is a development being proposed by Lennar Urban, and is being analyzed at a project level of detail in the Project EIR. A wide range of uses are proposed, for a mixed-use community with residential, retail, office, research and development, civic and community uses, and parks and recreational open space. A major component would be a new stadium for the San Francisco 49ers, a National Football League team. The development program also includes a 10,000-seat arena. New infrastructure would be constructed to serve the development. **Figure 3** presents the proposed land use plan for Candlestick Point and Hunters Point Shipyard. As noted above, a detailed Project description is provided in Transportation Study Appendix B. **Table 1** summarizes the land use program that was assumed for Project analysis.

Table 1
Project Land Use Program Summary

	Proposed Project
Hunters Point Shipyard	
Residential (units)	2,650
Neighborhood Retail (gsf)	125,000
Research & Development (gsf)	2,500,000
Artists Studios (gsf) [1]	255,000
Community Services (gsf)	50,000
Park (acres)	231
Stadium (seats)	69,000
Marina (slips)	300
Candlestick Point	
Residential (units) [2]	7,850
Neighborhood Retail (gsf)	125,000
Regional Retail (gsf)	635,000
Office (gsf)	150,000
Hotel (rooms)	220
Community Services (gsf)	50,000
Park (acres)	105
Arena (seats)	10,000

Notes:
1. Project includes 225,000 sf of existing artist studio space that would be renovated and replaced.
2. Project include existing 256 units at Alice Griffith housing complex that would be replaced
Source: San Francisco Redevelopment Agency, Lennar Urban.



SOURCE: Lennar, BVHP, LLC, 2009.

FIGURE 3: CANDLESTICK POINT - HUNTERS POINT SHIPYARD PHASE II PROPOSED LAND USE PLAN

Implementation of the Development Plan would require amendments to the *Bayview Hunters Point (BVHP) Redevelopment Plan* adopted in 2006 and the *Hunters Point Shipyard (HPS) Redevelopment Plan* adopted in 1997. The Candlestick Point Activity Node program allowed for a new San Francisco 49ers football stadium, and 1.2 million square feet of retail uses, both of which are not planned for in the current plan. The 1997 HPS Redevelopment Plan allows a different mix of industrial and commercial uses than the uses now proposed under the Development Plan.

Design for Development (D4D) documents that would apply in each of the redevelopment plan areas would accompany the Development Plan. The D4D document would include the standards for provision of off-street parking spaces and freight loading facilities, as well as bicycle parking and shower and locker facilities. In combination with the Development Plan, the D4D documents would supersede the San Francisco Planning Code for the CP-HPS Phase II Development Plan.

The Candlestick Point area of the Development Plan is immediately east of Executive Park, with the Bayview neighborhood to the north, the HPS to the north and east, and Candlestick Point State Recreation Area (SRA) along the Bay frontage, shown in **Figure 3.** The Candlestick Point area of the Development Plan is generally bounded by Hawes Street to the northwest, Candlestick Cove and the San Francisco Bay to the south, South Basin to the east, and Jamestown Avenue to the southwest. The northern boundary of Hawes Street is limited to the San Francisco Housing Authority's (SFHA) Alice Griffith public housing site between Gilman and Carroll Avenues, which extends north from Arelious Walker Drive.

The HPS Phase II area is to the southeast of the Bayview neighborhood. As shown in **Figure 3**, the HPS Phase II area is generally bounded by the San Francisco Bay to north, south and east. The south end of the western boundary extends from Yosemite Slough along Arelious Walker Drive to approximately Crisp Avenue, excluding the University of California San Francisco (UCSF) property. The northern boundary generally extends along Crisp and Spear Avenues. The northernmost end of the HPS Phase II area is contiguous with Earl Street and the southeastern boundary of the India Basin Shoreline area.

The 49ers Stadium subarea would provide a site for a new 69,000-seat National Football League stadium for the San Francisco 49ers. This subarea is on the southern half of HPS Phase II, with the stadium footprint on about 17 acres. The stadium would include about 1,860,000 gsf, with seating, ramps and stairs, office and administrative facilities, food service and retail areas, and access facilities for stadium visitors, players, and staff. Other secondary events could occur at the stadium including college football games, soccer games, concerts, festivals, antique and car shows, and other events. These secondary events would be limited to 20 total occurrences per year.

The parking areas surrounding the 49ers Stadium would serve stadium-related events. Dual-use fields adjacent to the proposed stadium and parking areas would serve as recreation and athletic fields when not used as parking for stadium events. The surface of the fields would be seeded grass above top soil with synthetic fibers and other base materials to support vehicle parking. The parking area and dual-use fields, on-site structures and street parking, and parking in the adjacent R&D park would provide approximately 16,415 parking spaces on game days. In addition, 1,000 spaces at Candlestick Center would be available for stadium parking on game-days. During non-game day activities, approximately 3,656 parking spaces would be available to serve the dual-use athletic fields and related events.

2.3 ROADWAY NETWORK IMPROVEMENTS

The Project would include a number of transportation improvements and the internal street network and roadway improvements were designed to support the transit, bicycle and pedestrian improvements. The Development Plan would improve existing roadways to serve Candlestick Point and Hunters Point Shipyard Phase II and surrounding the Bayview, South Basin, and Hunters Point neighborhoods. Roadway improvements would be within the CP-HPS Phase II Development Plan boundaries, and off-site as shown in **Figure 4**. Proposed roadway improvements would include the following:

Harney Way Widening: The existing four-lane Harney Way would widened to the north and south of its existing alignment, and would be rebuilt to contain between two and three travel lanes in each direction, turn pockets, two BRT-only lanes, Class I and Class II bicycle facilities, new sidewalks, as well as landscaped area. Initially, the roadway would be rebuilt as a new five-lane roadway (with right-of-way reserved for additional lane(s) to be built in the future as needed for increased traffic levels). There would be two lanes in each direction, with eastbound left-turn lanes at Thomas Mellon Circle and Executive Park Boulevard East and a westbound right-turn lane at the Executive Park Boulevard East intersection. **Figure 5** presents the initial phase of Harney Way widening. A Class II bicycle lane would be provided on the north side of the roadway, and a Class I bicycle path would be provided on the south side of the roadway. Two exclusive Bus Rapid Transit (BRT)[2] lanes would be constructed adjacent to the roadway on its north side. They would be separated from the roadway by a six-foot median that would widen to ten feet at the proposed BRT stops to allow for a passenger-loading platform. A BRT stop at the intersection of Harney Way and Thomas Mellon would serve the proposed Executive Park development. Six lanes would be constructed west of Thomas Mellon Drive to connect with the future modifications to the U.S. 101 interchange.

[2] Bus Rapid Transit (BRT) is an integrated system of facilities, services, and amenities that collectively improves the speed, reliability, and identity of bus rapid transit. BRT combines stations, vehicles, services, running ways (e.g., curb bus lanes, median busways, mixed-flow lanes), and Intelligent Transportation Systems (ITS) elements into an integrated system.

SOURCE: Fehr & Peers; AECOM

FIGURE 4: PROPOSED ROADWAY NETWORK IMPROVEMENTS

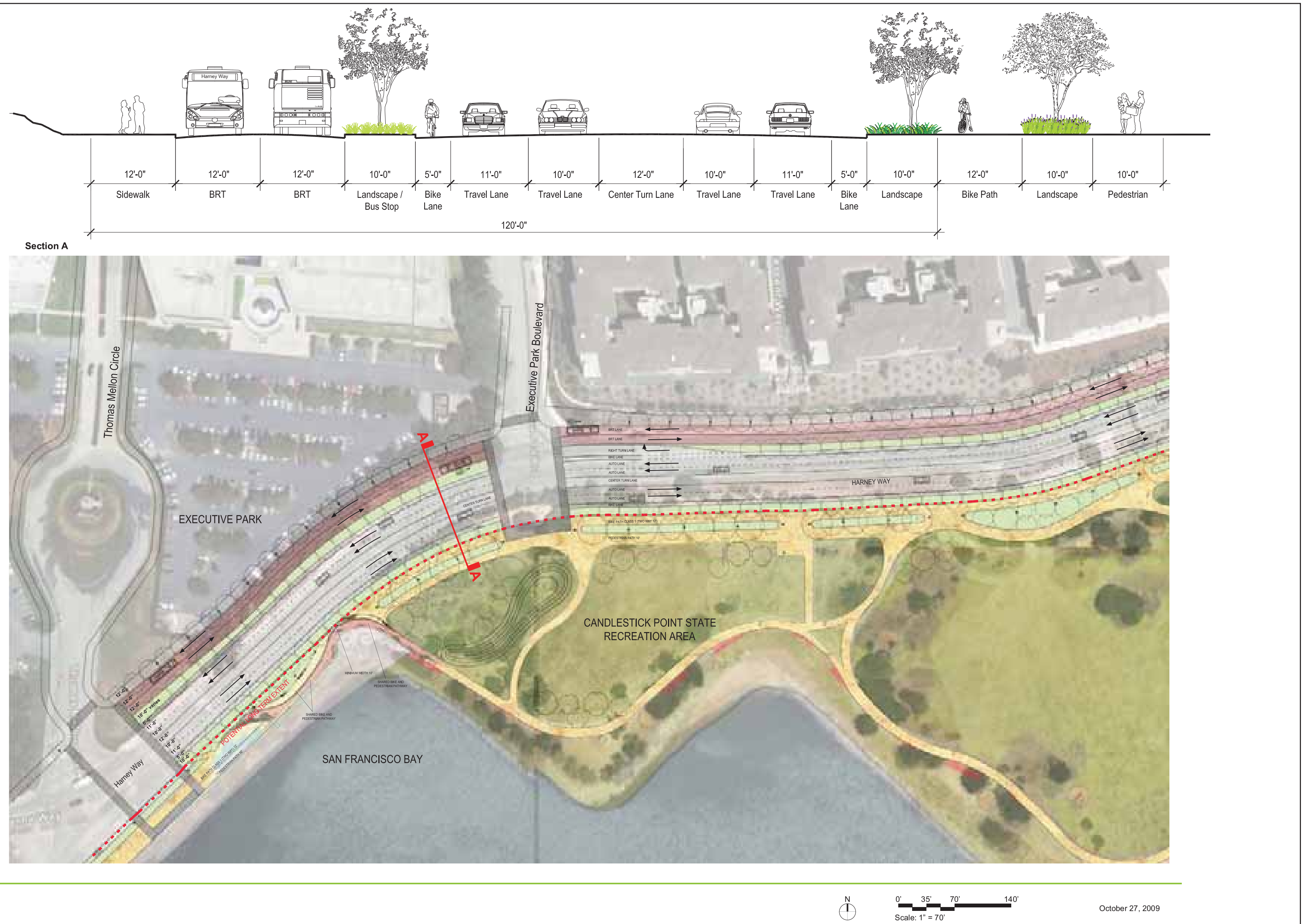


FIGURE 5: PROPOSED HARNEY WAY WIDENING - INITIAL CONFIGURATION

The BRT right-of-way has been designed to meet "rail ready" standards for future conversion to light rail, although such conversion is not contemplated in this Project. New traffic signals would be installed at these intersections. After games at the new 49ers stadium, left turns would be prohibited at the two Harney Way intersections with Thomas Mellon Drive and Executive Park Boulevard for a period to allow for the configuration of the roadway to change to four westbound auto lanes and one eastbound auto lane.

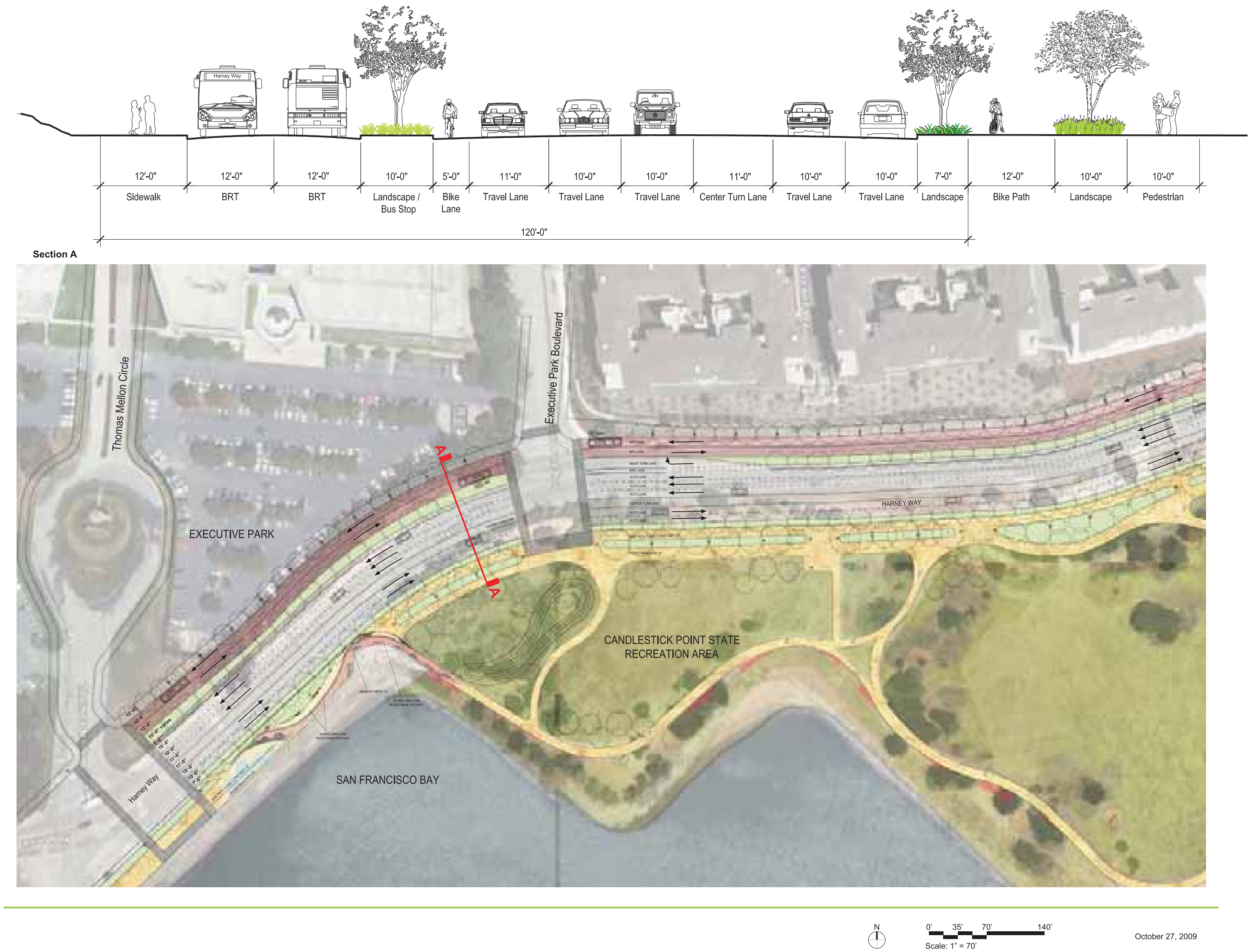
Under the final configuration, a portion of the landscaped area installed as part of the initial widening would be rebuilt to provide an additional lane from the proposed Harney Interchange east to Arelious Walker Drive, if necessary. **Figure 6** presents the final configuration of the Harney Way widening.

New and Improved Roadways – The street network proposed for Hunters Point Shipyard and Candlestick Point would be an extension of the existing grid of the adjacent Bayview neighborhood, using typical Bayview block sizes. Within Candlestick Point the extension and completion of the street network would enhance access between the existing neighborhoods and the existing and proposed waterfront park. Within Hunters Point Shipyard, the street grid would be aligned to focus on connections to the waterfront.

The internal street network would be composed of eight types of streets, as classified by the San Francisco Better Streets Plan (Draft for Public Review, June 2008): Commercial Throughway, Residential Throughway, Neighborhood Commercial Street, Neighborhood Residential Street, Mixed-Use Street, Parkway, Park Edge Street and Alley. Transportation Study Appendix C contains the proposed cross-sections for the various street types. Streets would be designed as complete streets consistent with the Better Streets Plan (Draft for Public Review, June 2008) to enable safe access for all users[3]. Proposed techniques would include driveway access management; traffic calming features such as signage and striping, pedestrian bulbouts where feasible at intersections, and refuge islands; streetscape amenities including street furniture, lighting, and plantings; and other features that would facilitate a high-quality pedestrian and bicycle network consistent with San Francisco's "Better Streets" Plan.

The spine of the Project's street network would be a continuous arterial beginning in the northwest of Hunters Point and traveling south to Candlestick Point. The portion of the arterial within Hunters Point would incorporate Innes Avenue, Robinson Street, and Crisp Avenue. The portion of the arterial connecting Hunters Point and Candlestick Point would incorporate a new Underwood Avenue extension and an improved Ingalls Street and Carroll Avenue. The reconfigured Arelious Walker Drive on the western edge of Candlestick Point would connect to an improved Harney Way at the southernmost point of Candlestick Point.

[3] Complete Streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists and transit riders of all ages would be able to safely move along and across a complete street.



Under final configuration, a portion of the landscaped area may be rebuilt to provide an additional lane from the proposed Harney Interchange east to Arelious Walker Drive, if necessary.

FIGURE 6: PROPOSED HARNEY WAY CONFIGURATION - ULTIMATE CONFIGURATION

The Hunters Point Shipyard and Candlestick Point arterial streets would function as the primary thoroughfares of the Project, with generally perpendicular collector, parkway and park edge streets playing a subordinate role. BRT lanes would be on the north side of Harney Way before diverting through the Candlestick Point site, using the Yosemite Slough bridge to reach Hunters Point Shipyard. Automobiles would not be permitted to use the Yosemite Slough bridge except on game days, and would instead be routed via Carroll Avenue, Ingalls Street, Thomas Avenue, and Griffith Street. The local streets that form the balance of the street network would be Neighborhood Residential streets.

Hunters Point Shipyard would be served by a four-lane roadway extension of Thomas Avenue connecting to Arelious Walker Drive and Crisp Avenue via Griffith Street. Ingalls Street would contain two travel lanes and on-street parking/loading on both sides of the roadway. The existing portion of Thomas Avenue would be converted from a two-lane to a four-lane facility. On Thomas Avenue, parking would be retained on both sides of the roadway. Innes Avenue east of Donahue Street would be reconfigured to provide for two travel lanes in each direction and on-street parking on both sides of the roadway (this segment was recently constructed as part of HPS Phase I and contains one travel lane in each direction).

Game Day Roadway Network – Several roadway lane configurations would be temporarily changed to allow for the efficient ingress and egress of auto traffic to and from the proposed 49ers stadium before and after games. These roadways include Innes Avenue, Robinson Avenue, and Fisher Avenue on the north side of the Hunters Point Shipyard; Crisp Avenue on the southern side of the Hunters Point Shipyard; Griffith Street, Thomas Avenue, and Ingalls Street between the Shipyard and Candlestick Point; and Arelious Walker and Harney Way on Candlestick Point. Additionally, the Yosemite Slough bridge would be opened to vehicular traffic during this period. The bridge would be able to carry four lanes of auto traffic before and after games. In all cases, a travel lane would be dedicated to the "off-peak" travel direction (away from the stadium pre-game and to the stadium post-game) for local traffic and emergency access vehicles. Traffic control officers would be stationed at major intersections.

Streetscape Improvements – Streetscape improvements are planned for several key Bayview Hunters Point roadways: Harney Way and Innes, Palou, Gilman, Ingerson, and Jamestown Avenues. These streets would serve as primary routes for pedestrians, bicyclists, transit riders, and drivers. They are proposed to enhance the safety and experience of road users and existing residents, and are consistent with San Francisco's "Better Streets" Plan.

Enhanced streetscape design, including street trees, sidewalk plantings, furnishings, and paving treatments would be designed to visually tie together the proposed Project with the greater Bayview neighborhood. Specific streetscape treatments would vary depending on existing right-of-way and traffic demands. Streetscape improvements would take into consideration visibility at STOP-sign controlled intersections.

Yosemite Slough Bridge – A new Yosemite Slough bridge would extend Arelious Walker Drive from Candlestick Point to Crisp Avenue in Hunters Point Shipyard. The bridge would have an 81-foot-wide right-of-way and would contain a 40-foot-wide landscaped greenway, two 11-foot-wide BRT lanes, a sidewalk, and a Class I bicycle path. On 49ers game days, the 40-foot-wide landscaped area would be converted to four peak direction travel lanes for game day auto traffic. The Yosemite Slough bridge would not be used for vehicular traffic at any other time, including secondary events at the new stadium.

The Yosemite Slough bridge is a fundamental component of the proposed BRT service between Hunters Point Shipyard and points to the west, including Candlestick Point, the Bayshore Caltrain station, and the Balboa Park BART station. It would be a continuation of the dedicated right-of-way for BRT on Harney Way and through Candlestick Point that, along with signal priority to BRT vehicles, is essential to provide direct, fast and reliable BRT service, and is designed to be "rail ready" (not to preclude possible conversion to light-rail).

The bridge sidewalk and Class I bicycle path would provide a direct connection between Candlestick Point and Hunters Point Shipyard for pedestrians and bicyclists at all times, and would reduce the potential for conflicts between BRT vehicles and motorists, pedestrians and bicyclists.

During game days, the 40-foot-wide landscaped median would serve as the primary and most-direct route between the stadium parking areas and U.S. 101. This route would minimize the intrusion of game day traffic onto local residential streets (by directing vehicles directly onto Harney Way) and reduce the duration of post-game congestion.

Other Off-site Improvements – The Development Plan includes installation of new traffic signals at existing unsignalized intersections as part of the transit preferential treatment[4] on Palou Avenue, or when traffic volumes warrant signalization at:

- Palou Avenue and Griffith Street
- Palou Avenue and Hawes Street
- Palou Avenue and Ingalls Street
- Palou Avenue and Jennings Street
- Palou Avenue and Keith Street
- Palou Avenue and Lane Street
- Carroll Avenue and Ingalls Street
- Thomas Avenue and Ingalls Street
- Arelious Walker Drive and Carroll Avenue
- Arelious Walker Drive and Gilman Avenue

[4] Transit preferential street treatments include measures (e.g. transit only lanes, traffic signal pre-emption, sidewalk bus bulbs) that would improve transit travel times and service by giving priority to transit vehicles when conflicts with cars occur.

- Arelious Walker Drive and Ingerson Avenue
- Arelious Walker Drive and Harney Way
- Pennsylvania Avenue/25th Street
- Evans/Jennings/Middlepoint

At the intersection of **Evans/Jennings/Middlepoint**, in addition to signalization, the Project would also revise the existing lane configuration on the Evans Avenue and Jennings Street approaches. The eastbound and westbound approaches of Evans Avenue at Jennings Street currently have three lanes (one left turn lane, a through lane, and a shared through-right turn lane). Neither on-street parking nor bicycle lanes are provided on the segment of Evans Avenue roughly 600 feet to the east, and 400 feet to the west of Jennings Street. Jennings Street has one lane in each direction, with on-street parking permitted on both sides of the street.

- The Project improvement would reconfigure the existing three travel lanes on Evans Avenue for both the eastbound and westbound approaches to provide a shared through and left turn lane, a through lane, and a right turn lane. As indicated above, since there are no bicycle lanes or on-street parking, this reconfiguration of the existing lanes would not impact parking or bicycle travel.
- The Project improvement would also reconfigure the southbound approach of Jennings Street to Evans Avenue to provide a southbound left turn pocket, and a shared southbound through and right turn lane. The reconfiguration of the southbound approach would require displacement of about 200 feet of on-street parking on the west side of Jennings Street, which would eliminate about 8 to 10 parking spaces.

At the intersection of **Palou/Griffith/Crisp**, in addition to signalization, the Project would revise the existing lane configuration on the westbound Crisp Avenue, eastbound Palou Avenue and northbound Griffith Street approaches. As presently configured, there are six approaches at the intersection. All approaches of the intersection have one lane per approach (a shared left-through-right lane). Griffith Street, Palou Avenue, and Crisp Avenue have on-street parking on both sides of the street, and there are industrial loading/unloading zones on segments of Palou Avenue. Palou Avenue is designated as a Class III bicycle route (Bicycle Route #70). There are no bicycle lanes on Palou Avenue.

- The Project would reconfigure the intersection by removing the southwest leg of Crisp Avenue and creating limited access for the eastern block of Palou Avenue. The Crisp Avenue westbound approach, which is a Project roadway, would be restriped to provide two approach lanes, a left turn lane and a shared left/through/right lane.
- The Project would also reconfigure the northbound Griffith Street approach to provide two lanes, a shared left/through/right turn lane and a right turn lane. Additionally, the eastbound approach of Palou Avenue would be reconfigured to provide two approach lanes, a left turn lane and a shared through and right turn lane. The reconfiguration of the northbound approach would require displacement of about 200 feet of on-street parking on the east side of Griffith Street, which would eliminate about 8 to 10 parking spaces.

At the intersection of **Carroll/Ingalls**, in addition to signalization, the Project would revise the existing lane configuration on the westbound approach of Carroll Avenue, the southbound approach of Ingalls Street, and the eastbound approach of Carroll Avenue. The northbound and southbound approaches currently have one travel lane and on-street parking in each direction. The westbound approach of Carroll Avenue has three approach lanes, a shared left and through lane, a through lane, and a right turn lane. There is on-street parking on the southern side of the street. The eastbound approach has a travel lane (shared left/through/right lane) and on-street parking on the southern side of the street. Carroll Avenue is designated as a Class III bicycle route (Bicycle Route #805).

- The Project would reconfigure Carroll Avenue to provide two travel lanes and a bicycle lane in each direction. This would allow for a shared left turn and through lane, and a shared through and right turn at both the east- and westbound approaches. The southbound approach would be reconfigured to allow for two approach lanes: a left turn lane, and a shared through and right turn lane. The reconfiguration of the southbound approach would require displacement of about 200 feet of on-street parking/loading on the west side of Ingalls Street.

At the intersection of **Thomas/Ingalls,** in addition to signalization, the Project would revise the existing lane configuration on the westbound approach of Thomas Avenue. As presently configured all approaches of the intersection have one lane per approach (shared left/through/right lane) and on-street parking on both sides of the street. There are no bicycle facilities provided.

- The Project improvement would reconfigure the westbound approach of Thomas Avenue to Ingalls Street to provide two lanes, a left turn lane and a shared through and right turn lane. Thomas Avenue would be reconfigured to provide two travel lanes in each direction and on-street parking on both sides of the street.

Transportation Management System: The Project would include a transportation management system. The system would include the installation and coordination of existing and new signals at over 30 intersections in the Project vicinity and the surrounding area using fiber-optic technology including several changeable message signs and lane use control signals on roadways with reversible lanes. A Transportation Management Center near the 49ers stadium site would operate the system on game days. The Transportation Management Center would be operated by SFMTA.

2.4 TRANSIT NETWORK IMPROVEMENTS

The Transportation Plan for Project includes the following transit improvements, which were assumed as part of the future transportation network:

- Extension of existing Muni routes to better serve the Project area;
- Increased frequencies on existing routes to provide more capacity; and,
- Provision of new transit facilities and routes to better serve the Development Plan's proposed land use program and transit demand.

New direct transit service is proposed to serve employment trips to downtown San Francisco. Connections to the regional transit network (BART and Caltrain) would serve employment centers in the South Bay. Many of the proposed transit lines would include transit priority systems that use sensors to detect approaching transit vehicles and alter signal timings to improve transit efficiency. The analyses and proposals documented in this report acknowledge three components that must be funded in order to expand transit services. First, operating costs must be provided on an ongoing basis to underwrite the drivers, mechanics, supervisors, schedulers and other staffing necessary to put additional service in place, and these are costed on a fully-allocated funding basis. Secondly, additional transit vehicles are needed to provide any service expansion. In the Project service plan these include standard 40-foot diesel (now hybrid diesel-electric) motor coaches, 60-foot articulated motor coaches, 40-foot electric trolley coaches, and 73-foot electric light rail vehicles. Lastly, and particularly because the magnitude of new transit services proposed is substantial, funding to expand maintenance and storage facilities to accommodate these expanded fleets must also be provided. The proposed transit improvements are illustrated in **Figure 7** and are described below:

Extended bus routes and new bus routes: Existing Muni routes 23-Monterey, 24-Divisadero, 44-O'Shaughnessey, 48-Quintara-24th Street, and 54-Felton would be extended to Hunters Point Shipyard; the 29-Sunset would terminate at Candlestick Point. Service frequencies on these lines would be increased. Capacity on the T-Third route would be increased by operating two-car trains instead of single-car trains. A new Downtown Express route would connect both Candlestick Point and Hunters Point Shipyard with the Financial District. The Hunters Point Shipyard Downtown Express would have a stop on Innes Avenue to serve India Basin.

BRT Service: BRT service to connect the Project with the Bayshore Caltrain station and the Balboa Park BART station would be provided. The 28L-19th Avenue would be extended from its proposed TEP[5] terminus on Geneva Avenue (just east of Mission Street), to the east along

[5] TEP = Transit Effectiveness Project. SFMTA is currently initiating environmental assessment of the recommendations resulting from its Transit Effectiveness Project. The TEP is a comprehensive review of Muni operations, with numerous proposals for service and street network changes to address issues related to reliability, travel times and service areas.

SOURCE: Fehr & Peers; AECOM

FIGURE 7: PROPOSED TRANSIT IMPROVEMENTS

Geneva Avenue and Harney Way, across the proposed Yosemite Slough bridge, and into the Hunters Point Shipyard Transit Center. The 28L-19th Avenue currently operates during the morning (7 to 9 AM) and afternoon (2 to 4 PM) peak periods. With TEP improvements, limited stop service on the 28L-19th Avenue would operate from 9 AM to 6 PM. Harney Way/Geneva corridor would have exclusive bus and BRT lanes between the Hunters Point Transit Center and Bayshore Boulevard, through Candlestick Point and the Bayshore Caltrain Station.

Harney/Geneva BRT/Transit Preferential Street: The Harney Way/Geneva corridor would have exclusive bus and BRT lanes between the Hunters Point Transit Center and Bayshore Boulevard, through Candlestick Point and the Bayshore Caltrain Station.

Hunters Point Transit Center: The Hunters Point Transit Center would serve Hunters Point Shipyard and the Hunters Point Village Center subareas. The transit center would have approximately ten bus bays and the seven bus lines serving HPS would terminate at the center.

Bus Rapid Transit Stops: BRT stops would be at the Hunters Point Shipyard Transit Center, at three locations within Candlestick Point, and at two intermediate locations.

Palou Avenue Transit Preferential Street: The 24-Divisadero line would be extended along Palou Avenue to serve the Hunters Point Shipyard Transit Center. In addition, the 23-Monteery and the 44-O'Shaughnessey lines would continue to use Palou Avenue. Transit-priority technology would be installed on Palou Avenue including new traffic signals along Palou Avenue at Griffith, Hawes, Ingalls, Jennings, Keith and Lane Streets or other transit priority treatments.

2.5 BAY TRAIL, BLUE GREENWAY, AND BICYCLE CIRCULATION IMPROVEMENTS

The Project would include the construction of the regionally adopted Bay Trail in the southeastern portion of San Francisco, and incorporation of the Blue Greenway, a network of enhanced pedestrian and bicycle links in through the eastern portion of San Francisco to the waterfront. Trail improvements would include a pedestrian and bicycle trail along the shoreline with connections to the existing and new parks, from the western boundary of Candlestick Point near the Harney Way/U.S. 101 interchange, through the SRA, Yosemite Slough, and HPS shoreline to India Basin. The Bay Trail would be incorporated into the design of the parks.

Bikeways would provide connections within the Project and the surrounding neighborhoods and other parts of the City, including exclusive bikeways on the proposed Yosemite Slough bridge. Bicycle lanes would be provided along major roadways, consistent with City guidelines, and it is anticipated that as the street network develops, the bicycle facilities would be incorporated into the official Bicycle Route network. The Bay Trail would be extended along the entire Project waterfront. There would be bicycle parking in each commercial parking facility and residential garages. New commercial buildings with at least 20,000 gsf of floor area, as well as other facilities and attractions would provide locker and shower facilities. Bicycle racks would also be installed in parks, and along the streetscape of commercial and some residential streets. The proposed bicycle facilities and Bay Trail improvements within Hunters Point Shipyard and Candlestick Point are presented in **Figure 8**.

2.6 PEDESTRIAN CIRCULATION IMPROVEMENTS

The pedestrian network would encourage walking as a primary mode of transportation within the Project site, and with separated pedestrian pathways, between Hunters Point and Candlestick Point on the Yosemite Slough bridge. Sidewalk and multi-use pathways would allow access to transit facilities and to shopping, schools, and recreation. The interior roadway network would include traffic calming features to facilitate safe pedestrian travel. The streets would be designed to accommodate multi modal travel with features including curb extensions, intersection bulb-outs, raised crosswalks, comprehensive signage, street trees, narrow roadway lanes, and short blocks and other features to slow auto traffic. All pedestrian facilities would meet American with Disabilities Act (ADA) standards and are designed to conform to San Francisco's "Better Streets Plan" wherever possible. The proposed pedestrian circulation plan for Candlestick Point and Hunters Point Shipyard is presented on **Figure 9**.

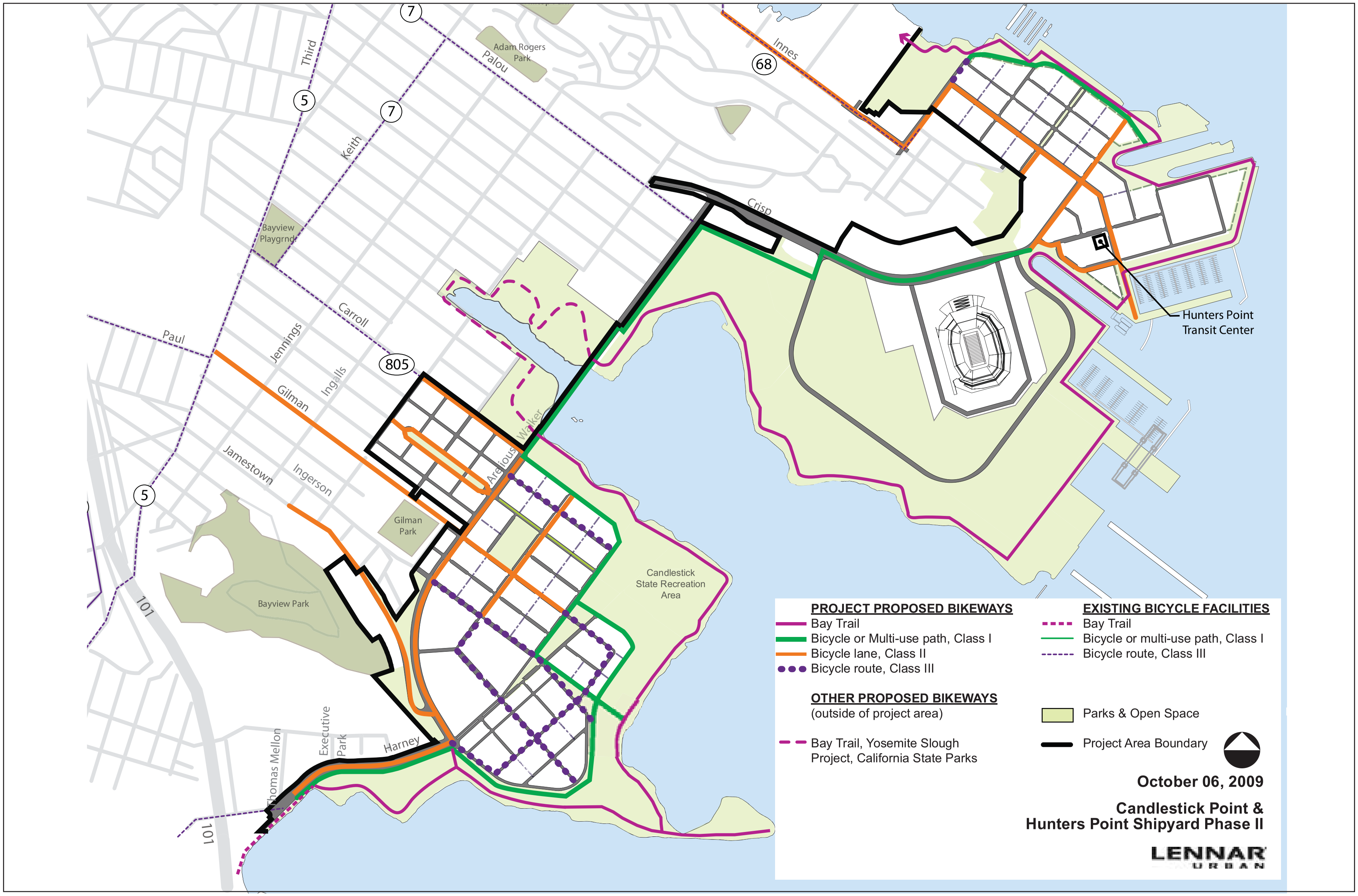
2.7 PARKING SUPPLY

Development within Hunters Point Shipyard and Candlestick Point would include off-street parking to accommodate residents, visitors and employees. The parking supply would be based on the D4D standards for the Project. In addition, on-street parking would be provided on a number of streets to support commercial and residential uses. The estimates of parking supply within Candlestick Point and Hunters Point Shipyard are presented on **Figure 10**.

The 49ers stadium area would have about 16,415 parking spaces, and an additional 1,000 off-street spaces would be available during game days within the commercial parking garage at the Candlestick Park retail center, for a total supply of 17,415 spaces. **Figure 11** presents the proposed stadium game day parking supply.

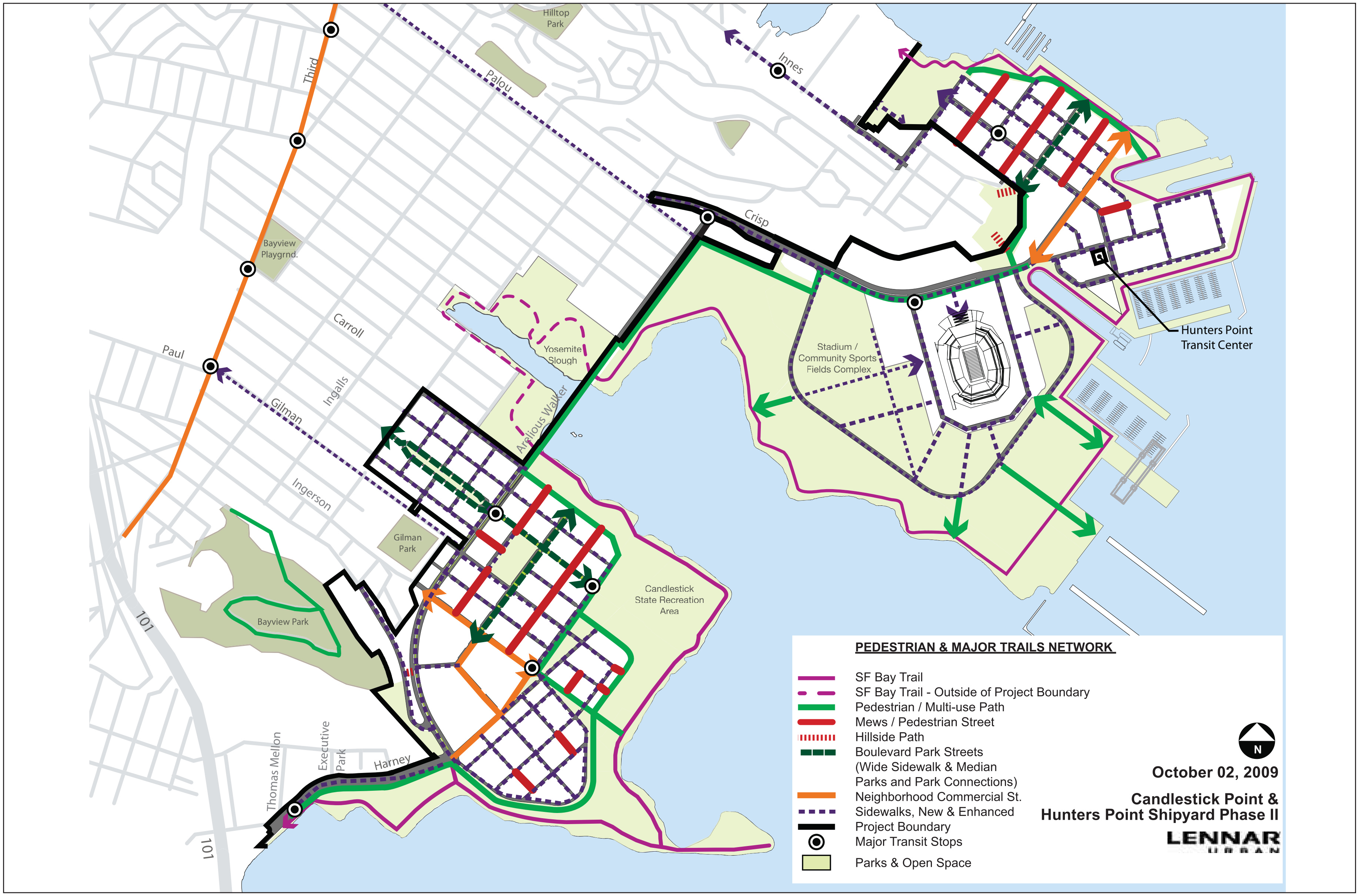
2.8 LOADING SUPPLY

Development within Hunters Point Shipyard and Candlestick Point would also include off-street freight loading facilities to accommodate loading and unloading activities (commercial delivery and moving trucks). The loading supply would be based on the D4D standards for the CP-HPS Phase II Development Plan, and would generally be consistent with Planning Code requirements for San Francisco. On-street loading spaces would serve as short-term parking near building entrances to meet the needs of disabled individuals, as a general convenience, and to allow package and other commercial deliveries.



SOURCE: Lennar Urban

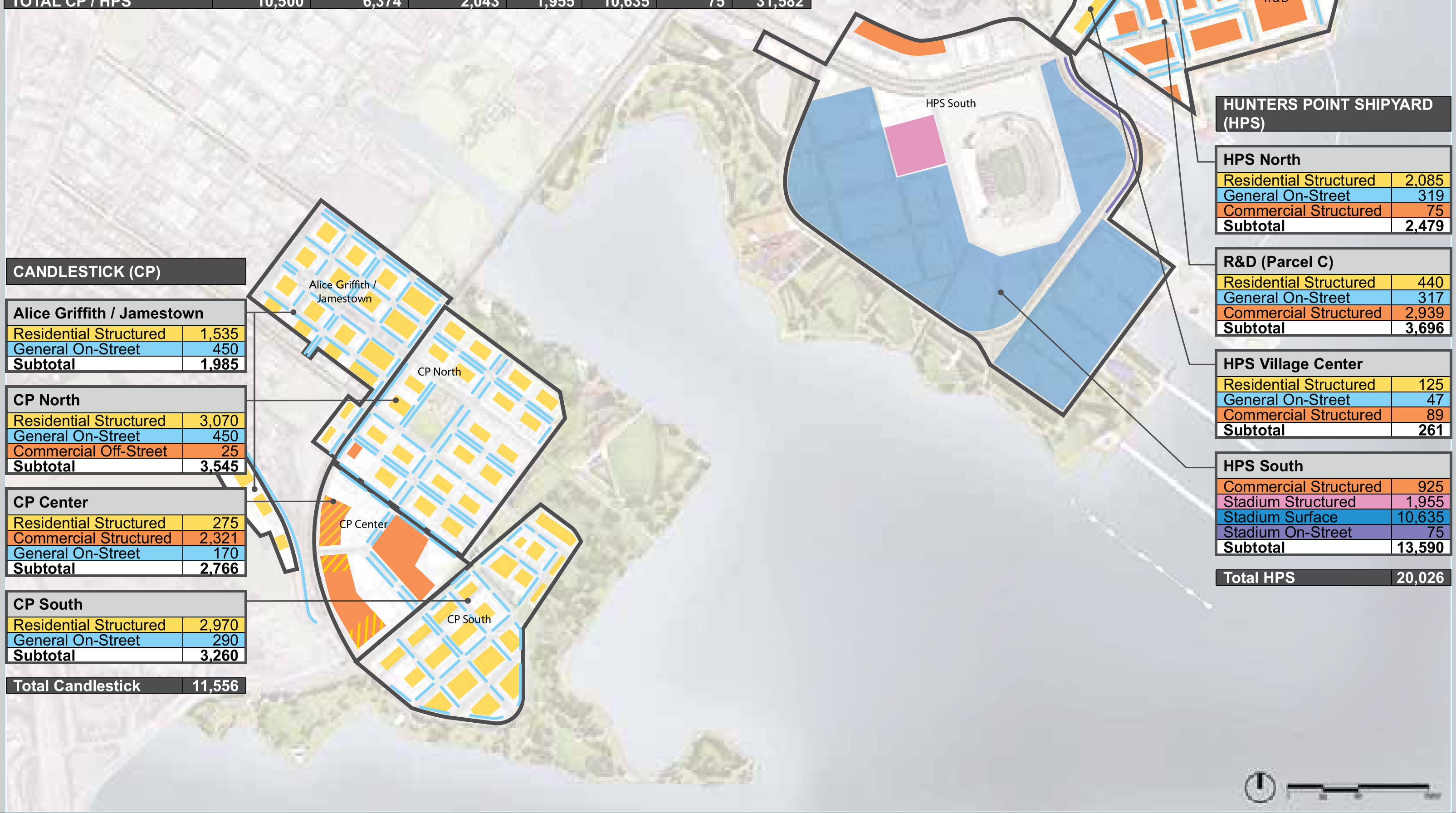
FIGURE 8: PROPOSED BICYCLE FACILITIES AND BAY TRAIL IMPROVEMENTS



SOURCE: Lennar Urban

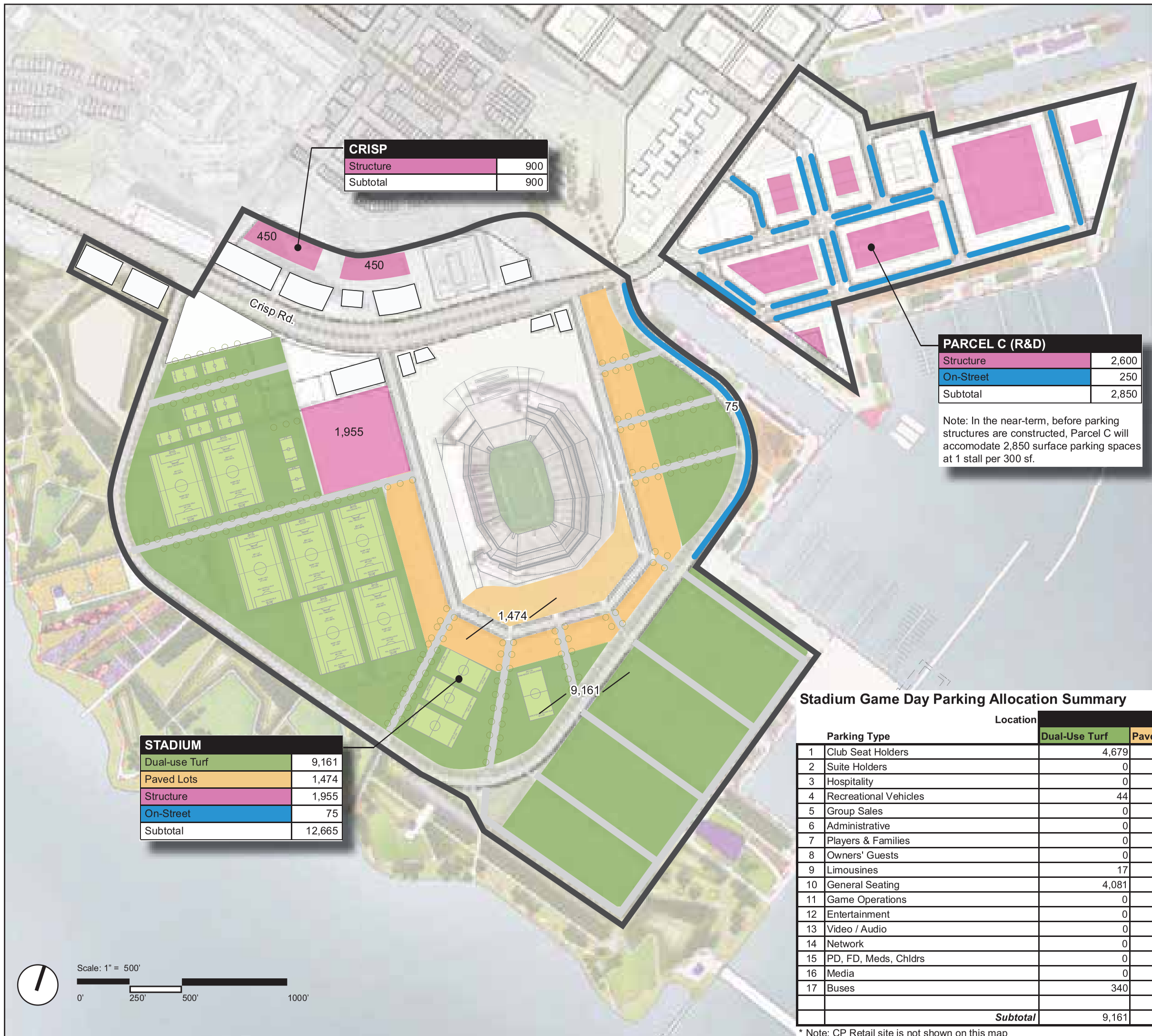
FIGURE 9: CP-HPS II PROPOSED PEDESTRIAN CIRCULATION PLAN

Parcel	Residential	Commercial	General	Stadium			Total
	Structure	Structure/ Off-Street	On-Street	Structure	Surface	Street	
CANDLESTICK POINT (CP)							
Alice Griffith / Jamestown	1,535	0	450	0	0	0	1,985
CP North	3,070	25	450	0	0	0	3,545
CP Center	275	2,321	170	0	0	0	2,766
CP South	2,970	0	290	0	0	0	3,260
Total CP	**7,850**	**2,346**	**1,360**	**0**	**0**	**0**	**11,556**
HUNTERS POINT SHIPYARD (HPS)							
HPS North	2,085	75	319	0	0	0	2,479
HPS Village Center	125	89	47	0	0	0	261
R & D (Parcel C)	440	2,939	317	0	0	0	3,696
HPS South	0	925	0	1,955	10,635	75	13,590
Total HPS	**2,650**	**4,028**	**683**	**1,955**	**10,635**	**75**	**20,026**
TOTAL CP / HPS	**10,500**	**6,374**	**2,043**	**1,955**	**10,635**	**75**	**31,582**



SOURCE: Lennar Urban

FIGURE 10: CP-HPS II PROPOSED PARKING SUPPLY



Stadium Game Day Parking Allocation Summary

	Location	STADIUM					CRISP	PARCEL C			CP RETAIL*	TOTAL
	Parking Type	Dual-Use Turf	Paved Lots	Structure	On-Street	Subtotal	Structures	Structures	On-Street	Subtotal	Structures	
1	Club Seat Holders	4,679	0	0	0	4,679	0	0	0	0	0	4,679
2	Suite Holders	0	0	1,202	0	1,202	0	0	0	0	0	1,202
3	Hospitality	0	44	0	0	44	0	0	0	0	0	44
4	Recreational Vehicles	44	0	0	0	44	0	0	0	0	0	44
5	Group Sales	0	0	20	0	20	0	0	0	0	0	20
6	Administrative	0	0	25	0	25	0	0	0	0	0	25
7	Players & Families	0	220	0	0	220	0	0	0	0	0	220
8	Owners' Guests	0	60	0	0	60	0	0	0	0	0	60
9	Limousines	17	0	0	0	17	0	0	0	0	0	17
10	General Seating	4,081	680	483	75	5,319	900	2,600	250	2,850	1,000	10,069
11	Game Operations	0	0	225	0	225	0	0	0	0	0	225
12	Entertainment	0	30	0	0	30	0	0	0	0	0	30
13	Video / Audio	0	30	0	0	30	0	0	0	0	0	30
14	Network	0	60	0	0	60	0	0	0	0	0	60
15	PD, FD, Meds, Chldrs	0	200	0	0	200	0	0	0	0	0	200
16	Media	0	150	0	0	150	0	0	0	0	0	150
17	Buses	340	0	0	0	340	0	0	0	0	0	340
	Subtotal	9,161	1,474	1,955	75	12,665	900	2,600	250	2,850	1,000	**17,415**

* Note: CP Retail site is not shown on this map

SOURCE: Lennar Urban

FIGURE 11: PROPOSED STADIUM GAME DAY PARKING

The CP-HPS Phase II Development Plan also identifies roadways within the Project site for truck drivers to park while waiting for off-street loading spaces to become available and while resting between deliveries. Federal and state rules concerning safety related to hours of driving and mandatory rest periods require drivers to take a 10-hour rest period. Within Hunters Point Shipyard and Candlestick Point most parking lanes are 7 feet wide, however, curb lanes on the stadium Inner Ring Road and Outer Ring Road would be between 11 and 18 feet wide, which would accommodate most delivery trucks. An area of about 300 feet would be designated for truck parking only during non-game days.

2.9 TRANSPORTATION DEMAND MANAGEMENT PLAN

The CP-HPS Phase II Development Plan includes a commitment to develop and implement a Transportation Demand Management TDM Program designed to reduce use of single-occupant vehicles and to increase the use of rideshare, transit, bicycle and walk modes for trips to and from, as well as within the Project. The TDM program would be developed by a professional transportation consultant, in consultation with San Francisco Municipal transportation Agency (SFMTA) and the Planning Department. The program would establish target goals, monitoring program, and a reporting program to SFMTA and the Planning Department. A draft TDM Plan is included in Transportation Study Appendix B. The TDM Program would highlight the demand management qualities of the overall CP-HPS Phase II Development Plan, including:

1. **Jobs-Housing Linkage.** By providing a range of job types (retail, research, hospitality, office, etc.) and a range of housing types from affordable apartments to single family homes, the CP-HPS Phase II Development Plan would maximize the potential jobs/housing "matches" on site. Each match reduces the number of vehicle trips that would enter and leave the Project site during peak hours.

2. **Streets designed for low speed and safe crossings.** In addition to new residential and commercial buildings, the CP-HPS Phase II Development Plan would provide new infrastructure, including streets. All new streets and intersection upgrades would consider the needs of pedestrians and bicyclists.

3. **Land uses and transit located to encourage walking.** People walk more when destinations are within close proximity, along flat routes with easy street crossings, and through interesting areas with storefronts, street trees, street furniture and other pedestrian-oriented amenities. The CP-HPS Phase II Development Plan embraces these principles, with all homes located within a 15-minute walk of transit and neighborhood retail services integrated into residential blocks. Many existing neighborhoods would also benefit from their proximity to enhanced transit service, schools, retail locations, and jobs with the Project site.

The program would then describe a menu of TDM tools that, when employed, would make the most of the above design qualities of the Development Plan. These include:

Parking Strategies

1. **Visitor Variable, Market-Rate Parking Pricing.** Visitor parking charges at variable market rates would encourage transit use. This can be accomplished by increasing parking rates during the peak period when transit service is most frequent, or increasing parking rates progressively to favor short-term parking over long-term parking, discouraging commuter parking.

2. **Maximum Permitted Parking Ratios.** The Development Plan includes a maximum permitted of one off-street parking space per residential unit, as well as maximum permitted ratios for other development types.

3. **Flexible Parking Management Strategies.** Additional parking management strategies such as residential permit parking, time of day restrictions, parking technologies, and parking wayfinding would also be considered as needed to supplement other parking strategies.

4. **Unbundled Residential Parking.** As required for all new residential developments with more than 10 units in San Francisco, residential parking would be “unbundled” and sold or leased separately from units. Unbundling parking makes the cost of parking visible to households, and may encourage some residents to save money by opting for a single off-street space or no dedicated parking. Unbundled parking would also serve as a “self selection” incentive for residents who prefer to live in car-free or car-reduced neighborhoods.

Transit Strategies and Support Strategies

1. **Central Transit Hub.** A transit center at Hunters Point Shipyard would enable efficient and convenient transfers while providing a central location for transportation brochures and other information to be distributed and for attended bicycle parking. Major BRT stops throughout the Project site would also include information kiosks and real-time transit updates.

2. **Enhanced Transit Service and Bicycle Facilities.** Exclusive bike lanes and frequent bus rapid transit (BRT) service operating in dedicated lanes with signal priority, would offer convenient alternatives to driving to, from, and within the Project site. Additional transit service would include extended Muni routes, increased Muni frequencies, and enhanced connections to the regional network (BART and Caltrain).

3. **Bicycle Support Facilities.** Bicycle support facilities to encourage bicycling would include parking facilities in both residential and commercial developments (such as racks, indoor/long-term parking, lockers, and showers), attended bicycle parking and repair facilities at major destinations (with discounted rental space for a bike station at the Hunters Point Shipyard Transit Center), and potentially a bike sharing or rental program.

4. **Wayfinding.** A comprehensive wayfinding signage program would support the network of walkways and shared-use paths, encouraging pedestrian and bicycle trips.

5. **EcoPass.** Homeowner's dues would include the cost of transit passes. The transit pass or "EcoPass" would offer significant benefits including: a group discount (transit pass costs, while mandatory, would be priced significantly lower than individual passes because they are mandatory), a steady funding stream for enhanced transit service, and a "self selection" incentive – whereby more Eco-Minded (transit-inclined) residents would be attracted to live in the Project site.

6. **Carshare Services.** Local carshare organizations would provide carshare vehicles throughout the Project site. Carshare services, such as City CarShare and ZipCar, allow members to use vehicles when needed, paying based on how much they drive. Employers may include carshare memberships for their employees as an element of their mandatory TDM Program. For multi-unit housing developments, carshare vehicles may be provided in residential garages.

7. **Employee TDM Programs**. Employers of 20 or more employees in the Project site would be required to participate in TDM programs that would encourage the use of transit and facilitate walking and bicycling among their employees through both incentives and disincentives. Elements of the TDM programs may include:

    a. **Information Boards/Kiosks.** Employers would display transit routes and schedules; carpooling and vanpooling information; and bicycle lanes, routes, paths and facility information on information boards/kiosks or direct employees to web resources.

    b. **Commuter Benefits.** The TDM program would include participation in the Commuter Benefits program for tax-free paycheck deductions of transit and bicycle commuter expenses (a program mandatory for San Francisco employers of 20 or more employees).

    c. **Employee EcoPass.** Opportunities to provide employees with an "EcoPass" would be pursued, similar to the programs already underway at the University of California and the City of Berkeley. These passes would allow unlimited transit use and could be purchased at a discount bulk rate on a monthly and/or annual basis, and then be made available to all employees who work on the Project site.

d. **Carpool/Vanpools.** Through their TDM program and in collaboration with the On-Site TDM Coordinator, employers would offer carpool and vanpool matching services, subsidies, and priority accommodation. Designated and convenient spaces in parking facilities would be provided free to vanpools and carpools. The transit centers would also have designated signed areas for casual carpooling. Casual carpooling information would be provided through the On-Site Coordinator's TDM website, brochures, and targeted marketing.

e. **Guaranteed Ride Home Program.** A Guaranteed Ride Home program supported by employer participation would reimburse transit riders for return trip travel in the event of an emergency when an alternative means of travel is not available.

f. **Compressed Work Weeks, Flex Time, and Telecommuting.** Through these strategies, employees would adjust their work schedule to reduce vehicle trips to the worksite.

Implementation and Monitoring Strategies

1. **CP-HPS Transportation Management Association.** A CP-HPS Transportation Management Association would be formed to develop, implement, operate and administer strategies and programs to manage transportation resources in CP-HPS (including Phase I and Phase II) in accordance with the Transportation Demand Management Plan for CP-HPS.

2. **On-Site Transportation Coordinator and Website.** An On-site Transportation Coordinator would provide residents, employers, employees, and visitors with information regarding available transportation alternatives. The Transportation Coordinator would be responsible for implementation, monitoring, and improvement of the measures of the TDM plan. The Coordinator would maintain a website to include transportation-related data and real-time transit information. The Coordinator would serve as a liaison to City staff for all transportation concerns/communication needs.

3. **Targeted Marketing.** From the day that the first employee comes in to work and the first family moves in, a plan would be in place to help people discover alternatives to driving alone in a car. The On-Site Coordinator would be available to help people plan their trips and work with transportation agencies and others to promote transit, vanpooling, carpooling and carsharing, bicycling, and walking. In addition to one-on-one outreach, TDM brochures and a website would be available on an ongoing basis. A

yearly transportation options "fair" would also be scheduled for the neighborhood, with smaller outreach efforts available to employers and other organizations.

4. **Monitoring of Transportation Demand** The transportation measures and programs would all be monitored on an annual basis to determine the success of the programs and to allow the On-Site Coordinator to make decisions about the allocation of resources or changes in the services that may be needed to better address the needs of the Development Plan area. The objective of the monitoring would be to maximize the use of alternatives to the single occupant automobile and reduce peak hour congestion. A monitoring program could include user surveys, automobile counts, transit ridership, and bicycle and car share usage and costs.

5. **Monitoring Effectiveness of Congestion-Reducing and Traffic Calming Efforts.** As part of annual monitoring, the On-site Coordinator would, in cooperation with SFMTA, review the effectiveness of the Project's transportation measures and other traffic calming measures implemented in the area to reduce congestion due to Project vehicle trips and minimize traffic spillover to neighboring residential streets. If warranted, the On-Site Coordinator and SFMTA would consider implementation of additional traffic-calming and congestion-alleviating measures, such as adding additional lanes to the streets that approach Third Street, or other congested areas.

2.10 PROJECT PHASING

The Project would be implemented in four overlapping phases, with construction anticipated to be initiated in 2011 and completed by 2029. **Table 2** on page 27 presents the amount of development projected to be constructed at the end of each phase, as well as the transportation infrastructure improvements that would be implemented. As indicated in the table, the majority of development and infrastructure improvements would be completed by the end of the second phase, which has a scheduled completion date of 2021.

Table 2
Project Phasing of Land Use Program and Transportation Improvements

	Phase 1 2017	Phase 2 2021	Phase 3 2025	Phase 4 2029	Total
Land Use Program					
Hunters Point Shipyard					
Residential (units)	2,325	325	--	--	2,650
Neighborhood Retail (gsf)	60,000	65,000	--	--	125,000
Research & Development (gsf)	2,278,000	222,000	--	--	2,500,000
Artists Studios (gsf) 1	255,000	--	--	--	255,000
Community Services (gsf)	--	50,000	--	--	50,000
Marina (slips)	--	--	--	300	300
Stadium (seats)	69,000	--	--	--	69,000
Candlestick Point					
Residential (units)	795	2,520	3,255	1,280	7,850
Neighborhood Retail (gsf)	--	125,000	--	--	125,000
Regional Retail (gsf)	--	635,000	--	--	635,000
Office (gsf)	--	150,000	--	--	150,000
Hotel (rooms) [1]	--	220	--	--	220
Community Services (gsf)	--	50,000	--	--	50,000
Arena (seats)	--	10,000	--	--	10,000
Parkland (acres) [1]	*265*	*262*	*336*	*336*	*336*
Roadway Improvements [2]					
HPS – CP Roadway Network	X	X	X	X	--
Harney Way Widening	X	--	--	--	--
Palou TPS	X	--	--	--	--
Roadway Streetscape Improvements	X	--	--	--	--
Yosemite Slough Bridge	X	--	--	--	--
New Signals	X	--	--	--	--
Transportation Management Center	X	--	--	--	--
Transit Improvements [3]					
HPX – HPS Downtown Express	X	--	--	--	--
44-O'Shaughnessey Reroute	X	--	--	--	--
48-Q-24th Frequency & Reroute	X	--	--	--	--
24-Divisadero Extension	--	X	--	--	--
29-Sunset Increased Frequency	--	X	--	--	--
T-Third – 2-car trains	X	X	--	--	--
28L-19th Ave - BRT to HPS	--	X	--	--	--
29-Sunaset Extension to CP	--	X	--	--	--
CPX – Candlestick Downtown Express	--	X	--	--	--
28L-BRT Increased Frequency	--	--	X	--	--
Transit Center at HPS	--	X	--	--	--
Travel Demand Management Plan [3]	X	--	--	--	--

Notes:
1. At Project completion there would be 105 acres on Candlestick Point and 231 acres on Hunters Point Shipyard. Includes existing 120 acres on CSPRA lands.
2. Roadway network improvements include pedestrian and bicycle improvements.
3. TDM Plan and Transit Improvements are incorporated as Mitigation Measures 1 and 7, respectively.
Source: Lennar Urban, Fehr & Peers.

2.11 PROJECT VARIANTS AND ALTERNATIVES TO THE PROJECT

This section describes the five Project Variants and five Alternatives to the Project.

2.11.1 Project Variants

Five variants of the Project were formulated by the Redevelopment Agency, the City and Lennar Urban, and other stakeholders for purposes of the environmental analysis.

- Two variants address the scenario of the San Francisco 49ers moving to the City of Santa Clara with no football stadium constructed at Hunters Point Shipyard (HPS) Phase II. Those two variants include a different land use distribution at the HPS Phase II site. Compared to the Project, the development program of these variants at HPS Phase II would be increases in R&D space under the No Stadium—Additional Research and Development Variant (R&D Variant) and relocating residential units to HPS Phase II under the No Stadium - Housing Variant (Housing Variant).

- Three Candlestick Point tower variants (Variant 3) would have the same land use program and overall description as the Project, but would have different locations and heights for residential towers at Candlestick Point (Candlestick Point Tower Variants A, B, and C).

- A utilities variant (Variant 4) would include an automated solid waste collection system, decentralized wastewater treatment, and district energy.

- Variant 5 would include the scenario of a shared stadium where both the 49ers and Oakland Raiders would play at a new stadium at HPS Phase II

Project Variant 3 (Candlestick Point Tower) and Variant 4 (Utilities) would have the same development program and transportation network as the Project and therefore their transportation impacts would be the same. For this reason, these variants are not further discussed in the transportation study. Variant 5 (49ers/Raiders Shared Stadium) is assessed qualitatively because impacts would be similar to those identified for the Project conditions, however the number of times per year that these impacts would occur would double.

Table 3 summarizes the land use assumptions for the Project and for Project Variants 1 and 2. **Table 4** presents a comparison of the transportation network improvements for the Project and Project Variants.

Table 3
Summary of Project and Project Variants – Land Use Program

	Project	Project Variant 1 (R&D Variant)	Project Variant 2 (Housing Variant)
Hunters Point Shipyard			
Residential (units)	2,650	2,650	***4,000***
Neighborhood Retail (gsf)	125,000	125,000	125,000
Research & Development (gsf)	2,500,000	***5,000,000***	2,500,000
Artists Studios (gsf) [1]	255,000	255,000	255,000
Community Services (gsf)	50,000	50,000	50,000
Marina (slips)	300	300	300
Park (acres)	238	238	238
Stadium (seats)	69,000	--	--
Candlestick Point			
Residential (units) [2]	7,850	7,850	6,500
Neighborhood Retail (gsf)	125,000	125,000	125,000
Regional Retail (gsf)	635,000	635,000	635,000
Office (gsf)	150,000	150,000	150,000
Hotel (rooms)	220	220	220
Community Services (gsf)	50,000	50,000	50,000
Park (acres)	147	147	147
Arena (seats)	10,000	10,000	10,000

Notes:
1. Project and Variants includes 225,000 sf of existing artist studio space that would be renovated and replaced.
2. Project and Variants include existing 256 units at Alice Griffith housing complex that would be replaced.

Source: San Francisco County Redevelopment Agency, Lennar Urban.

Table 4 Summary of Transportation Improvements - Project and Project Variants			
Improvement	**Project**	**Project Variant 1 (R&D Variant)**	**Project Variant 2 (Housing Variant)**
Harney Widening	X	X	X
New and Improved Roadways	X	X	X
Streetscape Improvements	X	X	X
Yosemite Slough Bridge	X	X	X
New Signals			
Palou/Griffith	X	X	X
Palou/Hawes	X	X	X
Palou/Ingalls	X	X	X
Palou/Jennings	X	X	X
Palou/Keith	X	X	X
Palou/Lane	X	X	X
Carroll/Ingalls	X	X	X
Thomas/Ingalls	X	X	X
A. Walker Dr/Carroll	X	X	X
A. Walker Dr/Gilman	X	X	X
A. Walker Dr/Ingerson	X	X	X
A. Walker Dr/Harney	X	X	X
Pennsylvania/25th	X	X	X
Evans/Jennings/Middlepoint	X	X	X
Intersection Improvements			
Evans/Jennings/Middlepoint	X	X	X
Palou/Griffith/Crisp	X	X	X
Carroll/Ingalls	X	X	X
Thomas/Ingalls	X	X	X
Transp Management System			
Extended & New Bus Routes	X	X	X
BRT Service	X	X	X
Harney/Geneva BRT/TPS	X	X	X
Hunters Point Transit Center	X	X	X
BRT Stops	X	X	X
Palou Avenue TPS	X	X	X
Bay Trail & Bicycle Improvements	X	X	X
Pedestrian Improvements	X	X	X
TDM Plan	X	X	X

Source: Lennar Urban, Fehr & Peers.

Variant 1 – No Stadium - R&D Variant

Variant 1 assumes that the 49ers stadium would not be constructed at Hunters Point Shipyard, and, instead, the 49ers would move to the City of Santa Clara. Under Project Variant 1, an additional R&D uses would be developed. As indicated in **Table 3** above, the land use program would be the same as for the Project, with the exception that 5,000,000 sf of research and development space, rather than 2,500,000 sf of R&D space would be developed at Hunters Point Shipyard. Variant 1 assumes the same roadway and transit improvements as the Project, including construction of the Yosemite Slough bridge. However, the bridge would be narrower than the bridge included as part of the Project, with a 39-foot wide right-of-way to accommodate two 11-foot wide BRT lanes, a sidewalk, and a Class I bicycle path.

Variant 2 – No Stadium – Housing Variant

Variant 2 also assumes that the 49ers stadium would not be constructed at Hunters Point Shipyard, and, that instead the 49ers would move to the City of Santa Clara. The land use program would be the same as for the Project, with the exception that 4,000 residential units, rather than 2,650 units, would be developed at Hunters Point Shipyard. As with Variant 1, Variant 2 assumes the same roadway and transit improvements as the Project, including construction of the Yosemite Slough bridge. The bridge would be narrower than the bridge included as part of the Project, with a 39-foot wide right-of-way to accommodate two 11-foot wide BRT lanes, a sidewalk, and a Class I bicycle path.

Variant 3 – Candlestick Point Tower Variants (Tower Variants A, B, and C)

The three Candlestick Point Tower Variants (Tower Variants A, B, and C) would have the same overall land use program as the Project. While there would be additional towers under these variants, the total number of residential units would remain the same as the Project. Transportation impacts associated with this variant would be the same as the Project, and are therefore not addressed further in the transportation study.

Variant 4 – Utilities

The Utilities Variant assumes the implementation of additional on-site utility infrastructure, including (1) district heating and cooling, (2) on-site wastewater treatment, and (3) an automated trash collection system. All land uses at Candlestick Point and the HPS Phase II site would be constructed at the same locations and at the same intensities proposed under the Project, although some minor shifts in building locations could occur to accommodate some elements of the proposed utility systems, which would require some additional built space. Transportation impacts associated with this variant would be the same as the Project, and are therefore not addressed further in the transportation study.

Variant 5 – SF 49ers and Oakland Raiders Shared Stadium at Hunters Point Shipyard

This variant assumes that both the 49ers and the Oakland Raiders would play home games at the new stadium at Hunters Point Shipyard. This variant addresses the requirement of the National Football League for NFL teams in close geographic proximity to one another to evaluate the potential shared use of a stadium. There currently are no specific plans for use of the stadium by a second NFL team.

This variant would have the identical land uses as the Project, however, the number of days during which football games would occur at the stadium would increase. Given that teams typically play half of all pre-season, post-season, and regular season games at home, the use of the stadium by two NFL teams could result in one NFL event at the stadium occurring every week from the beginning of the pre-season in August through the end of December for up to 24

NFL events per year. In addition, there would also be up to 20 secondary smaller events at the stadium per year.

2.11.2 Alternatives to the Project

As noted above, five Alternatives to the Project are analyzed in the transportation study. **Table 5** summarizes the land use assumptions for the Project and for the five Alternatives to the Project. **Table 6** presents a comparison of the transportation network improvements for the Project and the Alternatives to the Project.

Table 5
Summary of Project and Alternatives to the Project – Land Use Program

	Project	Alt 1 No Project	Alt 2 No Bridge	Alt 3 49ers at Candlestick	Alt 4 Lesser Build	Alt 5 No Park Agreement
Hunters Point Shipyard						
Residential (units)	2,650	1,800	2,650	4,000	1,855	4,000
Neighborhood Retail (gsf)	125,000	570,000	125,000	125,000	87,500	125,000
R&D (gsf)	2,500,000	1,087,000	2,500,000	2,500,000	1,750,000	2,500,000
Artists Studios (gsf) [1]	255,000	225000	255,000	255,000	255,000	255,000
Community Services (gsf)	50,000		50,000	50,000	50,000	50,000
Park (acres)	231		231	245	231	245
Stadium (seats)	69,000		69,000			
Mixed Use		580,000				
Cultural and Education		330,600				
Candlestick Point						
Residential (units) [2]	7,850	256 [3]	7,850	1,210	5,495	6,500
Neighborhood Retail (gsf)	125,000		125,000		87,500	125,000
Regional Retail (gsf)	635,000		635,000		444,500	635,000
Office (gsf)	150,000		150,000		105,000	150,000
Hotel (rooms)	220		220		154	220
Community Services (gsf)	50,000		50,000		50,000	50,000
Park (acres)	105	120 [4]	105	120 [4]	147	126
Arena (seats)	10,000		10,000		10,000	10,000

Notes:
1. Project and Alternatives include 225,000 sf of existing artist studio space that would be renovated and replaced.
2. Project and Alternatives include existing 256 units at Alice Griffith housing complex that would be replaced.
3. Existing 256 units at Alice Griffith housing complex.
4. Existing 120 acres of State Park lands within project area.
Source: San Francisco County Redevelopment Agency, Lennar Urban.

Table 6
Summary of Transportation Improvements - Project and Alternatives to the Project

Improvement	Project	Alt 1 No Project	Alt 2 No Bridge	Alt 3 49ers at Candlestick	Alt 4 Lesser Build	Alt 5 No Park Agreement
Harney Widening	X	--	X	--	X	X
New and Improved Roadways	X	--	X	--	X	X
Streetscape Improvements	X	--	X	--	X	X
Yosemite Slough Bridge	X	--	--	X	--	--
New Signals						
Palou/Griffith	X	X	X	X	X	X
Palou/Hawes	X	--	X	X	X	X
Palou/Ingalls	X	--	X	X	X	X
Palou/Jennings	X	--	X	X	X	X
Palou/Keith	X	--	X	X	X	X
Palou/Lane	X	--	X	X	X	X
Carroll/Ingalls	X	--	X	X	X	X
Thomas/Ingalls	X	--	X	--	X	X
A. Walker Dr/Carroll	X	--	X	--	X	X
A. Walker Dr/Gilman	X	--	X	--	X	X
A. Walker Dr/Ingerson	X	--	X	--	X	X
A. Walker Dr/Harney	X	--	X	--	X	X
Pennsylvania/25th	X	--	X	X	X	X
Evans/Jennings/Middlepoint	X	--	X	X	X	X
Intersection Improvements						
Evans/Jennings/Middlepoint	X	--	X	X	X	X
Palou/Griffith/Crisp	X	X	X	X	X	X
Carroll/Ingalls	X	--	X	--	X	X
Thomas/Ingalls	X	--	X	--	X	X
Transp Management System	X	--	X	X	X	X
Extended & New Bus Routes	X	--	X	X	X	X
BRT Service	X	--	X	X	X	X
Harney/Geneva BRT/TPS	X	--	X	X	X	X
Hunters Point Transit Center	X	--	X	X	X	X
BRT Stops	X	--	X	X	X	X
Palou Avenue TPS	X	--	X	X	X	X
Bay Trail & Bicycle Improvements	X	--	X	X	X	X
Pedestrian Improvements	X	--	X	X	X	X
TDM Plan	X	--	X	X	X	X

Source: Lennar Urban, Fehr & Peers.

Alternative 1 – No Project

Alternative 1 assumes that the CP-HPS Phase II Development Plan would not be implemented and that the land uses proposed under San Francisco Proposition G, the legislation that enabled the CP-HPS Phase II Development Plan, would not be pursued. Development regulations and zoning would revert to the regulations that were in place prior to passage of Propositions D and F and establishment of the Candlestick Point Special Use District[6].

Alternative 1 assumes that the program included in the existing Hunters Point Shipyard Redevelopment Program would be built out. No new development is assumed for Candlestick Point, and the existing stadium would remain.

Alternative 2 – No Bridge

The land use program for Alternative 2 would be the same as the Project. However, Alternative 2 would modify the circulation plan proposed under the CP-HPS Phase II Development Plan, and would not include construction of the Yosemite Slough bridge.

Under Alternative 2, since the Yosemite Slough bridge would not be constructed, motorized and non-motorized traffic would be required to circumnavigate the slough. Between the intersection of Carroll Avenue/Arelious Walker Drive and Crisp Avenue within Hunters Point Shipyard, the proposed BRT line would be routed on Carroll Avenue between Arelious Walker Drive and Hawes Street, on Hawes Street between Carroll Avenue and Armstrong Avenue (currently unimproved), and on Armstrong Avenue between Hawes Street and the Navy Rail right-of-way, along the Navy rail right-of-way between Armstrong Avenue and Shafter Avenue, along Shafter Avenue between the Navy rail right-of-way and Arelious Walker Drive, and on Arelious Walker Drive between Shafter Avenue and Crisp Avenue (currently unimproved). **Figure 12** illustrates the proposed route.

- On Carroll Avenue the BRT line would operate within an exclusive BRT lane – one transit-only lane and two mixed-flow travel lanes would be provided in each direction.
- Hawes Street between Carroll Avenue and Armstrong Avenue, and Arelious Walker Drive between Shafter Avenue and Crisp Avenue are currently unimproved streets and would be built out to accommodate one transit-only travel lane in each direction.
- The Navy rail right-of-way between Armstrong Avenue and Shafter Avenue would be improved to provide one transit-only travel lane in each direction.
- Shafter Avenue between the rail right-of-way and Arelious Walker Drive would be reconfigured to provide four travel lanes, with BRT operating within the center lanes. Providing four travel lanes would require either prohibiting parking on one side of the street or narrowing sidewalks by four feet (from 15 feet wide to 11 feet wide) on both sides of the street.

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[6] In June 1997, San Francisco voters adopted two measures – proposition D and Proposition F – providing for the development of a new state-of-the-art stadium for the San Francisco 49ers football team and an entertainment/retail shopping center at Candlestick Point. Proposition F amended the General Plan, Planning Code, and Zoning Map, and established the Candlestick Point Special Use District to accommodate the development of a stadium suitable for professional football and a shopping and entertainment center with open space and related parking facilities, as principal uses, and other conditional uses, such as

Existing RR ROW

BRT Path: Using RR ROW for portion of route around Slough

Auto Route Alignment

0 500 Feet

SOURCE: SFMTA

FIGURE 12: BRT ROUTE FOR NO BRIDGE PROJECT CONDITIONS

Alternative 3 – 49ers at Candlestick

Alternative 3 assumes that the 49ers would continue to utilize the existing Candlestick Park stadium. The only new development that would occur at Candlestick Point would be replacement of Alice Griffith housing complex (256 units), and construction of 954 additional housing units. Within Hunters Point Shipyard, the land use program would be similar to the Project, however, the stadium would not be constructed, and instead, 1,350 residential units more than proposed as part of the Project would be developed. The Candlestick Park stadium would remain at its existing site.

Alternative 3 includes the construction of a bridge over Yosemite Slough for use by pedestrians, bicycles, and BRT. The bridge would be narrower than the bridge proposed as part of the Project, and would have a 39-foot wide right-of-way to accommodate two 11-foot wide BRT lanes, a sidewalk, and a Class I bicycle path.

Alternative 4 – Lesser Build

Land uses proposed under Alternative 4 would be similar to the Project, however, the proposed floor areas for most uses would be approximately 30 percent smaller at full buildout in comparison to the Project. The floor area for the artists studios, community services, the arena and stadium would remain the same as for the Project. Candlestick Park stadium would be demolished, and a new stadium would not be constructed.

Alternative 4 would not include construction of a bridge over Yosemite Slough. As under Alternative 2, motorized and non-motorized traffic would be required to circumnavigate the slough, and the most direct route between Hunters Point Shipyard and Candlestick Point would be via Ingalls Street. The proposed BRT line would be routed primarily within the Navy rail right-of-way as described under Alternative 2 above, and illustrated in **Figure 12.**

Alternative 5 – No Park Agreement

The land use program for Alternative 5 would be the same as Project Variant 2, which assumes that 1,350 residential units would be shifted from Candlestick Point to Hunters Point Shipyard. Alternative 5 assumes that the existing stadium would be demolished, and that a new stadium would not be constructed. However, Alternative 5 would not involve State land exchange, and therefore would not include construction of a bridge over Yosemite Slough.

Motorized and non-motorized traffic would be required to circumnavigate the slough, and the most direct route between Hunters Point Shipyard and Candlestick Point would be via Ingalls Street. The proposed BRT line would be routed primarily within the Navy rail right-of-way as described under Alternative 2 above, and illustrated in **Figure 12.**

Chapter 3
PROJECT SETTING

This chapter describes the facilities and systems that currently comprise the local and regional transportation network serving the Project. These facilities and systems include a network of local street, ramps and freeways; local and regional bus and rail transit lines; parking; pedestrian and bicycle facilities; and good movement.

This setting chapter describes: 1) the transportation study area; 2) existing regional and local transportation facilities and services that serve the Project area; 3) existing transportation conditions; and 4) transportation conditions following a football game at the existing stadium.

3.1 TRANSPORTATION STUDY AREA

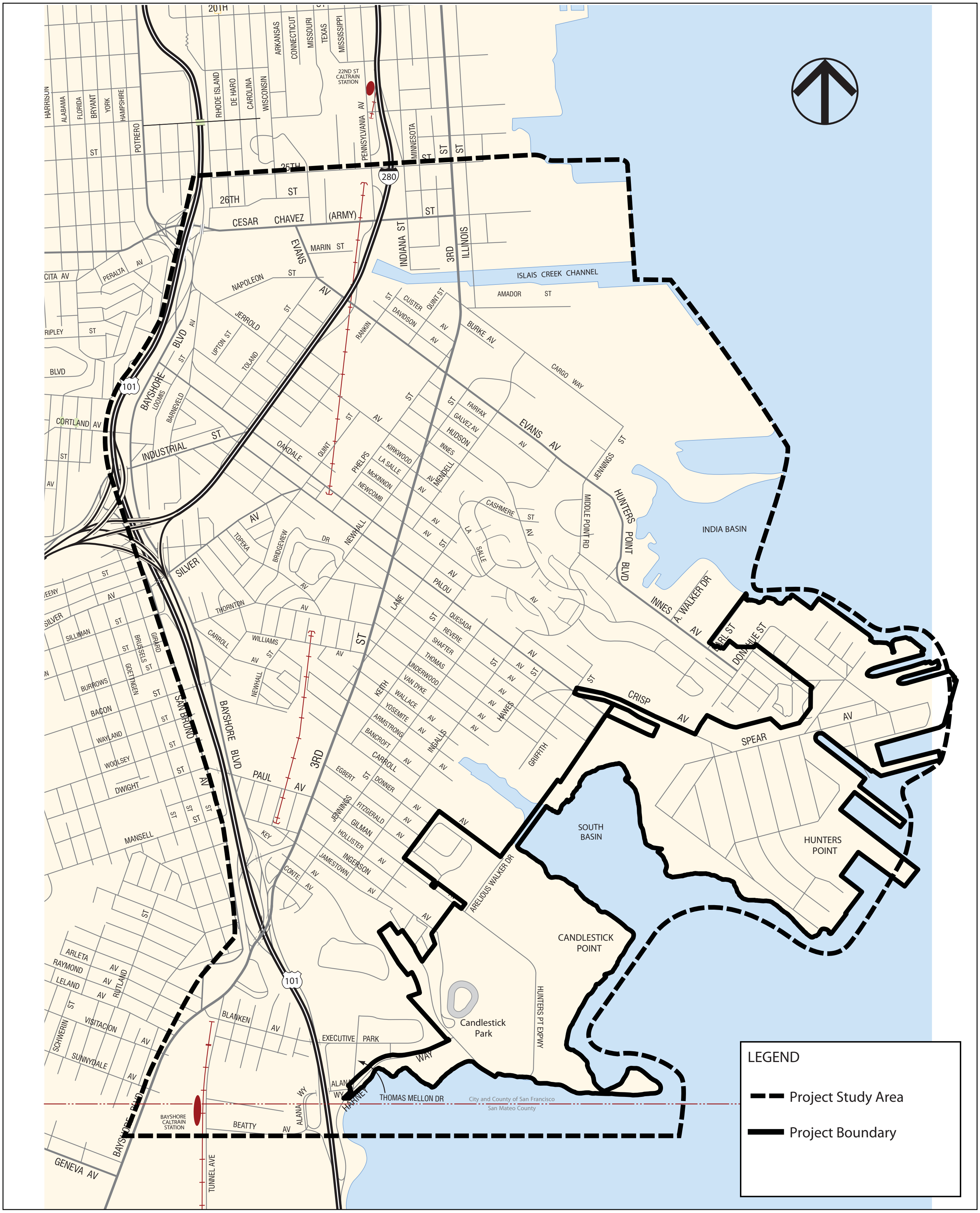
The transportation study area includes all aspects of the transportation network that may be measurably affected by Project traffic. The transportation study area is defined by travel corridors and by facilities such as bus stops/transit stations. It includes the freeway segments, freeway ramps and existing and proposed street intersections that residents and visitors would use in traveling to and from the Project. **Figure 13** presents the transportation study area.

A total of 59 existing intersections (including five intersections within the City of Brisbane), 11 freeway on- and off-ramps, and five freeway segments within the study area were identified as key locations that are likely to be impacted by the Project, and were selected for detailed study of the Project impacts. The study intersections include all major intersections along Third Street, Bayshore Boulevard, and access routes to and from U.S. 101 (including the off-ramp and local street junctions). Intersections further away were not analyzed as part of the study, as Project traffic remaining on local streets would be dispersed and consequently, the Project contribution would be less than at the study intersections. **Figure 14** presents the traffic analysis locations.

The parking analysis focused on two subareas where the stadium game day parking would occur including the on-site and off-site lots, as well as residential streets adjacent in Little Hollywood and Bayview/Candlestick Point.

3.2 ROADWAY NETWORK

This section provides a discussion of the existing roadway network within the study area. Transportation Study Appendix D contains definitions and regulatory requirements for the various San Francisco General Plan (General Plan) roadway classifications.



SOURCE: LCW Consulting

FIGURE 13: PROJECT STUDY AREA

SOURCE: Fehr & Peers

FIGURE 14: TRAFFIC ANALYSIS LOCATIONS

3.2.1 Regional Access

Travel to and from the Project site involves the use of regional transportation facilities, highways and transit services that link San Francisco with other parts of the Bay Area and Northern California. Candlestick Point is accessible by local streets with connections to and from regional freeways and highways in the state system.

U.S. 101 is generally a north/south freeway, connecting San Francisco with the Peninsula and beyond to the south, and Marin County and beyond to the north. Between I-80 and I-280, U.S. 101 is an eight to ten-lane limited-access freeway. Between I-80 and the Golden Gate Bridge, U.S. 101 is a six-lane surface street along Van Ness Avenue, Lombard Street and Doyle Drive.

U.S. 101 has both northbound and southbound on- and off-ramps at Harney Way/Beatty. At Bayshore/Third, there is no northbound on-ramp, and at Cesar Chavez Street, there is no southbound on-ramp. U.S. 101 has a southbound off-ramp at Paul/San Bruno; southbound and northbound on-ramps at Industrial Avenue; and southbound on- and off-ramps and a northbound off-ramp at Silver Avenue.

U.S. 101 is one of the most heavily used corridors in the Bay Area. U.S. 101 and I-280 merge approximately two miles north of Candlestick Point, a common location of congestion during weekday commute periods and pre- and post-game periods. Approximately two miles south of Candlestick Point, U.S. 101 merges with I-380[7] near the San Francisco International Airport.

I-80, which merges with U.S. 101 north of Candlestick Point and south of downtown San Francisco, is generally an east-west freeway, stretching from San Francisco in the west to Sacramento and beyond to the east. The San Francisco-Oakland Bay Bridge connects with U.S. 101 south of downtown San Francisco.

I-280 is generally a north-south freeway, connecting San Francisco with the Peninsula. The freeway provides a direct connection to U.S. 101 and terminates at the surface streets in the South of Market/Mission Bay area. South of the interchange with the U.S. 101 I-280 is currently a six- to eight-lane freeway.

Table 7 presents the U.S. 101 and I-280 ramps serving the study area. Within the study area, ramps are closely spaces, and standard full interchanges are not provided.

[7] I-380 is a short 3.3-mile east-west highway that connects I-280 in San-Bruno with U.S. 101 near the San Francisco International Airport.

Table 7
U.S. 101 and I-280 Ramps in Study Area
Existing Conditions

	Northbound		Southbound	
	On-Ramp	**Off-Ramp**	**On-Ramp**	**Off-Ramp**
U.S. 101				
Harney Way & Alana/Beatty	X	X	X	X
Third/Bayshore/Hestor	X	X	X	X
Mansell Street				X
Silliman Street			X	X
Silver Avenue		X		
Alemany Avenue/Industrial Street	X		X	X
Cesar Chavez/Bayshore	X	X	X	X
I-280				
25th/Indiana/Pennsylvania	X		X	X
Cesar Chavez Street		X		

Source: Fehr & Peers.

3.2.2 Local Roadway Network

This section provides a discussion of the existing local roadway system in the vicinity of the Project site, including the roadway designation, number of travel lanes, and traffic flow directions.

Alana Way is an approximately 1,500-foot two-way roadway segment that connects Beatty Avenue with Harney Way. It serves as the primary connection between Harney Way and U.S. 101 southbound ramps at Alana/Beatty. Alana Way has one travel lane in the eastbound direction towards Harney Way, and two travel lanes in the westbound direction towards Beatty Avenue. On-street parking is not permitted at any time.

Arelious Walker Drive (previously named Fitch Street) is a north-south discontinuous roadway that is divided by the Yosemite Slough and Hunters Point Hill. Arelious Walker Drive runs between Gilman and Carroll Avenues, between Shafter and Palou Avenues, and between Innes and Galvez Avenues. Like other north-south streets in the vicinity, the Arelious Walker Drive alignment has a 64-foot wide right-of-way with room for two 10-foot wide sidewalks (presently un-paved). This street serves as an alternative way to access the northern unpaved privately-owned parking lots used for stadium parking. Arelious Walker Drive between Gilman and Carroll Avenues is part of Bicycle Route #805, and is part of the unimproved on-street Bay Trail.

Bayshore Boulevard is a north-south arterial that generally parallels U.S. 101. Bayshore Boulevard has three travel lanes in each direction, separated by a median. The General Plan designates Bayshore Boulevard as a Major Arterial, part of the MTS Network, and a Transit Preferential Street (other – secondary), and a Neighborhood Commercial Street. South of Arleta Avenue, Bayshore Boulevard is designated as a Transit Preferential Street (other – secondary). Bayshore Boulevard is part of Bicycle Routes #25 and #5. The T-Third light rail line runs on Bayshore Boulevard between Hester Avenue and Sunnydale Avenue.

Beatty Avenue is a two-way east-west roadway between Tunnel Avenue and the U.S. 101 southbound ramps at the intersection of Alana/Beatty. Beatty Avenue has one travel lane in each direction.

Blanken Avenue is a two-way east-west roadway that extends from Bayshore Boulevard through the Little Hollywood area west of Executive Park. The roadway has one lane in each direction with sidewalks and unrestricted parking on both sides of the street. Commercial vehicles weighing more than 6,000 pounds are prohibited from using this roadway as a through route. Blanken Avenue terminates at the intersection of Executive Park Boulevard and Candlestick Road.

Cargo Way is an east-west roadway that extends between Third and Jennings Streets, and serves as the primary access point for the Port of San Francisco's Intermodal Container Terminals. Cargo Way generally contains two travel lanes in each direction. The General Plan identifies Cargo Way as a Secondary Arterial, and as a street with significant truck traffic. Cargo Way is part of the unimproved on-street Bay Trail.

Carroll Avenue is an east-west roadway between Third Street and Arelious Walker Drive. Carroll Avenue has one eastbound lane and two westbound lanes. Carroll Avenue has a right-of-way width of 80 feet. It has discontinuous sidewalks, and, due to the rail tracks there is no sidewalk on the south side of Carroll Avenue between Jennings and Third Streets. Between Ingalls and Hawes Streets there are no sidewalks on the north side of the street, and between Hawes and Griffith Streets there are no sidewalks on either side of the street. Sidewalk accommodations to the east of Ingalls Street are generally discontinuous or frequently obstructed by parked vehicles. On-street parking is permitted west of Ingalls Street. The General Plan identifies Carroll Avenue as a street with significant truck traffic. Carroll Avenue is a part of Bicycle Route #805. Between Arelious Walker Drive and Ingalls Street, Carroll Avenue is currently part of the unimproved on-street Bay Trail.

Cesar Chavez Street is a major east-west arterial between Douglass Street to the west and the Port of San Francisco North Container Terminal, east of Third Street. In the vicinity of the Project, Cesar Chavez Street generally has two to three travel lanes in each direction, with a center median. West of Guerrero Street, Cesar Chavez Street has one lane in each direction. In the General Plan, Cesar Chavez Street is identified as a Major Arterial in the CMP Network from Guerrero Street to Third Street, a Secondary Arterial east of Third Street, and part of the MTS

Network. It is identified as a Route with Significant Truck Traffic east of U.S. 101. Cesar Chavez Street is part of the Bicycle Route #60.

Crisp Avenue is an east-west roadway that extends from the intersection of Griffith/Palou to Spear Avenue within the Shipyard. Public vehicle access is currently not permitted, with the exception of emergency vehicles, and the roadway is currently gated (Crisp south gate) at the intersection of Griffith/Palou. Crisp Avenue served as the primary truck and rail access into the Shipyard until 1971. Crisp Avenue would be reopened as part of the Project.

Evans Avenue is an east-west arterial, with two travel lanes in each direction. Evans Avenue extends between Cesar Chavez Street and Jennings Street (where it becomes Hunters Point Boulevard). The General Plan identifies Evans Avenue between Cesar Chavez Street and Third Street as a Major Arterial in the CMP Network, and part of the MTS Network. Evans Avenue between Third Street and Jennings Street is identified as a Secondary Arterial, and part of the MTS Network. The General Plan also identifies Evans Avenue as a street with significant truck traffic. Evans Avenue is part of Bicycle Route #68, and between Third and Jennings Streets a bicycle lane is provided in each direction.

Geneva Avenue is a major east-west roadway that connects Bayshore Boulevard in Brisbane and Daly City to Highway 1 and I-280 in San Francisco. Geneva Avenue generally has two travel lanes in each direction. The General Plan designates Geneva Avenue as a major arterial, and as a Transit Preferential Street. It is also part of the congestion Management Program Network. Geneva Avenue is part of Bicycle Route #90. The Geneva Avenue Corridor is part of an ongoing Transit Preferential Street study by SFMTA to identify short- and mid-term improvements to increase transit reliability, performance and service.

Gilman Avenue is an east-west street between Third Street and Giants Drive/Hunters Point Expressway. Gilman Avenue has one eastbound travel lane and two westbound lanes, and on-street parking is generally permitted. As with Jamestown and Ingerson Avenues, commercial vehicles weighing more than 6,000 pounds are prohibited from Gilman Avenue between Third and Fitch Streets, except for local service.

Griffith Street is a north-south discontinuous roadway that is divided by Yosemite Slough. On the southern side of the slough, Griffith Street runs between Gilman Avenue and Cameron Way. North of the Slough, Griffith Street extends from Navy Road south to Thomas Avenue. Between Thomas Avenue and the Slough, Griffith Street is an unimproved dirt road. The General Plan identifies Griffith Street between Thomas Avenue and Crisp Avenue as a street with significant truck traffic.

Harney Way is the primary southern access road to Candlestick Point. Harney Way provides a direct connection between U.S. 101 and Jamestown Avenue. Vehicles destined to and from U.S.

101 northbound use the Harney Way ramps, while vehicles destined to and from U.S. 101 southbound use the Alana/Beatty ramp on the west side of U.S. 101 (via Alana Way). Between Alana Way and Jamestown Avenue, Harney Way has two travel lanes in each direction. On-street parking is not permitted at any time, and a sidewalk is provided only on the north side. Harney Way is part of Bicycle Route #805.

Hunters Point Boulevard is an arterial that connects Evans Avenue at Jennings Street with Innes Avenue. Hunters Point Boulevard and Innes Avenue serve as the primary access road to the Shipyard. Hunters Point Boulevard has two travel lanes in each direction. The General Plan identifies Hunters Point Boulevard as a Secondary Arterial, and part of the MTS Network. It also identifies Hunters Point Boulevard as a street with significant truck traffic. Hunters Point Boulevard is part of Bicycle Route #68, and contains a bicycle lane in each direction.

Hunters Point Expressway (and the road south of the Harney Way/Jamestown Avenue intersection, called Jamestown Avenue Extension) circles the existing stadium and parking lot, and connects the east end of Jamestown Avenue with the east end of Gilman Avenue. Hunters Point Expressway provides access to the Candlestick Point State Recreational Area east of the Project site. The number of travel lanes on Hunters Point Expressway varies. In general, there are two continuous travel lanes in each direction, with additional lanes providing access between Jamestown and Gilman Avenues and the gates to the on-site parking. On-street parking is not permitted at any time. However, along parts of Jamestown Avenue Extension, on-street parking is permitted but restricted on event days. Hunters Point Expressway is part of Bicycle Route #805.

Illinois Street is a two-way, north-south roadway that generally parallels Third Street north of the Project site, extending from 16th Street over the Islais Creek Channel and merges into Cargo Way at the Amador Street intersection. The roadway primarily has one lane in each direction with sidewalks and on-street parking on both sides of the street

Indiana Street is a north-south roadway between Mariposa and Tulare Streets. Between Cesar Chavez and 25th Streets, Indiana Street operates one-way northbound and provides access to the I-280 northbound on-ramps at 25th Street. Indiana Street generally has on-street parking, both perpendicular and parallel, on both sides of the street. Indiana Street is part of Bicycle Route #907.

Ingalls Street is a north-south roadway between Jamestown Avenue and Innes/Middle Point. Ingalls Street has one travel lane in each direction, and on-street parking and sidewalks on both sides of the street. Ingalls Street has narrow sidewalks and very wide travel lanes between Yosemite Avenue and Thomas Avenue. Prior to the closure of the Hunters Point Shipyard, Ingalls Street was part of the designated truck route between Carroll Avenue and the currently inactive south (Crisp) gate at Palou Avenue. The General Plan identifies Ingalls Street between

Carroll and Thomas Avenues as a street with significant truck traffic. Ingalls Street between Carroll and Yosemite Avenues is currently part of the unimproved on-street Bay Trail.

Ingerson Avenue is an east-west street between Third Street and Giants Drive. Ingerson Avenue has one travel lane in each direction and on-street parking is permitted. Commercial vehicles weighing more than 6,000 pounds are prohibited from traveling on Ingerson Avenue between Third and Arelious Walker Drive, except for local service.

Innes Avenue is an east-west arterial that provides direct access to Hunter Point Shipyard's Innes (north) gate. It contains two travel lanes in each direction. The General Plan identifies Innes Avenue as a Secondary Arterial and part of the MTS Network. It also identifies Innes Avenue as a street with significant truck traffic. Innes Avenue is part of Bicycle Route #68.

Jamestown Avenue is an east-west street between Third Street and Hunters Point Expressway. West of Redondo Street, Jamestown Avenue has one travel lane in each direction. East of Redondo Street to Giants Drive, there is a substantial change in lane width as Jamestown Avenue increases to one lane in the eastbound direction and two lanes in the westbound direction. Commercial vehicles weighing more than 6,000 pounds are prohibited from using Jamestown as a through route. On-street parking is generally permitted on Jamestown Avenue. Jamestown Avenue provides access to Bayview Park and the Candlestick Point Recreation area, and is identified in the General Plan as a Recreational Street.

Oakdale Avenue is an east-west arterial between Bayshore Boulevard and Third Street. East of Third Street, Oakdale Avenue is discontinuous and is generally a residential street. The General Plan identifies Oakdale Avenue between Bayshore Boulevard and Third Street as a Secondary Arterial. Oakdale Avenue between Bayshore Boulevard and Phelps Street is part of Bicycle Route #170, and bicycle lanes are provided on both sides of the street between Selby and Phelps Streets.

Palou Avenue is an east-west roadway between Barneveld Avenue and Griffith Street. It generally has one travel lane in each direction, and parking on both sides of the street. Palou Avenue has truck restrictions (vehicles in excess of 6,000 pounds prohibited) between Selby Street and Griffith Street. Between Phelps and Griffith Streets, Palou Avenue is part of Bicycle Routes #7 and #70.

Pennsylvania Avenue is a two-way north-south roadway between 17th and Cesar Chavez Streets. Pennsylvania Avenue generally has on-street parking on both sides of the street. Pennsylvania Avenue provides on- and off-ramp access to southbound I-280 at Mariposa, 18th, 25th and Cesar Chavez Streets.

Sunnydale Avenue is a two-way east-west roadway that extends west of Bayshore Boulevard to Persia/Mansell. To the east of Bayshore Boulevard, Sunnydale Avenue is an unpaved dead-end roadway. West of Bayshore Boulevard, the roadway has one lane in each direction with sidewalks and on-street parking on both sides.

Third Street is the principal north-south arterial in the southeast part of San Francisco, extending from its interchange with U.S. 101 and Bayshore Boulevard, to its intersection with Market Street. It is the main commercial street in the Bayview Hunters Point district and also serves as a through street and an access way to all of the industrial areas north and east of U.S. 101. In the vicinity of the Project, Third Street has two travel lanes in each direction. On-street parking is generally permitted on one side of the street. The T-Third light rail operates in an exclusive median right-of-way, with the exception of the segment between Kirkwood and Thomas Avenues, where the light rail shares the travel lane with vehicles. In the General Plan, Third Street is designated as a Major arterial, as a Transit Preferential Street (TPS) in the General Plan, and as a route with significant truck traffic (between the segment between Jerrold Avenue and Fourth Street).

Thomas Avenue is an east-west roadway between Third and Griffith Streets. West of Ingalls Street, Thomas Avenue is a residential street, while east of Ingalls Street, there is a mix of land uses, including residential and light industrial uses. The General Plan identifies Thomas Avenue between Ingalls and Griffith Streets as a street with significant truck traffic.

Tunnel Avenue is a two-way north-south roadway that extends south of Bayshore Boulevard and merges into Bayshore Boulevard at Old County Road. The roadway has one lane in each direction with sidewalks and unrestricted on-street parking on both sides of the street. Tunnel Avenue provides access to Bayshore Caltrain Station and to the U.S. 101 ramps at Alana/Betty. Tunnel Avenue is part of Bicycle Route #905.

Underwood Avenue is an east-west roadway between Third Street and Hawes Street. Underwood Avenue is primarily a residential street between Third and Jennings Streets, and between Jennings and Ingalls Streets there is a mix of residential and light industrial land uses. Between Ingalls Street and Hawes Streets, Underwood Avenue is an unimproved street without paving or gutters, with light/medium industrial land uses.

25th Street is a two-way east-west roadway that runs two blocks north of Cesar Chavez Street between Michigan Street to the east and Grand View Avenue, near Market Street, to the west. It is discontinuous across U.S. 101. 25th Street has one travel lane in each direction, with parking on both sides of the street.

Truck Restrictions

The *San Francisco Transportation Code* Section 501 restricts vehicles with a gross weight of more than 6,000 pounds, or vehicles with a gross weight of more than 18,000 pounds, of operating on identified streets. Within the study area, this regulation was intended to discourage through truck traffic from using Third Street and local residential streets to bypass congestion on the parallel freeways, and to reduce the potential for conflicts between truck traffic and non-industrial land uses. **Figure 15** presents the streets within the study area that have truck restrictions.

San Francisco Congestion Management Program

The San Francisco Congestion Management Program (CMP) has identified U.S. 101 and I-280 as part of the CMP roadway network, with a Level of Service (LOS)[8] standard of E. Of the freeway analysis segments on U.S. 101 and I-280, only U.S. 101 northbound, between the county line and I-280 was identified operating at LOS F during the PM peak hour. The 2007 Level of Service Monitoring Report for the CMP roadway network indicates that during the AM peak period, U.S. 101 northbound between Cortland Street and the I-80 merge, as well as I-280 between Weldon Street and the 6th/Brannan off-ramp operate at LOS E conditions. All other CMP roadway segments within the study area operate at LOS D or better. See Transportation Study Appendix D.

3.3 TRAFFIC OPERATING CONDITIONS

Existing traffic operating conditions were determined for key freeway segments, ramps, and intersections in the study area. Operating conditions were determined using existing intersection and roadway traffic count data collected in November and December 2007, as well as June 2009, and recent freeway and ramp volumes obtained from Caltrans. Table E-1 in Transportation Study Appendix E lists the intersection and date of traffic count.

Analysis of existing conditions on regional facilities and at local intersections were analyzed for the weekday AM (8:00 to 9:00 a.m.) and PM (5:00 to 6:00 p.m.) peak hours, and for Sunday (no football game) PM peak hour (4:00 to 5:00 p.m.) conditions. The weekday AM and PM peak hours consider the current morning and evening commute periods. The Sunday PM peak hour coincides with the time that afternoon football games typically end, and the majority of the spectators depart the stadium. **Figure 14** presents the study area analysis locations.

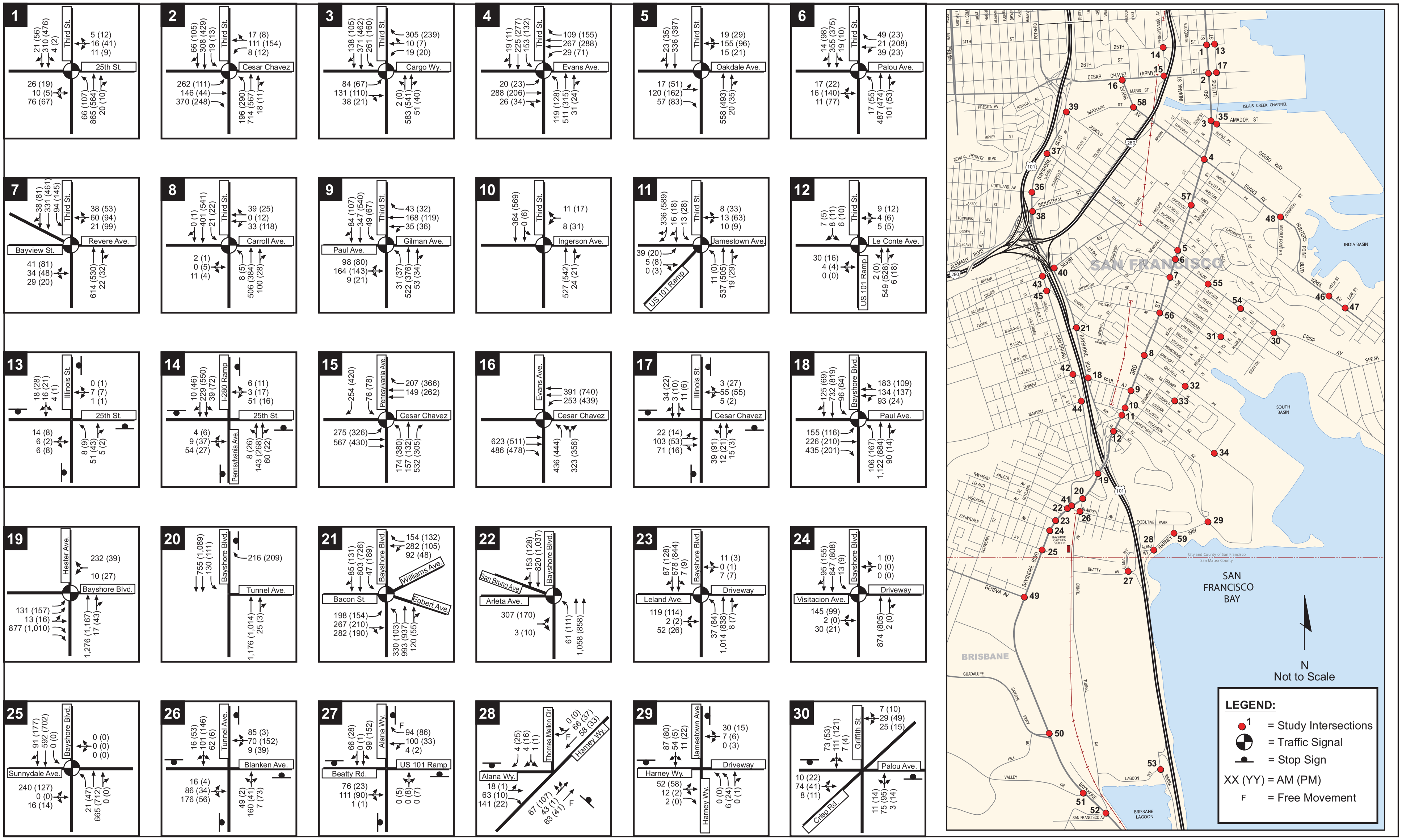
3.3.1 Intersection Analysis

Existing intersection operating conditions were evaluated for 59 intersections in the study area that could be affected by the Project. Of the 59 study intersections, 42 are signalized and 17 are unsignalized. Existing traffic volumes at the 59 study intersection are presented on **Figure 16A** and **Figure 16B** for the weekday AM and PM peak hours, and on **Figure 16C** and **Figure 16D** for the Sunday PM peak hour (no football game conditions). Transportation Study Appendix E contains intersection turning movement volume summaries.

[8] Level of Service (LOS) is a measure of effectiveness used to determine the quality of service of transportation infrastructure.

SOURCE: SFMTA

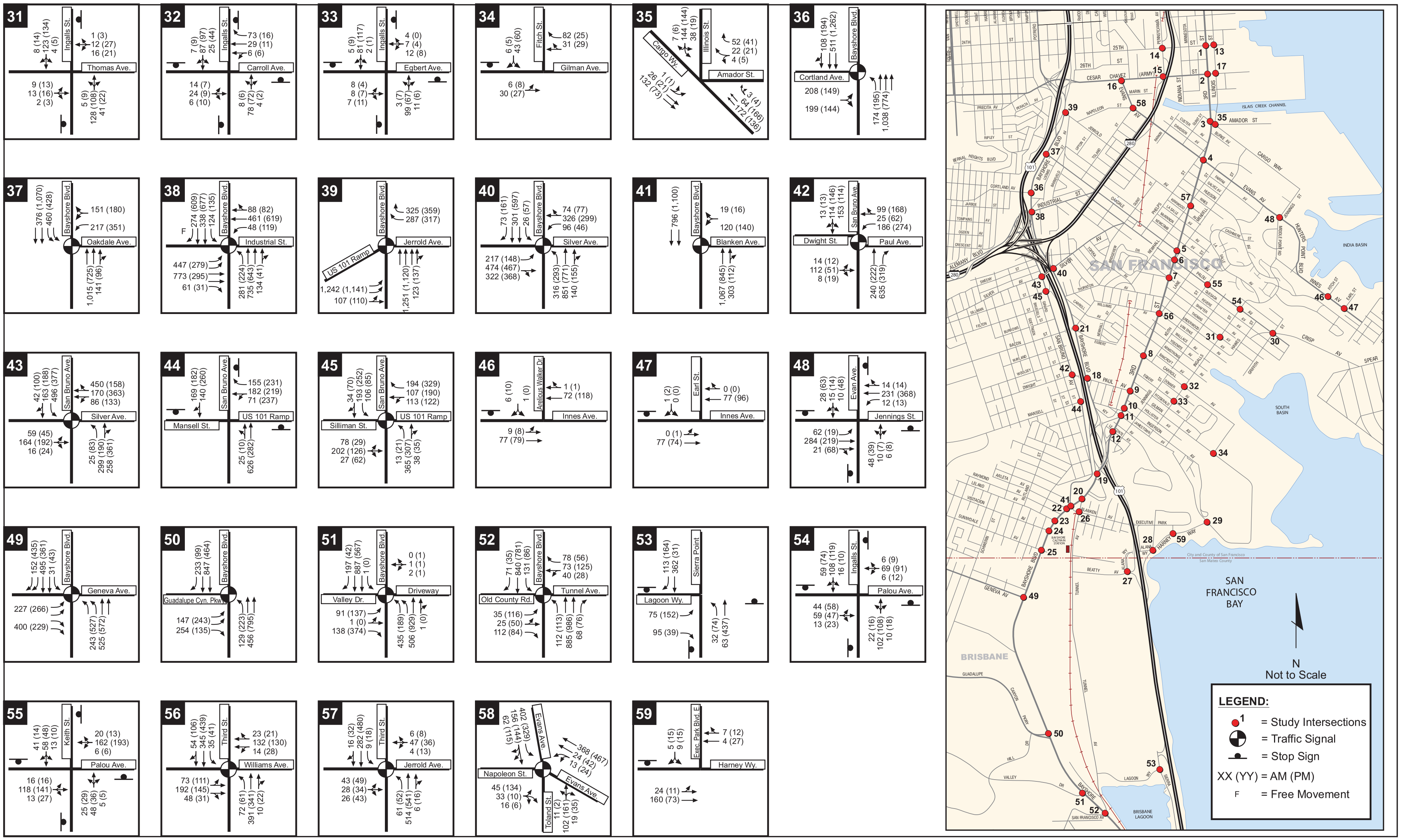
FIGURE 15: EXISTING TRUCK RESTRICTIONS IN STUDY AREA



CP-HPS Phase II Development Plan Transportation Study

EXISTING WEEKDAY PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS

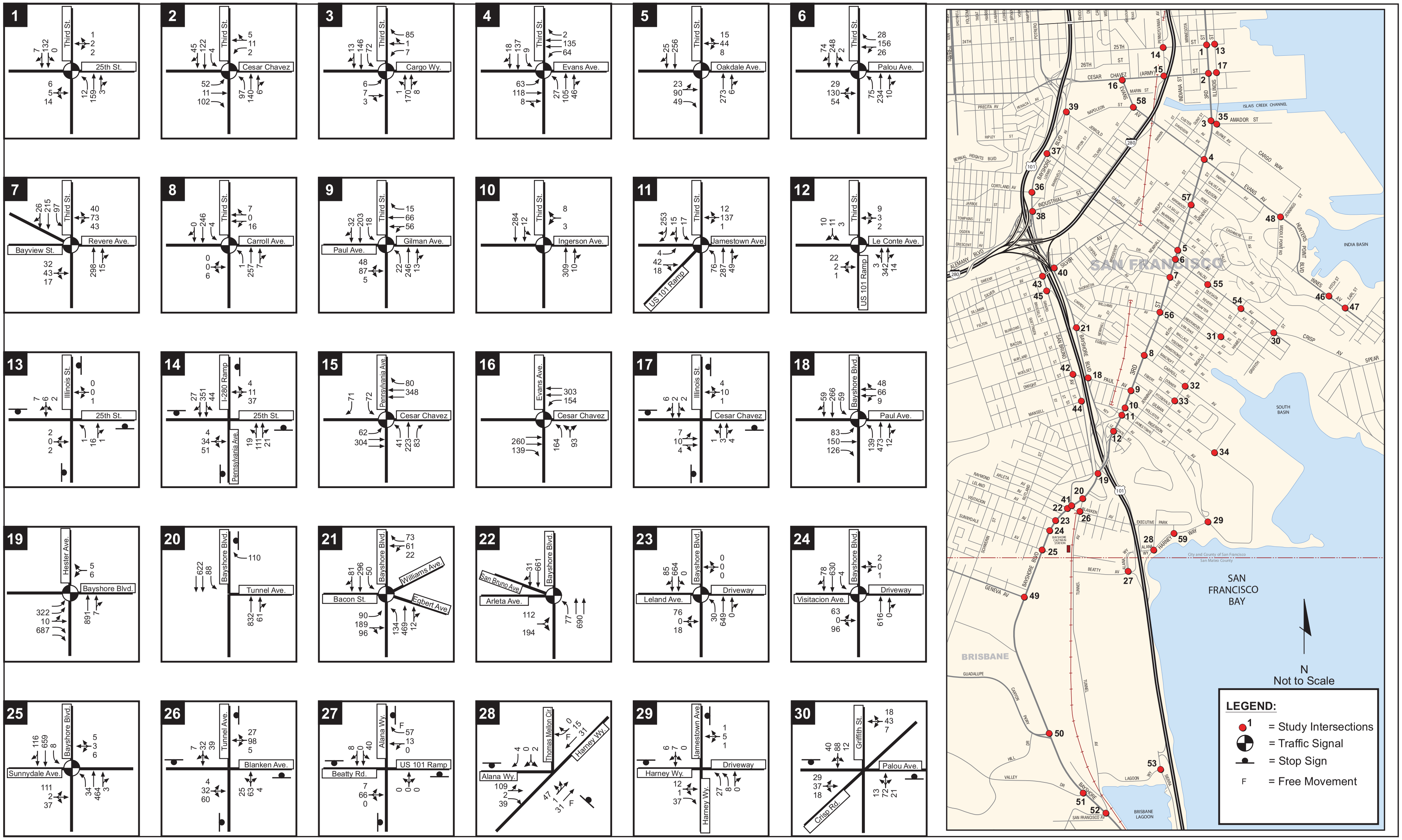
FIGURE 16A



CP-HPS Phase II Development Plan Transportation Study

EXISTING WEEKDAY PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS

FIGURE 16B



CP-HPS Phase II Development Plan Transportation Study

EXISTING SUNDAY PM PEAK HOUR (NO FOOTBALL GAME) TRAFFIC VOLUMES AND LANE CONFIGURATIONS

FIGURE 16C

FEHR & PEERS
TRANSPORTATION CONSULTANTS

June 2009
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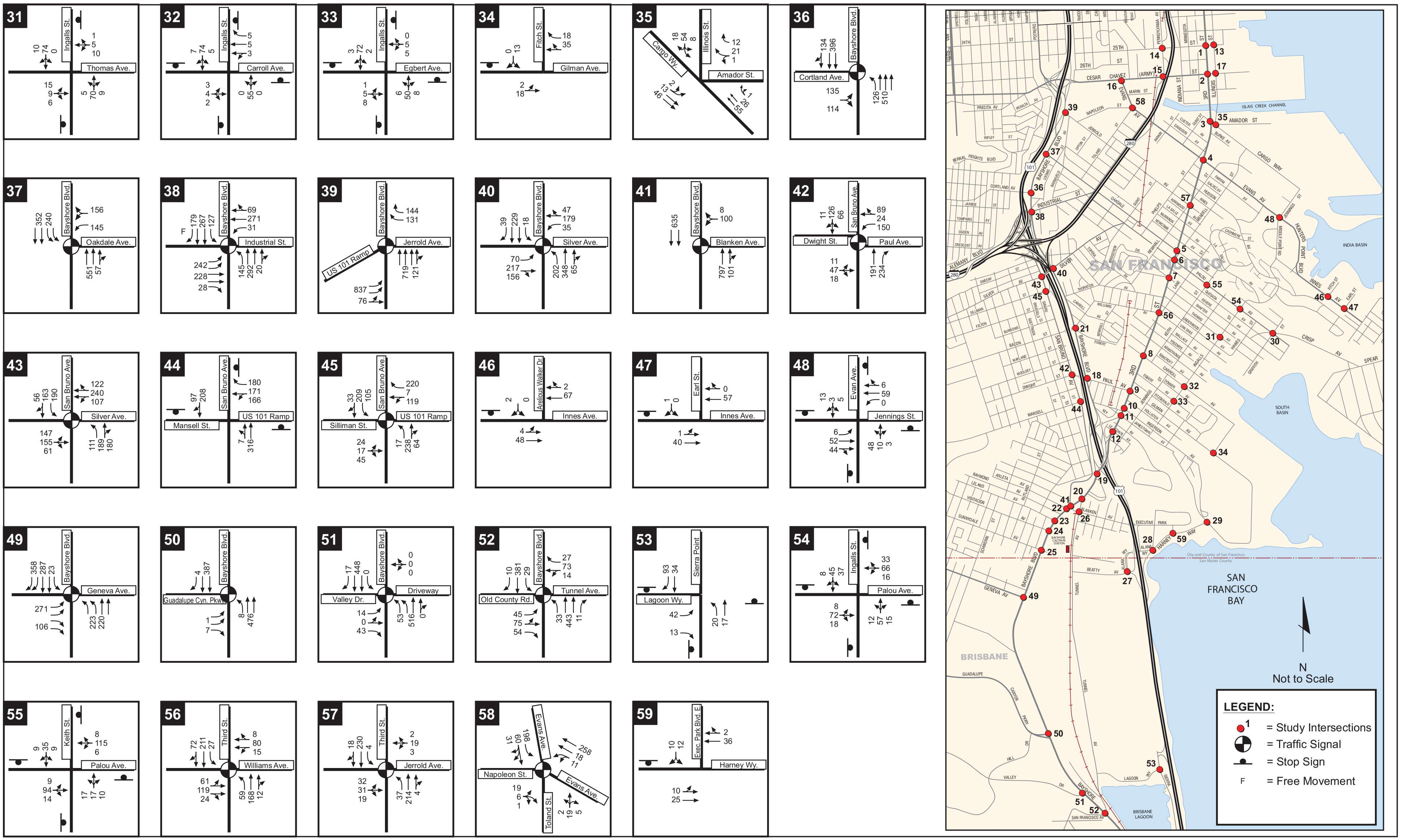


CP-HPS Phase II Development Plan Transportation Study

EXISTING SUNDAY PM PEAK HOUR (NO FOOTBALL GAME) TRAFFIC VOLUMES AND LANE CONFIGURATIONS

FIGURE 16D

The operating characteristics of signalized and unsignalized intersections are described by the concept of Level of Service ("LOS"). LOS is a qualitative description of an intersection's performance based on the average delay per vehicle. Intersection levels of service range from LOS A, which indicates free flow or excellent conditions with short delays, to LOS F, which indicates congested or overloaded conditions with extremely long delays. LOS A through D are considered excellent to satisfactory service levels, LOS E is undesirable, and LOS F conditions are unacceptable. **Table 8** presents the level of service definitions for signalized and unsignalized intersections.

Table 8
LOS Definitions for Signalized and Unsignalized Intersections

Control/ LOS	Description of Operations	Average Control Delay (seconds per vehicle)
Signalized		
A	Insignificant Delays: No approach phase is fully used and no vehicle waits longer than one red indication.	≤ 10
B	Minimal Delays: An occasional approach phase is fully used. Drivers begin to feel restricted.	> 10.0 and ≤ 20.0
C	Acceptable Delays: Major approach phase may become fully used. Most drivers feel somewhat restricted.	> 20.0 and ≤ 35.0
D	Tolerable Delays: Drivers may wait through no more than one red indication. Queues may develop but dissipate rapidly without excessive delays.	> 35.0 and ≤ 55.0
E	Significant Delays: Volumes approaching capacity. Vehicles may wait through several signal cycles and long queues form upstream.	> 55 and ≤ 80
F	Excessive Delays: Represents conditions at capacity, with extremely long delays. Queues may block upstream intersections.	> 80.0
Unsignalized		
A	No delay for STOP-controlled approach.	≤ 10.0
B	Operations with minor delays.	> 10.0 and ≤ 15.0
C	Operations with moderate delays.	> 15 and ≤ 25.0
D	Operations with some delays.	> 25.0 and ≤ 35.0
E	Operations with high delays and long queues.	> 35.0 and ≤ 50.0
F	Operations with extreme congestion, with very high delays and long queues unacceptable to most drivers.	> 50.0

Source: Highway Capacity Manual (HCM 2000), Transportation Research Board, 2000.

The study intersections were evaluated using the *Highway Capacity Manual 2000* methodology ("*HCM*").[9] For signalized intersections, this methodology determines the capacity for each lane group approaching the intersection. The LOS is then based on average delay per vehicle (in seconds per vehicle) for the various movements within the intersection. A combined weighted

[9] As part of the *HCM* methodology, adjustments are typically made to the capacity of each intersection to account for various factors that reduce the ability of the streets to accommodate vehicles (such as the downtown nature of the study area, number of pedestrians, vehicle type, lane widths and queues). These adjustments are performed to ensure that the LOS analysis results reflect the operating conditions that are observed in the field. See Appendix D for adjustments made at study intersections.

average delay and LOS is presented for the intersection. In San Francisco, LOS E and F are considered unacceptable operating conditions for signalized intersections. For unsignalized intersections, average delay and LOS operating conditions are calculated by approach (e.g., northbound) and movement (e.g., northbound left-turn), for those movements that are subject to delay. For the purpose of this analysis, the operating conditions (LOS and delay) for unsignalized intersections are presented for the worst approach (i.e., the approach with the highest average delay per vehicle) for side-street STOP-sign controlled intersections, and average intersection delay is presented for all-way STOP controlled intersections. LOS calculation sheets are included in Transportation Study Appendix F.

Table 9 presents the results of the intersection LOS analysis for the existing weekday PM peak hour conditions.

Table 9
Intersection LOS
Existing Conditions

Intersection	Control	Weekday AM		Weekday PM		Sunday PM	
		Delay	LOS	Delay [1]	LOS	Delay	LOS
1. Third St/25th St	Signal	14	B	16	B	13	B
2. Third St/Cesar Chavez St	Signal	36	D	31	C	23	C
3. Third St/Cargo Way	Signal	23	C	20	B	17	B
4. Third St/Evans Ave	Signal	35	C	34	C	32	C
5. Third St/Oakdale Ave	Signal	17	B	19	B	15	B
6. Third St/Palou Ave	Signal	15	B	30	C	29	C
7. Third St/Revere Ave	Signal	19	B	31	C	22	C
8. Third St/Carroll Ave	Signal	12	B	14	B	9	A
9. Third St/Paul Ave	Signal	27	C	24	C	21	C
10. Third St/Ingerson Ave	Signal	5	A	5	A	3	A
11. Third St/Jamestown Ave	Signal	13	B	14	B	21	C
12. Third/Le Conte/US 101 nb off	Signal	11	B	11	B	12	B
13. 25th St/Illinois St	AWSC	7	A	7	A	7	A
14. 25th St/Pennsylvania Ave	AWSC	9	A	12	B	10	A
15. Cesar Chavez/Penns/I-280	Signal	**78**	**E**	39	D	28	C
16. Cesar Chavez St/Evans Ave	Signal	21	C	21	C	15	B
17. Cesar Chavez St/Illinois St	Signal	13	B	19	B	14	B
18. Bayshore Blvd/Paul Ave	Signal	21	C	17	B	12	B
19. Bayshore/Hester/US 101 sb off	Signal	28	C	13	B	14	B
20. Bayshore Blvd/Tunnel Ave	Signal	19	B	16	B	8	A

Table 9 (continued)
Intersection LOS
Existing Conditions

Intersection	Control	Weekday AM		Weekday PM		Sunday PM	
		Delay	LOS	Delay [1]	LOS	Delay	LOS
21. Bayshore Blvd/Bacon St	Signal	**76**	**E**	22	C	12	B
22. Bayshore Blvd/Arleta St	Signal	25	C	25	C	24	C
23. Bayshore Blvd/Leland Ave	Signal	21	C	22	C	18	B
24. Bayshore Blvd/Visitacion Ave	Signal	17	B	15	B	15	B
25. Bayshore Blvd/Sunnydale Ave	Signal	20	C	19	B	19	B
26. Tunnel Ave/Blanken	Signal	11	B	9	A	8	A
27. Alana Way/Beatty Ave	SSSC	10	A	9	A	8	A
28. Alana Way/Harney Way/T.Mellon	SSSC	8	A	8	A	9	A
29. Harney Way/Jamestown Ave	SSSC	8	A	8	A	7	A
30. Crisp Ave/Palou Ave	SSSC	11.4(nb)	B	11.6(nb	B	11.1(sb	B
31. Ingalls St/Thomas Ave	SSSC	11.3(wb	B	11.5(w	B	9.9(wb)	A
32. Ingalls St/Carroll Ave	SSSC	8	A	8	A	7	A
33. Ingalls St/Egbert Ave	AWSC	8	A	8	A	7	A
34. A.Walker/Gilman Ave	SSSC	9.1(sb)	A	9.2(sb)	A	8.9(sb)	A
35. Amador St/Cargo Way	Signal	28	C	24	C	28	C
36. Bayshore Blvd/Cortland Ave	Signal	19	B	25	C	17	B
37. Bayshore Blvd/Oakdale Ave	Signal	30	C	26	C	24	C
38. Bayshore/Alemany/Industrial	Signal	44	D	**58**	**E**	35	C
39.Bayshore/US 101 nb off to Cesar	Signal	43	D	48	D	25	C
40. Bayshore Blvd/Silver Ave	Signal	50	D	50	D	15	B
41. Bayshore Blvd/Blanken Ave	Signal	12	B	11	B	9	A
42. San Bruno Ave/Paul Ave	Signal	20	B	20	B	16	B
43. San Bruno Ave/Silver Ave	Signal	**75**	**E**	46	D	41	D
44. San Bruno/Mansell/US 101 sb off	AWSC	17	C	33	D	16	C
45. San Bruno/Silliman/US 101 sb off	Signal	24	C	20	B	17	B
46. Innes Ave/A.Walker Drive	SSSC	8.6(sb)	A	8.7(sb)	A	8.5(sb)	A
47. Innes Ave/Earl St	SSSC	8.5(sb)	A	8.6(sb)	A	8.5(sb)	A
48. Evans Ave/Jennings St	Signal	9	A	10	A	8	A
49. Bayshore Blvd/Geneva Ave [3]	Signal	24	C	25	C	20	B
50. Bayshore/Guadalupe Pkwy [3]	Signal	16	B	14	B	10	A

Table 9 (continued)
Intersection LOS
Existing Conditions

Intersection	Control	Weekday AM		Weekday PM		Sunday PM	
		Delay	LOS	Delay [1]	LOS	Delay	LOS
51. Bayshore Blvd/Valley Dr [3]	Signal	23	C	16	B	11	B
52. Bayshore Blvd/Old County Rd [3]	Signal	28	C	29	C	26	C
53. Sierra Pt/Lagoon Way [3]	AWSC	12	B	16	C	8	A
54. Ingalls St/Palou Ave	AWSC	9	A	9	A	8	A
55. Keith St/Palou Ave	AWSC	9	A	9	A	8	A
56. Third/Williams/Van Dyke	Signal	22	C	22	C	22	C
57. Third St/Jerrold Ave	Signal	22	C	23	C	21	C
58. Evans/Napoleon/Toland	Signal	37	D	46	D	32	C
59. Harney/Executive Park East	SSSC	9.1(sb)	A	8.9 (sb)	A	8.8 (eb)	A

Notes:
1. Delay presented in seconds per vehicle. Intersections operating at LOS E or LOS F conditions highlighted in bold.
2. Intersection STOP-controlled. Delay and LOS presented for worst approach. Worst approach indicated in ( ).
3. Intersections within Brisbane city limits.
Source: Fehr & Peers.

During the weekday AM and PM, and Sunday PM peak hours, most study intersections currently operate at LOS D or better. During the weekday AM peak hour, the intersections of Cesar Chavez/Pennsylvania/I-280 and San Bruno/Silver operate at LOS E conditions. During the weekday PM peak hour, the intersection of Bayshore/Alemany/Industrial operates at LOS E conditions. The poor operating conditions at intersections operating at LOS E are generally related to high volumes of traffic destined to U.S. 101 and I-280. During Sunday PM peak hour conditions (without a football game), none of the 59 study intersections currently operate at LOS E or LOS F conditions.

3.3.2 Freeway Mainline Analysis

The LOS for a freeway section, weaving section, and on-ramp junction with the freeway is based on vehicle density (passenger cars/lane/mile) and service volume (passenger cars/hour) using the relationships presented in **Table 10**. Service volume is the primary measure of the overall weaving segment. The specific level of service, and thus service volume, is prescribed by the weaving movement predicated on the weaving volume, number of lanes, and length of weave relationship. The value of service volume is determined with the aid of nomographs published in *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, by J Leisch, & Associates, September 1983.

Table 10
LOS Definitions for Freeway Mainline, Weaving and Ramp Junction

LOS	Description of Operations	Maximum Density (Passenger Cars Per Mile Per Lane)		Service Volume (Passenger Cars Per Hour)		
		Basic Freeway Sections	Freeway Weaving Segments and Ramp Junctions	Freeway Weaving Sections (Lanes)		
				2	3	4
A	Free-flow speeds prevail. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream.	< 11	< 10	< 750	< 800	< 850
B	Free-flow speeds are maintained. The ability to maneuver with the traffic stream is only slightly restricted.	> 11 to 18	> 11 to 20	>750 to 1,000	>800 to 1,100	>850 to 1,200
C	Flow with speeds at or near free-flow speeds. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver.	> 18 to 26	> 20 to 28	>1,000 to 1250	>1,100 to 1,350	>1200 to 1,450
D	Speeds decline slightly with increasing flows. Freedom to maneuver with the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort.	> 26 to 35	> 28 to 35	>1,250 to 1550	>1,350 to 1,600	>1,450 to 1,650
E	Operation at capacity. There are virtually no usable gaps within the traffic stream, leaving little room to maneuver. Any disruption can be expected to produce a breakdown with queuing.	> 35 to 45	> 35	>1,550 to 1,900	>1,600 to 1,900	>1,650 to 1900
F	Represents a breakdown in flow.	> 45	Demand exceeds capacity	> 1900		

Source: Highway Capacity Manual (HCM) – Chapter 23: Basic Freeway Sections and Chapter 25: Ramps and Ramp Junctions Methodology, Transportation Research Board, 2000, Completion of Procedures for Analysis and Design of Traffic Weaving Sections, Jack E. Leisch & Associates, September 1983.

LOS is a qualitative description of traffic flow based on speed, travel time, delay, and freedom to maneuver. There are six levels, ranging from LOS A as the best operating conditions, to LOS F as the worst. LOS E represents "at-capacity" operation. When volumes exceed capacity, stop-and-go conditions result, and operations are designated as LOS F.

Within dense urban areas such as San Francisco, off-ramp operating conditions are largely controlled by the operations at the off-ramp terminus with the street network. For key off-ramps in the study area, the off-ramp queues during the red signal phase were compared to the storage capacity of the off-ramp. The storage capacity of the off-ramp was estimated by estimating the distance between the freeway diverge gore point[10], and the stop bar for the off-ramp approach to the street intersection. Vehicle queue lengths the off-ramp approaches to signalized intersections were estimated from intersection LOS calculations, by multiplying the 95th percentile vehicle queue of the constrained movement by 25 feet to account for average vehicle lengths and the space between queued vehicles.

Caltrans' policy is to maintain freeway mainline and ramp operations at the LOS C/D threshold based on the *Guide for the Preparation of Traffic Impact Studies* (Caltrans, December 2002). However, Caltrans acknowledges that this may not always be feasible and if an existing facility is operating at less than the appropriate target LOS, the existing service level should be maintained.

Freeway mainline and ramp volumes used in the traffic analysis are summarized and presented in Transportation Study Appendix E. Transportation Study Appendix G contains the level of service calculations. **Table 11** presents the level of service for the freeway mainline and weaving sections. All analysis segments experience LOS E or LOS F conditions during the commute periods – either in the AM or PM peak hours, with the exception of the segment of U.S. 101 southbound between the I-80 westbound merge and Cesar Chavez. The segment of U.S. 101 southbound between Third/Bayshore and Sierra Point experiences LOS E conditions during both the AM and PM peak hours.

[10] A gore point is the triangular area of land where freeways split or merge.

Table 11
Mainline and Weaving Segment LOS
Existing Conditions

Mainline Segment	Weekday AM (PM) LOS [1]	Weekday AM (PM) Density [2] (pc/mi/ln)	Sunday PM LOS	Sunday PM Density (pc/mi/ln)
U.S. 101				
NB - Cesar Chavez to Vermont	**E** (D)	**44.6** (26.8)	C	20.6
NB – Harney Way to Third/Bayshore	D **(E)**	33.8 **(42.3)**	C	22.0
NB – Sierra Point to Harney Way	D (**E**)	33.8 (**42.9**)	C	21.9
SB – I-80 Merge to Cesar Chavez	D (D)	33.4 (33.8)	D	28.8
SB – Third/Bayshore to Alana Way	**E (E)**	**43.0 (36.0)**	C	21.4
SB – Alana Way to Sierra Point	**E (E)**	**42.2 (36.8)**	C	21.2
I-280				
NB – Alemany Off to Alemany On	**E** (C)	**39.1** (23.9)	B	15.6
SB – Alemany On to Alemany Off	C **(F)**	23.9 (>**45**)	D	27.0
Weaving Segment [4]	**LOS**	**Service Volume[3] (pc/h)**	**LOS**	**Service Volume (pc/h)**
I-280				
NB – 25th Street to Mariposa Street	**E** (C)	**1,680** (1,350)	**A**	**--**
SB – Mariposa Street to 25th Street	B (**E**)	810 (**1,630**)	A	--

Notes:
1. Segments operating at LOS E or LOS F conditions highlighted in **bold**
2. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
3. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
4. Weaving segments with travel speeds greater than 50 mph are out of the realm of weaving analysis and thus are assumed to operate at LOS A conditions.
Source: Fehr and Peers.

3.3.3 Freeway Ramp Junction Analysis

A ramp junction analysis was conducted to determine the operating conditions for ramp volumes merging with the freeway mainline traffic flow. Freeway ramp analyses were conducted at 15 on-ramps. Freeway ramps were evaluated using the *Highway Capacity Manual 2000* methodology for ramp merge and diverge conditions. Service levels at the on- and off-ramps are determined based on density, as calculated using the freeway volumes and the ramp volumes at each study location. Similar to the freeway mainline, the operating characteristics of the ramps are described using the concept of LOS (see **Table 8**).

Table 12 presents the results of the freeway ramp LOS analysis for Existing conditions. During the weekday AM and PM peak hours, all of the ramps currently operate at LOS D or better, with the exception of the U.S. 101 southbound on- and off-ramps at Cesar Chavez, and northbound on-ramps from Cesar Chavez and Industrial. Transportation Study Appendix G contains the LOS calculation summary sheets.

Table 12
Ramp Junction LOS
Existing Condition

Ramp Location	Weekday AM and PM		Sunday PM	
	LOS [1]	Density [2] (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101				
NB on from Sierra Point Parkway	C (C)	27.0 (29.7)	B	19.3
NB on from Harney Way[2]	C (D)	20.2 (30.0)	B	19.5
NB on from Bayshore	D (D)	31.2 (28.6)	B	16.8
NB on from Alemany/Industrial	**E** (D)	**36.4** (30.2)	C	23.5
NB on from Bayshore/Cesar Chavez	**F** (B)	**>45** (19.6)	C	26.1
SB off to Bayshore/Cesar Chavez	**F (F)**	**>45 (>45)**	**E**	**37.5**
SB on from Cesar Chavez/Potrero	**F (F)**	**>45 (>45)**	D	30.6
SB on from Alemany/San Bruno	C (C)	24.1 (24.5)	B	17.3
SB on from Third/Bayshore	D (C)	30.0 (26.5)	B	16.5
SB on from Alana Way	D (C)	29.7 (24.2)	B	18.7
SB on from Sierra Point/Lagoon	C (C)	27.7 (26.5)	B	18.3
I-280				
NB off to Cesar Chavez	**F** (D)	**>45** (28.4)	B	19.2
NB on from Indiana/25th	D (C)	33.4 (27.4)	B	18.4
SB off to Pennsylvania/25th	C **(E)**	23.6 **(36.7)**	C	27.0
SB on from Pennsylvania/25th	C **(E)**	22.9 **(38.5)**	C	26.4

Notes:
1. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
2. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
Source: Fehr and Peers.

Table 13 presents the storage length of the study area off-ramps , as well as the queue length for weekday AM and PM peak hour, and Sunday PM peak hour (no football game) conditions. As indicated in the table, the queues at the off-ramp approach to the signalized intersections are accommodated within the ramp storage capacity.

Table 13 Freeway Diverge Queue Storage Ramp Junction LOS Existing Conditions				
Ramp Location	**Storage Length (feet)**	**Queue (feet)**		
		Weekday AM	**Weekday PM**	**Sunday PM**
U.S. 101				
Northbound off to Harney Way	2,800	<100	<100	<100
Northbound off to Bayshore/Cesar Chavez	750	400	375	175
Southbound off to San Bruno/Silliman	600	225	225	175
Southbound off to San Bruno/Mansell	650	<100	150	<100
Southbound off to Bayshore/Hester	1,700	225	325	300
Southbound off to Alana Way	1,000	<100	<100	<100
Southbound off to Sierra Point/Lagoon	1,250	<100	<100	<100
I-280				
Northbound off to Cesar Chavez	250	1,500	650	300
Southbound off to Pennsylvania	900	<100	<100	<100

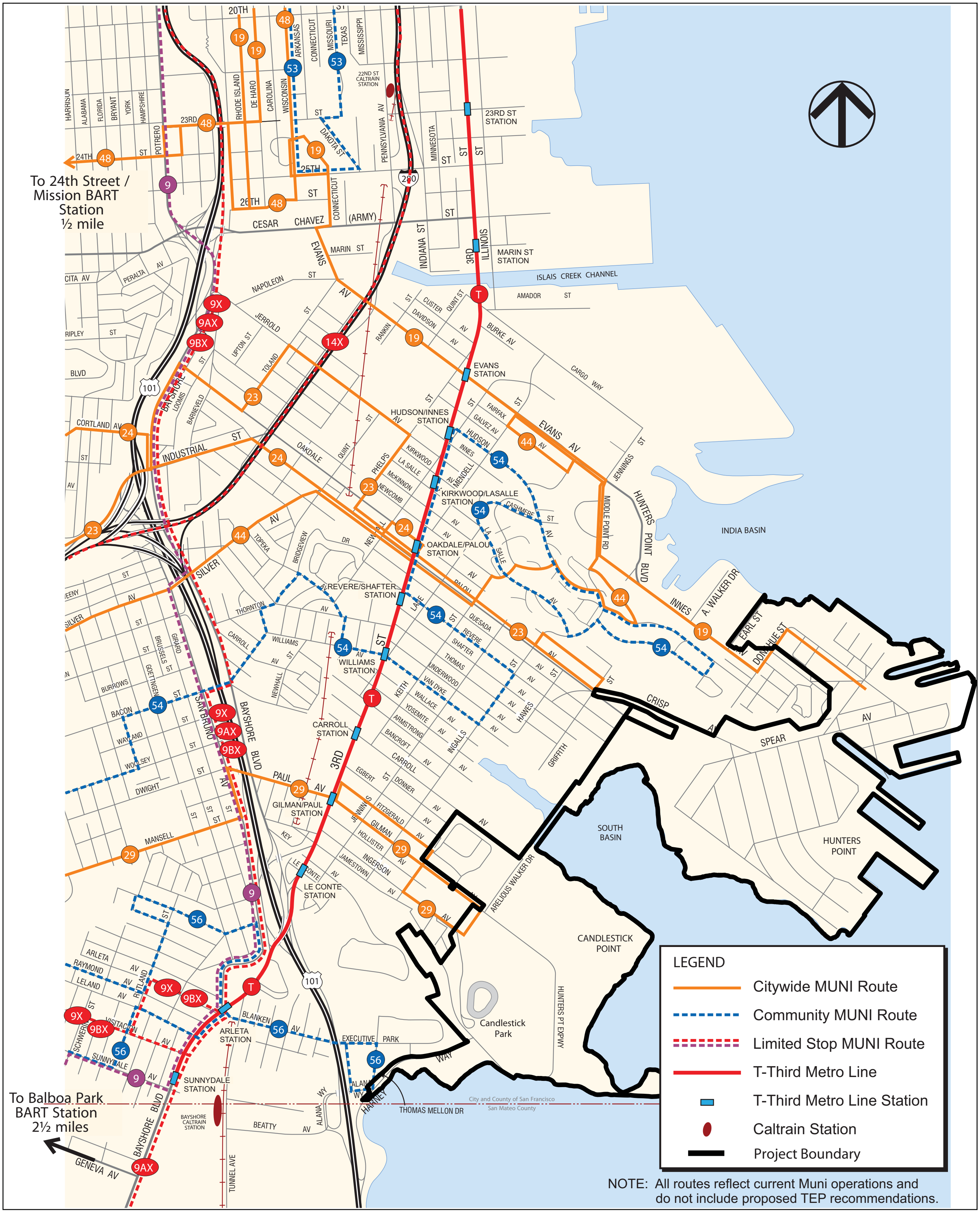
Source: Fehr & Peers.

3.4 TRANSIT NETWORK

This section describes the transit network within the transportation study area. The study area is relatively well-served by public transit, with routes providing crosstown, community, downtown and regional service. Local service within the study area is provided by the San Francisco Municipal Railway (Muni) bus and light rail lines, which can be used to access regional transit operators. Service to and from the East Bay is provided by BART, AC Transit and ferries; service to and from the North Bay is provided by Golden Gate Transit buses and ferries; and service to and from the Peninsula and South Bay is provided by Caltrain, SamTrans, and BART.

3.4.1 Local Muni Service

Figure 17 presents the Muni lines serving the study area. **Table 14** summarizes the frequency of service for the Muni bus and light rail lines serving the study area. Peak period service on most lines are at 8 to 10 minute headways between buses. The 54-Felton has headways between buses of 20 minutes, and the 56-Rutland has headways of 30 minutes. The 44-O-Shaughnessey runs most frequently, with 6 minute headways between buses.



SOURCE: Fehr & Peers; AECOM

C P - H P S   P H A S E   I I   D E V E L O P M E N T   P L A N   T R A N S P O R T A T I O N   S T U D Y

FIGURE 17: EXISTING TRANSIT NETWORK

Table 14
Muni Lines Serving Project Study Area

Route	Frequency of Service (average time in minutes)		
	AM Peak Period (7 to 9 AM)	Midday Period (9 AM to 4 PM)	PM Peak Period (4 to 6 PM)
9-San Bruno	7.5	10	7.5
9X-San Bruno Express	10	12	10
9AX-San Bruno "A" Express	10	--	10
9BX-San Bruno "B" Express	15	--	10
19-Polk	10	24	10
23-Monterey	15	20	14
24-Divisadero	8.5	10	10
28L-19th Avenue	10	--	10
29-Sunset	10	15	10
44-O-Shaughnessey	6	15	7.5
48-Quintara-24th Street	12	20	12
54-Felton	20	20	20
56-Rutland	30	30	30
T-Third	8.5	10	8.5

Source: SFMTA

9-San Bruno (MC)[11]: The 9-San Bruno line travels between the Ferry Building in the Financial District to Sunnydale and Santos in the Sunnydale District via San Bruno, Bayshore Boulevard, Potrero Avenue, 11th Street, and Market Street. This route provides service to the Visitacion Valley, Portola, Mission, SoMa, and Downtown districts. It serves all Market Street BART/Muni stations and all Muni Metro stations east of Van Ness Avenue.

19-Polk (MC): The 19-Polk line travels between Polk/Beach Streets in Fisherman's Wharf to the Hunters Point Naval Shipyard via Polk Street, Larkin/Hyde Streets, Seventh/Eighth Streets, Rhode Island/De Haro Streets, Evans Avenue, and Innes Avenue. This route provides service to the Hunters Point, Potrero Hill, SoMa, Civic Center, Tenderloin, Nob Hill, and Russian Hill districts. It also serves the Civic Center BART/Muni station.

23-Monterey (MC): The 23-Monterey line travels between Third & Palou Streets in the Bayview district and Great Highway & Sloat in the Parkside District via Palou, Phelps, Jerrold, Toland, Oakdale, Bayshore, Alemany, Crescent, Mission, Bosworth, Diamond, Monterey, Santa Clara, St. Francis Blvd., and Sloat. This route provides service to the Bernal Heights, Glen Park, Sunnyside, and St. Francis Wood districts and the San Francisco Zoo. It serves the Glen Park BART station.

24-Divisadero (TC): The 24-Divisadero travels between Third & Palou in the Bayview district and Jackson & Fillmore in Pacific Heights via Palou, Industrial, Bayshore, Cortland, Mission,

11 LRV = light rail vehicle, MC = motor coach, TC = trolley coach.

30th, Noe, 26th, Castro, Divisadero, and Jackson. This route provides service to the Bernal Heights, Noe Valley, Castro, and Western Addition districts.

29-Sunset (MC): The 29-Sunset travels between Gillman and Third Street in the Bayview district, and either California & 25th Street in the Richmond district or Letterman Boulevard in the Presidio via Gillman, Hawes, Fitzgerald, Paul, Bayshore, Mansell, Persia, Mission, Geneva, Plymouth, Grafton, Garfield, Junipero Serra, Holloway, 19^{th}, Winston, Lake Merced, Sunset, Lincoln Way, Crossover, 25th, Lincoln Blvd. Mason, Hallek, Lincoln Blvd., Montgomery, Moraga, Funston, Presido and Letterman. This route provides service to the Portola, Excelsior, Outer Mission, Ingleside, Parkside, Outer Sunset, Outer Richmond, and Seacliff districts. It serves the Balboa Park BART, City College of San Francisco, San Francisco State, Stonestown mall, and Golden Gate Park. This is the only bus providing daily direct service to Candlestick Point.

44-O'Shaughnessey (MC): The 44-O'Shaughnessey travels between Evans & Keith near India Basin and California & Sixth Street in the Inner Richmond via Evans, Middle Point, Young Cir, Keith, Palou, Silver, Alemany, Lyell, Bosworth, O'Shaughnessy, Woodside, Laguna Honda, 7th, Lawton, Ninth, MLK Jr. Drive, Eighth, Cabrillo, Sixth. It serves the Glen Park BART station, Golden Gate Park Main Concourse, and the Portola, Glen Park, Laguna Honda and Inner Sunset districts.

48-Quintara-24^{th} Street (MC): The 48-Quintara-24^{th} Street travels between 20^{th} Street & Third Streets in the Dogpatch/Central Waterfront districts and Great Highway and Quintara Street in the Sunset district via Third, 22^{nd}, Texas, 20^{th}, Wisconsin, 26^{th}, Rhode Island, 23^{rd}, 24^{th}, Douglass, Grandview, Portola, Ulloa, 14^{th}, Santiago, 17^{th}, and Quintara. The route provides service to the Potrero Hill, Mission, Noe Valley, Diamond Heights, Laguna Honda, West Portal, and Parkside districts. It serves the 24^{th} Street BART station and the 22^{nd} Street Caltrain station.

54-Felton (MC): The 54-Felton is a community route that travels between Newhall & Hudson in the Bayview district and the Daly City BART station in Daly City via Hudson, Northridge, Kiska, La Salle, Newhall, Palou, Revere, Ingalls, Van Dyke, Williams, Topeka, Thornton, Vesta, Phelps, Bacon, Holyoke, Woolsey, University, Felton, Moscow, Geneva, Louisburg, Grafton, Plymouth, Sagamore, Alemany, and St. Charles. It serves the Balboa Park and the Daly City BART stations.

56-Rutland (MC short): The 56-Rutland is a community route that travels between Thomas Mellon Dr. & Executive Park Blvd. and Visitacion Valley Middle School via Blanken, Bayshore, Wilde, Rutland, Raymond, and Visitacion Ave. This route serves a small corner of the South Bayshore/Visitacion Valley area, and also provides service to Executive Park.

T-Third (LRV): The T-Third is a light rail vehicle line that operates as a streetcar along the Bayshore/Third corridors, Fourth Street, King Street, and The Embarcadero before entering the Market Street subway at Folsom Street. The route is cross-listed with the K-Ingleside and forms a contiguous route through the Market Street subway, Twin Peaks tunnel, West Portal Ave., and Ocean Avenue to the Balboa Park BART station. The route serves all the Muni and BART stations along Market Street in Downtown in addition to the Fourth Street Caltrain terminal and operates in close proximity to the Bayshore Caltrain Station. The route serves the Visitacion Valley, Bayview, Dogpatch, Mission Bay, SoMa, and Downtown districts.

The T-Third is planned to run along a new alignment north of the Fourth & King station by 2016. The new alignment will take the line as a streetcar for three more blocks on Fourth Street before entering a new subway terminating in Chinatown. There will be three new subway stops: one south of Market Street on Fourth Street, one near Market Street on Stockton Street, and one in Chinatown along Stockton Street. The planned operating scenario for the T-Third is to continue to operate single-car trains between Bayview and Chinatown, at the same frequencies as today (approximately every 8 minutes), and a new two-car short-line would be added to operate between Chinatown and Mariposa Street at approximately 8 minute headways.

Bayshore Intermodal Station Access Study: The Transportation Authority is conducting the Bayshore Intermodal Station Access Study to develop multi-jurisdictional consensus around a vision and conceptual design for new intermodal transit connections and passenger access to the Bayshore Caltrain Station. Multiple planning processes are proceeding to develop projects that would connect new transit services to the Bayshore Station, including an extension of the T-Third Light Rail line from its current nearby terminus, a new Bus Rapid Transit line from Hunters Point Shipyard, and a new local street connection across Bayshore Boulevard, the Caltrain tracks, and U.S. 101 as a Geneva Avenue extension. The Authority is partnering with stakeholder agencies to develop the proposed station connections in a seamless fashion and to promote strong multimodal access to the station. The end result will be a set of conceptual designs for the station and the new connections to serve as a vision that the individual projects will implement as they progress through their planning and preliminary engineering phases.

3.4.2 Regional Providers

BART operates regional rail transit service in the metropolitan Bay Area connecting San Francisco with the East Bay and northern San Mateo County. BART provides service along Market and Mission Streets and near the western I-280 corridor in San Francisco. BART does not provide direct service into the BWP site. Transit connections can be made to the following BART stations from the BWP area: Balboa Park station via the 29-Sunset from Candlestick Point, Glen Park Station via the 23-Monterey and the 44-O'Shaughnessy, and the Embarcadero station via the T-Third light rail route. BART operates at service frequencies of 3 minutes in the peak periods for intra-San Francisco travel.

Caltrain provides rail passenger service on the Peninsula between Gilroy and San Francisco. The Peninsula Corridor Joint Powers Board (JPB), a joint powers agency consisting of San Francisco, San Mateo, and Santa Clara Counties, operates the service. Caltrain currently operates 86 trains each weekday, with a combination of baby bullet, express, and local services. Headways during the peak periods are approximately ten to thirty minutes. The San Francisco Caltrain terminal is located on Fourth Street between King and Townsend Streets to the north of the study area.

The closest active Caltrain station to the study area is the Bayshore station in Brisbane at the San Mateo/San Francisco County border. The station is located off of Tunnel Avenue, just southeast of Bayshore Boulevard. Not all trains stop at the Bayshore Station. During the peak commute periods only one train per hour in each direction stops at the Bayshore Station. There are not direct connections with other transit services. However, Muni and SamTrans can be accessed by walking two to three blocks to bus stops along Bayshore Boulevard.

SamTrans, operated by the San Mateo County Transit District, provides bus service between San Mateo County and San Francisco. SamTrans operates 12 diesel bus lines that serve San Francisco, including nine routes into the downtown area. However, only two routes – the 292 and 397 - serve the Bayview district along Bayshore Boulevard. Only the 292 operates during peak hours. Headways during the peak commuting periods are approximately 15 minutes per line. There are no direct SamTrans services to Candlestick Point, except during football game days. Route 7B operates along Bayshore and stops near the Bayshore Caltrain station on game days.

AC Transit is the primary bus operator for the East Bay, including Alameda and western Contra Costa Counties. AC Transit operates 37 routes between the East Bay and San Francisco, all of which terminate at the Transbay Transit Terminal, located on Mission Street, between First and Fremont Streets. Most transbay service is peak-hour and peak-direction (to San Francisco during the a.m. peak period and from San Francisco during the p.m. peak period), with headways of 15 to 30 minutes per route.

To access Candlestick Point, AC Transit riders first must transfer at the Transbay Terminal to the T-Third line, and then to the 29-Sunset at Paul Avenue.

Golden Gate Transit (bus service) operated by the Golden Gate Bridge, Highway, and Transportation District (GGBHTD), provides bus service between the North Bay (Marin and Sonoma Counties) and San Francisco. Golden Gate Transit operates 18 commute bus routes and two basic routes with service between cities in the North Bay and San Francisco. Most routes serve either the Civic Center (via Van Ness Avenue and Mission Streets) or the Financial District (via Battery and Sansome Streets). Basic bus routes operate at 15 to 90 minute headways, depending on the time and day of the week. Commute and ferry feeder bus routes operate at more frequent intervals in the mornings and evenings. Golden Gate Transit does not provide local service within San Francisco Golden Gate Transit can be accessed from the study area via the T-Third line, with a transfer near the Transbay Terminal.

Golden Gate Transit (ferry service): The GGBHTD also provides ferry service between the North Bay and San Francisco. During the a.m. and p.m. peak periods, ferries operate between Larkspur and San Francisco and between Sausalito and San Francisco. The San Francisco terminal is located at the Ferry Building, on the Embarcadero at Market Street. From the study area, access to the Ferry Building would generally require travel along the T-Third LRT line to the Embarcadero Station.

3.4.3 Transit Ridership and Capacity Utilization

This section presents the ridership and capacity utilization for Muni and regional transit providers for the AM and PM peak hours. Transportation Study Appendix H includes the ridership and capacity assumptions, and capacity utilization calculations.

Muni

Table 15 on the following page presents Muni's ridership and capacity utilization at the maximum load point for the local lines serving the study area for the weekday AM and PM peak hours. For each line, the number peak hour riders inbound and outbound from downtown San Francisco were obtained at the maximum load point (i.e., the point of greatest demand) from Muni monitoring data. The service capacity of each line was estimated by multiplying the passenger capacity standard for transit vehicles by the number of actual bus trips that occurred at the time that the ridership data was collected. The capacity includes seated passengers and an appreciable number of standing passengers per vehicle (the number of standing passengers is between 30 and 80 percent of the seated passengers depending upon the specific transit vehicle configuration). The maximum loads, including both seated and standing passengers, vary by vehicle type and are 45 passengers for a 30-foot bus, 63 passengers for a 40-foot bus, 94 passengers for a 60-foot bus, and 119 passengers for a light rail vehicle. The comparison of the ridership demand to the capacity provided is expressed as a percent utilization of capacity

As indicated in **Table 15**, the maximum load point of two of the ten bus and rail lines occur within the study area. For the 54-Felton bus line, the AM and PM peak hour maximum load points in both the inbound and outbound directions occur at the stops at the intersection of San Bruno Avenue and Bacon Street. For the T-Third light rail line, the maximum load point in the outbound direction during the AM peak hour is at the stop at Third Street and Evans Avenue.

Muni has established a capacity utilization standard of 85 percent. As shown in **Table 15,** the weekday AM and PM capacity utilization for most lines serving the study area do not exceed Muni's standards. However, during the AM peak hour in the inbound direction, the 44-O'Shaughnessey has capacity utilization at the maximum load point exceeding the 85 percent standard, indicating noticeably crowded conditions. Additionally, the 29-Sunset and 48-

Quintara-24th Street are operating at 84 percent of their capacity, nearly exceeding Muni's standard.

Table 15
Muni Ridership and Capacity Utilization at Maximum Load Points
Existing Conditions

Route	Ridership	Capacity Utilization [1]	Destination	Maximum Load Point
AM PEAK HOUR				
Inbound [2]				
9-San Bruno	415	55%	Downtown	Potrero & 23rd
19-Polk	186	49%	Fisherman's Wharf	DeHaro & 20th
23-Monterey	111	44%	Bayview	Diamond & Bosworth
24-Divisadero	260	68%	Pacific Heights	Castro St & 19th St
28L-19th Avenue Limited	110	29%	The Richmond	19th Ave & Quintara St
29-Sunset	321	84%	The Presidio	Balboa Park BART
44-O-Shaughnessey	442	**87%**	The Richmond	Silver Ave & Mission St
48-Quintara-24th St	268	84%	Potrero Hill	24th St & Harrison St
54-Felton	111	58%	Hunters Point	Bacon St & San Bruno Ave
56-Rutland	13	14%	Visitacion Valley	Wilde St & Brussels St
T-Third	336	35%	Sunnydale	4th St & King St
Outbound [2]				
9-San Bruno	218	29%	Visitacion Valley	Potrero Ave & 25th St
19-Polk	201	53%	Hunters Point	Eighth St & Market St
23-Monterey	140	55%	The Zoo	Diamond St & Bosworth St
24-Divisadero	142	37%	Bayview	Castro St & Duboce Ave
28L-19th Avenue Limited	104	27%	Daly City BART	19th Ave & Quintara St
29-Sunset	216	57%	Bayview	Ocean Ave & Geneva Ave
44-O'Shaughnessey	167	33%	Hunters Point	Silver Ave & Gambier St
48-Quintara-24th St	155	49%	Ocean Beach	24th St & Folsom St
54-Felton	100	52%	Daly City BART	Bacon St & San Bruno Ave
56-Rutland	5	6%	Visitacion Valley	Hahn St & Visitacion St
T-Third	512	54%	Castro	Third St & Evans Ave
PM PEAK HOUR				
Inbound				
9-San Bruno	429	57%	Downtown	Potrero Ave & 20th St
19-Polk	223	59%	Fisherman's Wharf	Seventh St & Howard St
23-Monterey	100	39%	Bayview	Diamond & Bosworth Ave
24-Divisadero	144	38%	Pacific Heights	Castro St & 17th St
28L-19th Avenue Limited	150	39%	The Richmond	19th Ave & Quintara St
29-Sunset	124	33%	The Presidio	Persia Ave & Mission St
44-O-Shaughnessey	187	37%	The Richmond	Silver Ave & Merrill St
48-Quintara-24th St	180	57%	Potrero Hill	24th St & Harrison St
54-Felton	59	31%	Hunters Point	Bacon St & San Bruno Ave
56-Rutland	12	13%	Visitacion Valley	San Bruno Ave & Arleta St
T-Third	333	35%	Sunnydale	4th St & King St

Table 15 (continued)
Muni Ridership and Capacity Utilization at Maximum Load Points
Existing Conditions

Outbound				
9-San Bruno	274	36%	Visitacion Valley	Potrero Ave & 22nd St
19-Polk	207	54%	Hunters Point	Eighth St & Market St
23-Monterey	98	39%	The Zoo	Diamond St & Bosworth St
24-Divisadero	215	56%	Bayview	Castro St & 19th St
28L-19th Avenue Limited	105	28%	Daly City BART	19th Ave & Quintara St
29-Sunset	160	42%	Bayview	19th Ave & Holloway Ave
44-O'Shaughnessey	334	66%	Hunters Point	Bosworth St & Diamond St
48-Quintara-24th St	160	50%	Ocean Beach	24th St & Folsom St
54-Felton	59	31%	Daly City BART	San Bruno Ave & Bacon St
56-Rutland	11	12%	Visitacion Valley	Hahn St & Visitacion St
T-Third	369	39%	Castro	Fourth St & King St

Notes:
1. Lines operating above Muni standard capacity utilization are highlighted in **bold.**
2. Route direction follows Muni convention; convention is generally inbound toward or clockwise around downtown with the following exceptions: 23-Monterey, 54-Felton, and T-Third lines inbound towards Bayview.
Source: SFMTA 2007 Trip Activity Reports, Fehr & Peers.

In addition to evaluating Muni operations at the maximum load point for individual routes, and consistent with standard practice in San Francisco, four screenlines for routes serving the downtown financial district were evaluated. This evaluation examined the overall utilization of Muni transit capacity into and out of downtown San Francisco from the northeast, northwest, southeast, and southwest. **Figure 18** presents the location of the downtown screenlines, while existing ridership and capacity utilization at each screenline location is shown in **Table 16**. Overall, each screenline currently operates within Muni's 85 percent utilization standard, with the southwest screenline the most crowded. The southwest screenline includes all subway lines except for the J-Church light rail, the F-Market historic streetcar, and the 6-Parnassus, 7-Haight, 71-Haight-Noriega, and 71L-Haight-Noriega Limited bus lines.

SOURCE: SF Transportation Impact Analysis Guildlines

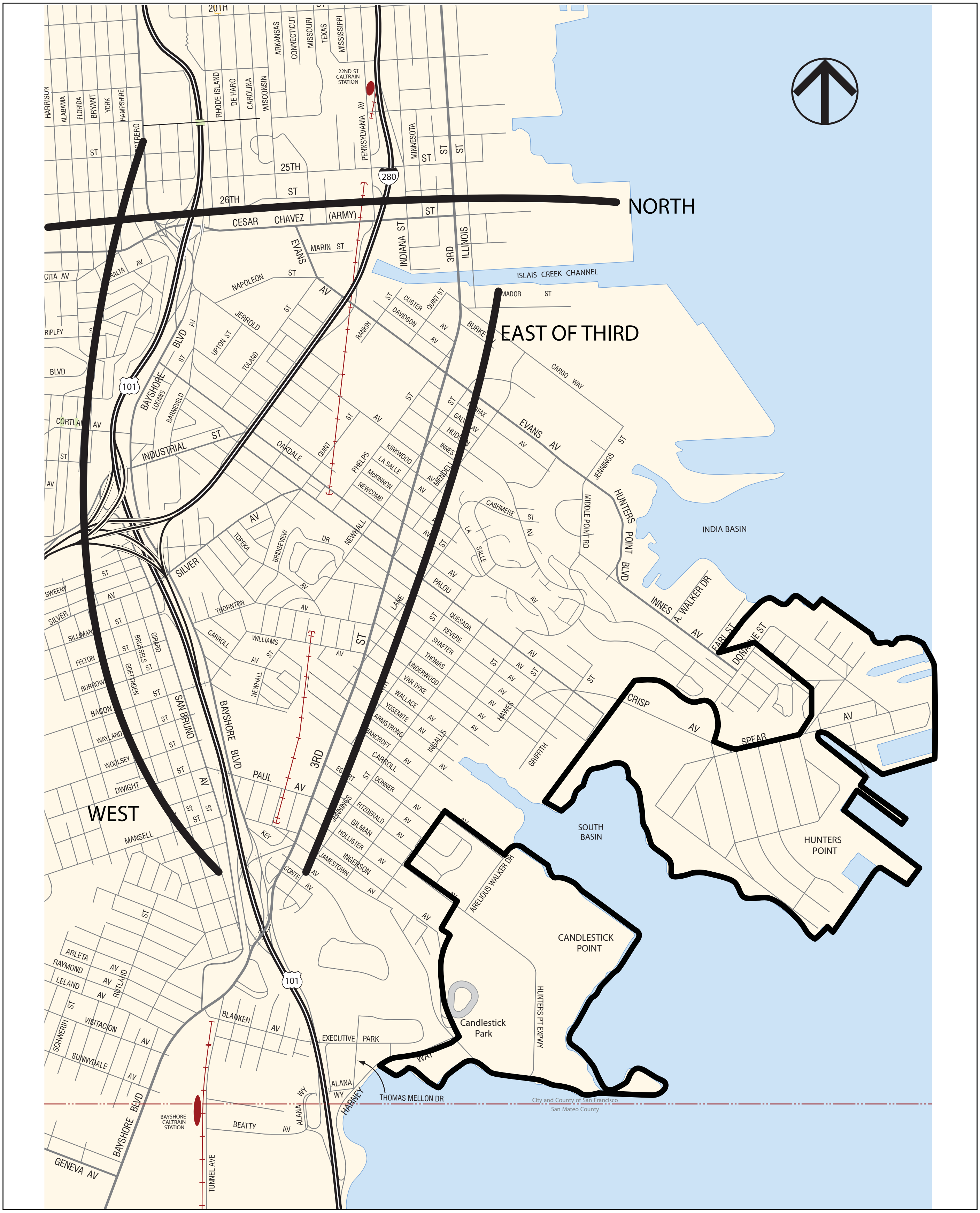
FIGURE 18: MUNI DOWNTOWN SCREENLINES

Table 16
Muni Ridership and Capacity Utilization at Downtown Screenlines
Existing Conditions – Weekday AM and PM Peak Hours

Screenline/Peak Hour	Ridership	Capacity Utilization
AM Peak Hour		
Northeast	1,882	50%
Northwest	7,434	65%
Southeast	4,248	67%
Southwest	6,627	76%
Total All Screenlines	20,191	67%
PM Peak Hour		
Northeast	1,886	52%
Northwest	6,621	65%
Southeast	4,668	66%
Southwest	7,434	77%
Total All Screenlines	20,609	68%

Source: SFMTA, Planning Department, AECOM, 2009.

Two cordons at the perimeter of the study area were also examined to analyze potential impacts of projects on Muni service: the north cordon at Cesar Chavez Street, and the west cordon located west of U.S. 101. In addition, a third cordon within the study area, located east of Third Street was reviewed to assess the degree to which Project transit demand between the Project site and the T-Third Street light rail service would affect localized transit capacity. **Figure 19** presents the cordon locations. **Table 17** presents the weekday AM and PM peak hour inbound and outbound ridership and capacity utilization for the north and west cordons, as well as for each line within the cordons. **Table 18** presents the weekday AM and PM peak hour inbound and outbound ridership and capacity utilization for the internal cordon located east of Third Street.



SOURCE: Fehr & Peers

FIGURE 19: STUDY AREA MUNI ANALYSIS CORDONS

Table 17
Muni Ridership and Capacity Utilization at Study Area Cordons
Existing Conditions

Cordon/Route	Ridership Inbound/Outbound	Capacity Utilization Inbound/Outbound
AM PEAK HOUR		
North (at Cesar Chavez)		
T-Third	329 / 512	35% / 54%
9-San Bruno	415 / 218	55% / 29%
19-Polk	115 / 24	30% / 6%
Subtotal	*859 / 754*	*41% / 36%*
West (West of U.S. 101)		
23-Monterey	111 / 140	44% / 55%
24-Divisadero	250 / 86	66% / 23%
29-Sunset	177 / 63	46% / 17%
44-O'Shaughnessey	442 / 167	87% / 33%
48-Quintara-24th St	268 / 155	84% / 49%
54-Felton	100 / 111	52% / 58%
Subtotal	*1,348 / 722*	*68% / 36%*
PM PEAK HOUR		
North (at Cesar Chavez)		
T-Third	330 / 278	35% / 29%
9-San Bruno	429 / 274	57% / 36%
19-Polk	87 / 74	23% / 19%
Subtotal	*846 / 626*	*41% / 30%*
West (West of U.S. 101)		
23-Monterey	100 / 98	39% / 39%
24-Divisadero	114 / 147	30% / 39%
29-Sunset	71 / 21	19% / 6%
44-O'Shaughnessey	187 / 334	37% / 66%
48-Quintara-24th St	180 / 160	57% / 50%
54-Felton	59 / 59	31% / 31%
Subtotal	711 / 819	36% / 42%

Source: SFMTA 2007 Trip Activity Reports, Fehr & Peers.

Table 18 Muni Ridership and Capacity Utilization at East of Third Street Cordon Existing Conditions		
Cordon/Route	**Ridership Inbound/Outbound**	**Capacity Utilization Inbound/Outbound**
AM PEAK HOUR		
19-Polk	115 / 24	30% / 6%
23-Monterey	38 / 56	15% / 22%
29-Sunset	177 / 63	46% / 17%
44-O'Shaughnessey	256 / 65	50% / 13%
54-Felton	100 / 111	52% / 58%
Subtotal	*686 / 319*	*40% / 19%*
PM PEAK HOUR		
19-Polk	87 / 74	23% / 19%
23-Monterey	58 / 15	23% / 6%
29-Sunset	71 / 21	19% / 6%
44-O'Shaughnessey	114 / 84	22% / 17%
54-Felton	59 / 59	31% / 31%
Subtotal	*389 / 253*	*23% / 15%*

Source: SFMTA 2007 Trip Activity Reports, Fehr & Peers.

Regional Providers

As a means to determine the amount of available space for each regional transit provider, capacity utilization is also used. For all regional transit operators, the capacity is based on the number of seated passengers per vehicle. All of the regional transit operators except BART have a one-hour load factor standard of 100 percent, which would indicate that all seats are full. BART has a peak period load factor standard of 115 percent, which indicates that all seats are full, and an additional 15 percent of the seating capacity are standees (i.e., 1.15 passengers per seat).

Regional transit service was also evaluated at the screenline level. **Figure 20** presents the location of the regional transit screenlines. Screenlines were evaluated for the locations where different regional transit service enters San Francisco, including the North Bay (Golden Gate Transit and Ferries), East Bay (BART, AC Transit, Ferries), and South Bay (BART, Caltrain, SamTrans). The capacity utilization for each of the three regional screenlines is presented in **Table 19**. As shown, regional transit service between San Francisco and the East Bay is currently over its seated capacity; however, since BART can accommodate a substantial number of standees, this excess transit demand is accommodated during peak hours.

SOURCE: SF Transportation Impact Analysis Guildlines

FIGURE 20: REGIONAL TRANSIT SCREENLINES

Table 19
Transit Ridership and Capacity Utilization at Regional Screenlines
Existing Conditions – Weekday AM and PM Peak Hours

Screenline/Peak Hour	Ridership	Capacity Utilization
AM Peak Hour		
East Bay	**20,401**	**108%**
North Bay	2,459	56%
South Bay	13,999	94%
Total All Screenlines	36,859	96%
PM Peak Hour		
East Bay	**20,204**	**102%**
North Bay	2,303	59%
South Bay	12,106	83%
Total All Screenlines	34,613	90%

Source: SFMTA, AECOM, 2009.

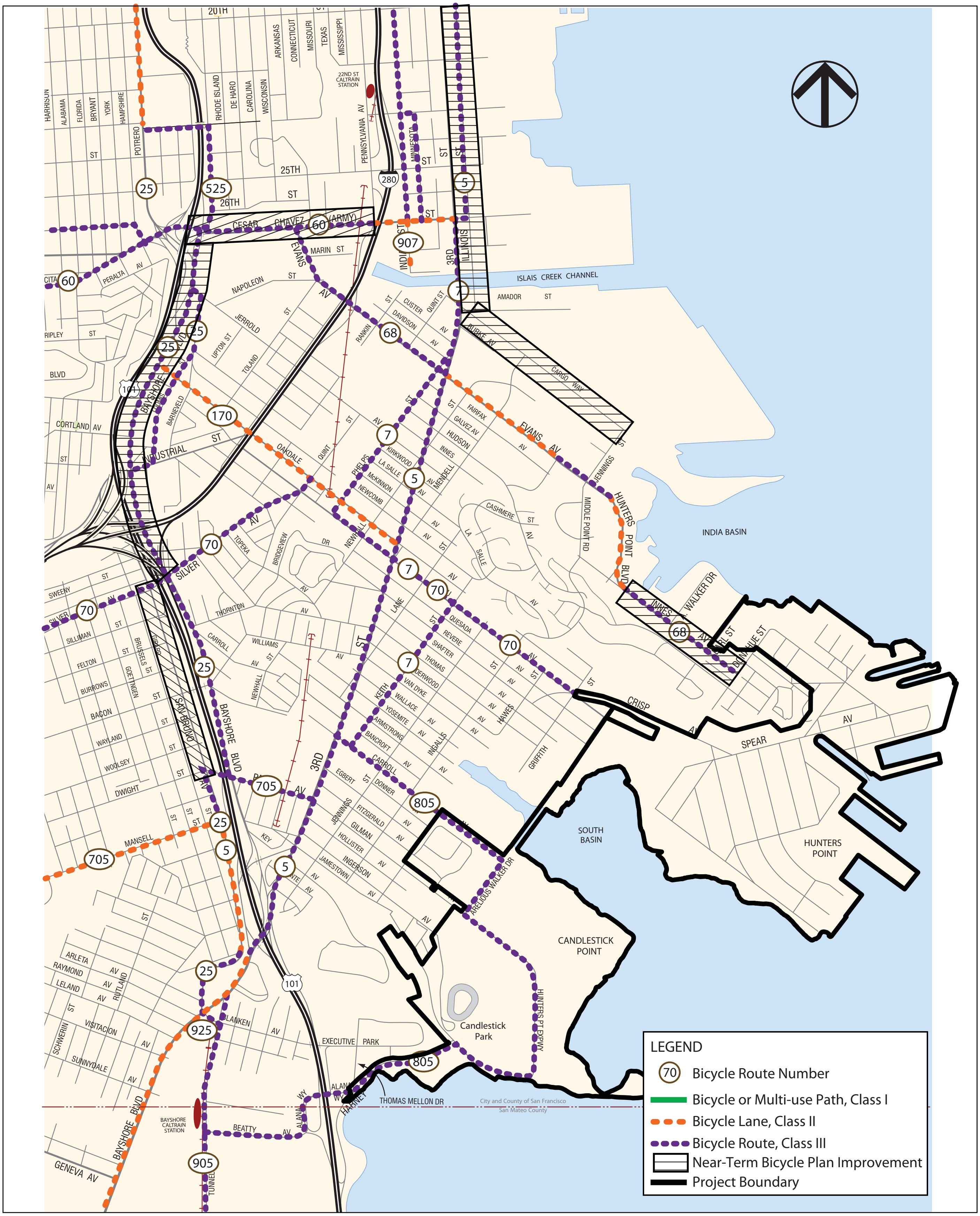
3.5 BICYCLE CONDITIONS

Several existing bicycle facilities are located in the study area. These facilities include municipal routes that are part of the San Francisco Bicycle Network, and regional routes, part of the San Francisco Bay Trail system. Bikeways are typically classified as Class I, Class II, or Class III facilities.[12] Class I bikeways are bike paths with exclusive right-of-way for use by bicyclists or pedestrians. Class II bikeways are bike lanes striped with the paved areas of roadways and established for the preferential use of bicycles, while Class III bikeways are signed bike routes that allow bicycles to share travel lanes with vehicles**.** **Figure 21** presents the bicycle routes within the study area, as identified in the *Official San Francisco Bike Route System*, while **Figure 22** presents the existing Bay Trail facilities.

The *San Francisco Bicycle Plan Draft EIR* was published in November 2008. In June 2009, the Final EIR was approved by the Planning Commission and the Bicycle Plan was approved by the SFMTA Board. In August 2009, the Board of Supervisors affirmed certification the *San Francisco Bicycle Plan Final EIR.* Near-term improvement projects on the existing bicycle network in the study area are noted below, and both near-term and long-term improvements are described in additional detail in Chapter 4 in section 4.3.3.

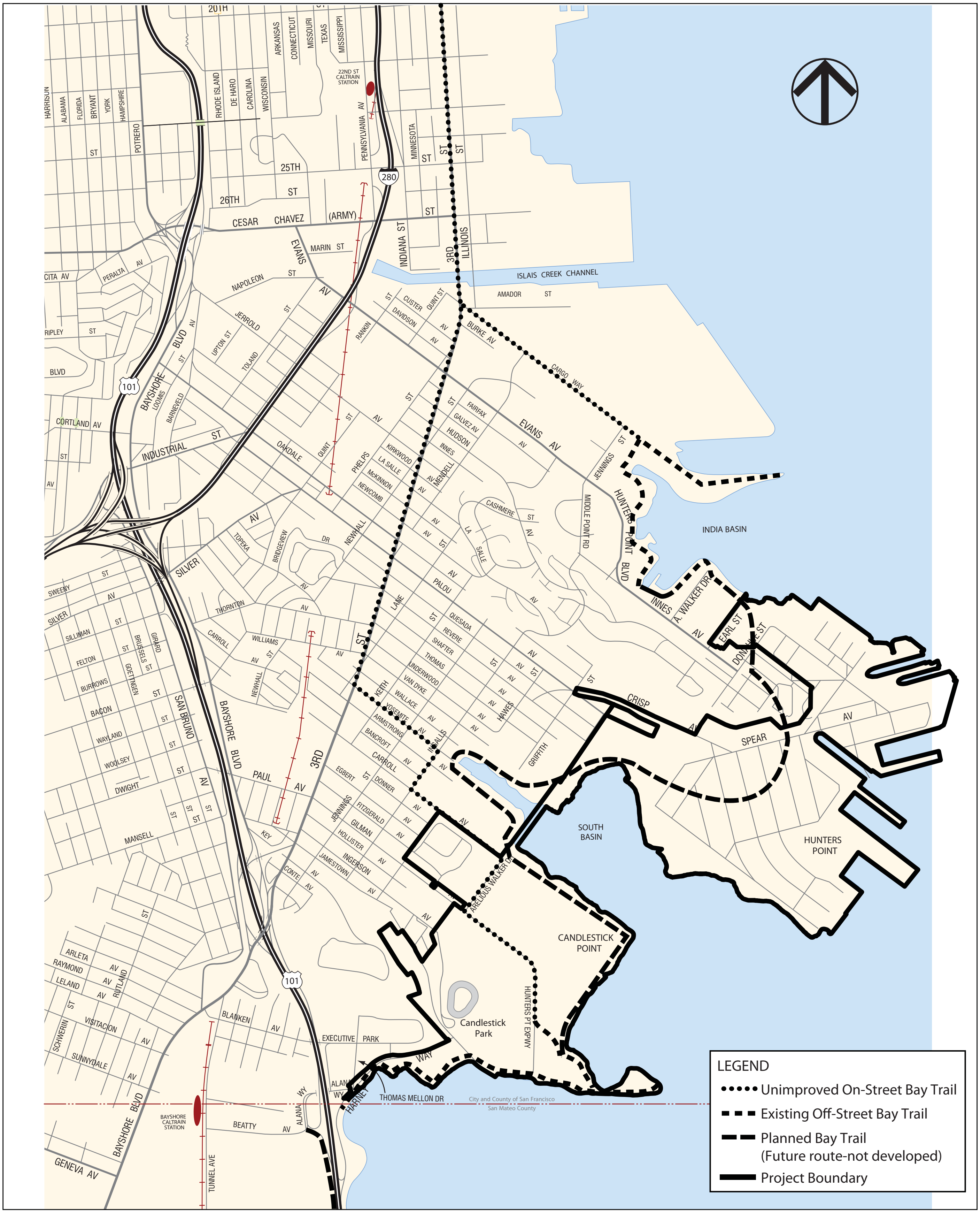
Route #5*:* Route #5 is the eastern-most north-south bicycle route. This route runs between Visitacion Valley and North Beach, primarily as a Class III facility along Bayshore Boulevard, Third Street, and Illinois Street, and as a Class II facility along The Embarcadero and San Bruno Avenue. Since southbound Third Street does not cross over U.S. 101 to connect with Bayshore Boulevard, southbound Bicycle Route #5 is routed onto Paul Avenue (via Connector Route #705) and San Bruno Avenue (also Bicycle Route #25).

12 Bicycle facilities are defined by the State of California in the California Streets and Highway Code Section, 890.4.



SOURCE: LCW Consulting, SFMTA, San Francisco Bicycle Plan

FIGURE 21: EXISTING SAN FRANCISCO BICYCLE ROUTE NETWORK



SOURCE: LCW Consulting

FIGURE 22: SAN FRANCISCO BAY TRAIL

This split in Bicycle Route #5 is required, since the U.S. 101 undercrossing that provides the connection between southbound Third Street and southbound Bayshore Boulevard would require bicyclists to weave across high-speed traffic. San Francisco Bicycle Plan Project 4-3: Illinois Street Bicycle Lanes, will involve the installation of Class II bicycle lanes in both directions on Illinois Street between 16th Street and Cargo Way. See section 4.3.3.

Route #7: Route #7 is a Class III bike route that runs between Mariposa Street and Carroll Avenue, via Indiana Street, Third Street, Phelps Street, Palou Avenue, and Keith Street. Route #7's southern terminus is at Keith Street and Carroll Avenue at the Bayview Playground and Martin Luther King Pool. It is a Class III facility, however, wider travel lanes that allow bicyclists to ride outside of the path of vehicle travel are provided on sections of Indiana and Phelps Streets, and on Keith Street.

Route #25: Route #25 runs between the southeastern part of San Francisco and the Marina District. Route #25 runs along San Bruno Avenue, Bayshore Boulevard, and Oakdale Avenue in the Bayview Hunters Point area. Within the study area, Route #25 is a Class III facility. North of the study area, Route #25 runs as both a Class II facility (e.g., along Potrero Avenue, Harrison Street, and 11th Street), and as a Class III facility (e.g., 10th Street, Polk Street). San Francisco Bicycle Plan Project 5-4: Bayshore Boulevard Bicycle Lanes, will involve the installation of Class II bicycle lanes in both directions of travel on Bayshore Boulevard between Cesar Chavez Street and Silver Avenue. See section 4.3.3.

Route #60: Route #60 runs between the Great Highway/Vicente and Cesar Chavez Street/Illinois Street. In the study area, it is a Class III facility along Cesar Chavez Street between Bayshore Boulevard and Mississippi Street, and a Class II facility between Mississippi and Illinois Streets. San Francisco Bicycle Plan Project 5-5: Cesar Chavez Bicycle Lanes, will involve the installation of Class II bicycle lanes in both directions on Cesar Chavez Street between Kansas Street (near U.S. 101) and Mississippi Street (near I-280). See section 4.3.3.

Route #68: Route #68 runs from the Innes north gate to Hunters Point Shipyard along Innes Avenue, Hunters Point Boulevard and Evans Avenue to Cesar Chavez. This route has dedicated bike lanes (Class II facility) on both sides of Evans Avenue, and Hunters Point Boulevard between Innes Avenue and Third Street. San Francisco Bicycle Plan Project 4-4: Innes Avenue Bicycle Lanes, will involve the installation of Class II or III bicycle facilities in both directions of Innes Avenue between Donahue Street and Hunters Point Boulevard. See section 4.3.3.

East-West Route #70 runs along Palou Avenue, Silver Avenue, and Monterey Boulevard between the Bayview Hunters Point area and West Portal as a Class III facility. The eastern terminus of this route is currently the Crisp south gate to Hunters Point Shipyard at Griffith Street and Palou Avenue.

Route #170: Connector Route #170 runs along Oakdale Avenue between Third Street and Bayshore Boulevard. Between Third Street and Bayshore Boulevard, this route has Class II bicycle lanes on both sides of the street.

Route #805: Connector Route #805 is a Class III facility that provides a connection between Beatty Avenue and Tunnel Avenue (near the Bayshore Caltrain Station) in Brisbane and Third Street and Carroll Avenue in the Bayview Hunters Point area. This route passes around Candlestick Park stadium and the Candlestick Point State Recreation Area via Harney Way, Hunters Point Expressway, Gilman Avenue, Arelious Walker Drive, and Carroll Avenue.

Route #905: Route #905 is a short Class III route that runs along Tunnel Avenue south, east of Bayshore Boulevard.

Route #907: Route #907 is a short Class II route that runs along Indiana Street between César Chávez Street and the embankment at Islais Creek, where it dead-ends.

Route #925: Route #925 is a short Class III route that runs along Blanken Avenue between Tunnel Avenue and Bayshore Boulevard, connecting Route #5 and Route #905.

The San Francisco Bay Trail is designed to create recreational pathway links to the various commercial, industrial and residential neighborhoods that surround the San Francisco Bay. In addition, the trail connects points of historic, natural and cultural interest; recreational areas such as beaches, marinas, fishing piers, boat launches, and over 130 parks and wildlife preserves totaling 57,000 acres of open space. At various locations, the Bay Trail consists of paved multi-use paths, dirt trails, bike lanes, sidewalks or city streets signed as bike routes. Within the study area, the Bay Trail has two discontinuous segments of existing, off-street pathways, one in the area of Candlestick Point and Harney Way, and another segment which partially surrounds India Basin. The Bay Trail currently bridges the gap between Islais Creek and Candlestick Point with an inland route that shares portions of Gilman Avenue, Arelious Walker Drive, Carroll Avenue, Ingalls Street, Yosemite Avenue and Third Street.

An improved trail exists in the southern part of the Candlestick Point State Recreation Area where public access improvements have been made, but the northern section is unimproved. The trail starts northeast of the U.S. 101 northbound Harney Way ramps. Parking is available off of Harney Way, west of Jamestown Avenue (approximately 30 parking spaces are currently provided), and parking, restrooms, and boat ramp facilities are provided off of Hunters Point Expressway near Gilman Avenue.

The Project includes development of the Bay Trail within the Project site along the shoreline through Candlestick Point and Hunters Point Shipyard. The Bay Trail is also planned to be extended south to Sierra Point on the west side of U.S. 101, potentially as part of the proposed development at Brisbane Baylands.

The majority of the study area is flat, with limited changes in grades, facilitating bicycling within and through the area. East of Third Street, there are active and inactive rail tracks within the roadways that could impede bicycle travel. Bicycle volumes were collected at four locations with the study area during the weekday AM (7 to 9 AM), weekday PM (4 to 6 PM) and Saturday midday (12 to 2 PM) periods in September 2007. All four locations are along the bicycle route network, and bicycle lanes are provided on Evans Avenue and Oakdale Avenue. **Table 20** summarizes the data collection effort for the peak hour of bicycle activity. As indicated in **Table 20**, there are more bicyclists on study area streets on weekdays, than on weekends. Third Street and Oakdale Avenue had the greatest number of bicyclists.

Table 20
Bicycle Volumes within Study Area – Existing Conditions

Count Location	Weekday AM [1]	Weekday PM [2]	Saturday Midday [3]
Third St – between Williams & Palou	21	21	3
Evans Ave – between Mendell & Third	7	8	3
Oakdale Ave – between Phelps & Third	27	14	2
Hunters Point Expressway – between Jamestown & Gilman	1	4	1

Notes:
1. Hourly volume between 8 and 9 AM
2. Hourly volume between 4 and 5 PM
3. Hourly volume between 12 and 1 PM
Source: LCW Consulting, September 2007 counts.

3.6 PEDESTRIAN CONDITIONS

Pedestrian facilities vary within the study area between the areas on the east side of Third Street and the industrial land uses surrounding the Caltrain rail corridor on the west side of Third Street. On the west side of Third Street, many of the commercial facilities surrounding the railroad mainline have partial or no sidewalks. Several of the streets in this area have active and inactive railroad tracks and many of the former industrial and storage buildings in the area retain large raised freight loading/unloading platforms abutting the street.

On Third Street and on the residential streets immediately surrounding Third Street, the sidewalk network is adequate and relatively complete. In the light manufacturing areas surrounding Yosemite Slough the sidewalk network is less complete and frequently obstructed by illegally parked vehicles and or loading vehicles. The extent, condition and usability of the sidewalks generally decrease closer to Yosemite Slough (within the Project area).

The Candlestick Point State Recreation Area has a network of existing multi-use trails that extend from the County Line to a point just southeast of the intersection of Gilman Avenue and Donahue Street (an as yet undeveloped 'paper' street). Most of these paths are within the park and do not intersect the local roadways, although some connect to, or are part of, the Bay Trail.

There are several dedicated pedestrian overcrossings in the vicinity of Candlestick Park. These structures are designed to reduce pedestrian-vehicle conflicts associated with Candlestick Park events and adjacent schools. These include the overcrossing of Jamestown Avenue just north of Harney Way, overcrossing of Harney Way, just west of Jamestown Avenue, and overcrossing of Gilman Avenue at Griffith Street (Adjacent to the Bret Harte School).

Pedestrian activity in the immediate vicinity of the Project site is light throughout the day during non-game days. During game days, pedestrians flood the area traveling between the on-site and off-site parking facilities and the stadium (game day conditions are discussed in section 3.8).

Third Street is the primary pedestrian corridor in the study area, with the central commercial core located roughly between Thomas Avenue and Kirkwood Streets (south of Evans Avenue). Counts of pedestrian volumes at crosswalks at three intersections on Third Street were conducted in September 2007 during the weekday AM and PM peak periods, and peak hour pedestrian volumes are summarized in **Table 21**.

Table 21
Pedestrian Crosswalk Volumes at Study Area Intersections
Weekday AM and PM Peak Hour Conditions

Intersection/Crosswalk Location	Weekday AM [1]	Weekday PM [2]
Third/Evans		
North	49	18
South	24	39
East	120	94
West	39	24
Total	*232*	*175*
Third/Palou		
North	295	364
South	219	403
East	301	363
West	131	234
Total	*946*	*1,364*
Third/Paul		
North	63	41
South	136	157
East	229	191
West	60	96
Total	*488*	*485*

Notes:
1. Hourly volume between 8 and 9 AM
2. Hourly volume between 4 and 5 PM
Source: LCW Consulting, September 2007 counts.

3.7 PARKING CONDITIONS

This section presents the existing parking conditions within the study area for typical weekday conditions, and for conditions during a 49er game at the existing stadium. On-street parking conditions were based on field surveys conducted in October 2007 during the weekday midday (1:30 to 3:00 p.m.) and evening (6:30 to 8:00 p.m.) periods. Surveys were also conducted during a Sunday midday (1:30 to 3:00 p.m.) period during a 49ers game at the existing stadium. The 1:30 to 3:00 PM Sunday time period is the peak parking period during football games at the existing stadium because spectators would have already arrived at the stadium. Transportation Study Appendix I contains the detailed parking survey results. Off-street parking supply for game day conditions was obtained from 49ers and compared against information previously collected by SFMTA.

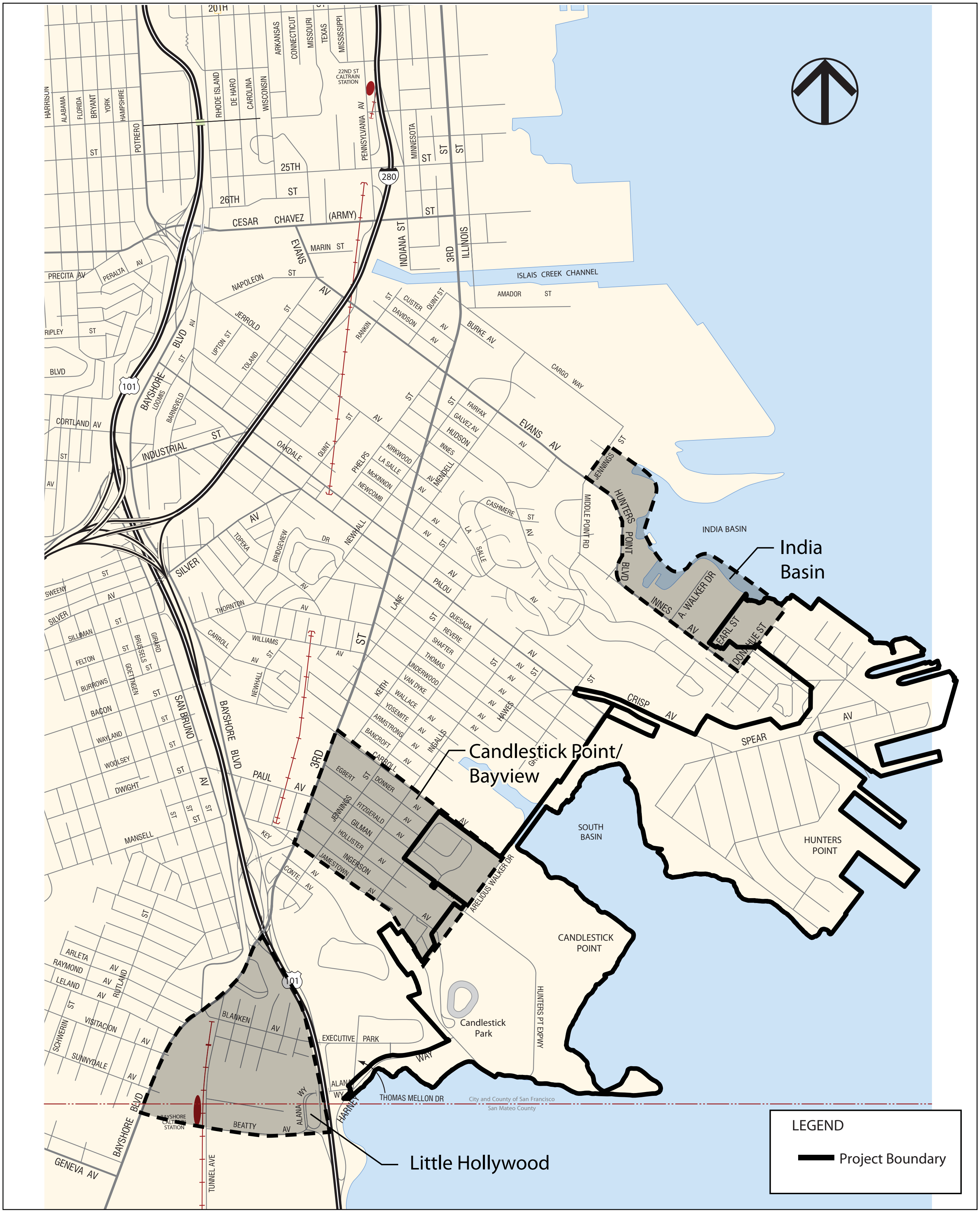
3.7.1 On-Street Parking Conditions

In general, on-street parking in the transportation study area is generally unrestricted (other than weekly street cleaning), and is typically permitted on both sides of the street. On the wider avenues in the study area (generally with an 80-foot wide right-of-way width) with light industrial land uses, roadways, such as Donner Avenue and Bancroft Avenue between Jennings and Hawes Streets, accommodate 90-degree perpendicular parking. Along Third Street on-street parking is metered, and has been removed in the vicinity of the light rail stations. There are no Residential Permit Parking (RPP) areas within the study area.

On-street parking supply and occupancy surveys were conducted for two subareas within the transportation study area, as shown on **Figure 23**:

- Candlestick Point/Bayview – within the mostly residential and partial industrial area bounded by Third Street to the west, Carroll Avenue to the north, Arelious Walker Drive to the east, and Jamestown Avenue to the south.
- Little Hollywood – within the mostly residential area bounded by Bayshore Boulevard to the west and north, U.S. 101 to the north and east, and the San Francisco/San Mateo County line to the south.
- India Basin – Within the mostly industrial area bounded by Jennings Street to the west, Hunters Point Boulevard to the south, Donahue Street to the east, and India Basin to the north.

Table 22 presents the weekday midday and evening parking supply and occupancy for the two subareas. During the daytime, on-street parking utilization is greatest in the Candlestick Point/Bayview subarea, and ranges between 66 percent during the midday period (accommodating employee parking demand associated with the industrial uses) and 57 percent during the evening. Parking demand within the Little Hollywood residential neighborhood is greatest during the evening period, with parking occupancy at about 60 percent.



SOURCE: CHS Consulting

FIGURE 23: ON-STREET PARKING STUDY AREAS

Of the three subareas, parking utilization is lowest within the India Basin subarea (between 17 and 28 percent), reflecting the limited residential and industrial uses in this area. Transportation Study Appendix I contains the detailed parking survey results.

Table 22
On-Street Parking Supply and Utilization
Existing Conditions

Parking Subarea	Supply (spaces)	Occupancy			
		Weekday Midday		Weekday Evening	
		Spaces	% Utilization	Spaces	% Utilization
Candlestick Point/Bayview	1,405	931	66%	807	57%
Little Hollywood	773	415	54%	466	60%
India Basin	398	110	28%	69	17%

Source: CHS Consulting.

There are no city-owned off-street parking facilities in the study area. There is limited number of privately-owned parking facilities in this subarea and most drivers rely on on-street parking in the area. The available privately-owned off-street parking facilities serve the employees and visitors to the businesses adjacent to them and are not available for general public parking.

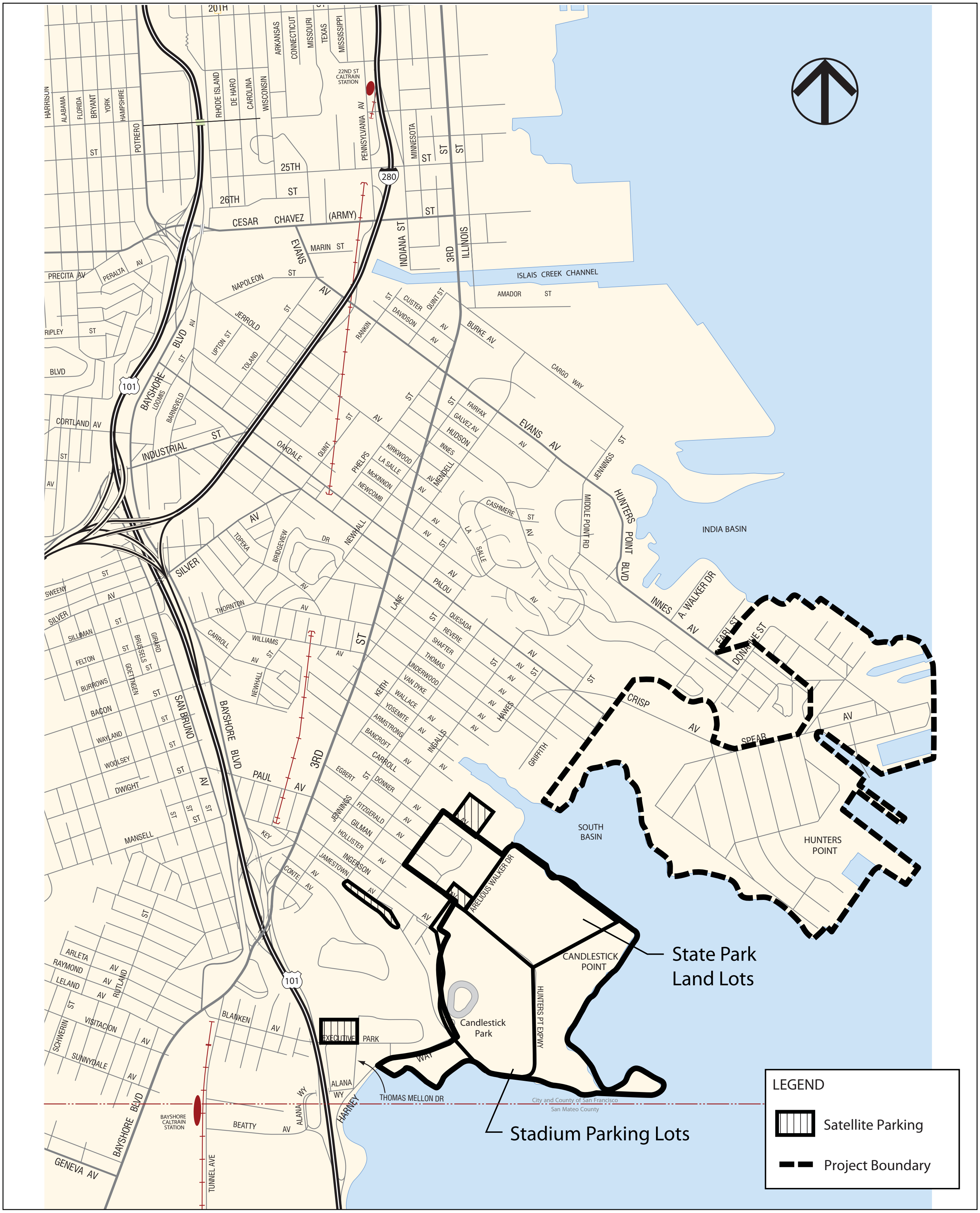
3.7.2 Game Day Parking Conditions

Game day parking demand for 49er games at the existing stadium is accommodated within off-street surface parking lots and on-street parking adjacent to the neighborhood and to the west in the Little Hollywood neighborhood. Game day parking demand varies depending on attendance levels, and maximum demand occurs during sell-out games. Game day conditions typically occur up to 12 times per year (two pre-season games, eight regular games, and usually up to two post-season games). During the last two seasons, two pre-season and eight regular games were played at Candlestick stadium.

Off-Street Parking

Parking for 49er games is provided within stadium parking lots, on state park land, and in satellite parking lots. These areas are identified on **Figure 24.**

- Stadium Parking: Stadium parking consists of the paved parking spaces that are located on the existing stadium premises in the area generally bounded by Hunters Point Parkway, Gilman Avenue, Giants Drive and an internal circulation road on the west side of the stadium.
- State Park Land Parking: Stadium event parking lots are also located between Hunters Point Expressway and the San Francisco Bay, east and northeast of the stadium premises. Most of these lots are unpaved and are located on undeveloped state park land owned by the state.



SOURCE: 49ers, 2008

FIGURE 24: EXISTING STADIUM OFF-STREET PARKING AREAS

- Satellite Parking: Satellite Parking in the study area consists of off-street lots north, west and southwest of the stadium. Existing satellite lots are located: 1) north of the stadium at the intersection of Gilman Avenue and Giants Drive, 2) west of the stadium along Jamestown Avenue, and 3) southwest of the stadium in the Executive Park Office complex.

Table 23 presents the total game day parking supply by the three parking areas.

Table 23
Off-Street Parking Supply for 49er Games
Existing Game Day Conditions

Parking Area	Supply (spaces)[1]
Stadium Parking	9,110
State Park Land Parking	5,470
Satellite Parking	
Executive Park Lots	1,950
Jamestown Lot	1,250
True Hope Church Lot	110
Hawes-Carroll Lot	990
Subtotal	4,300
Total	***18,880***

Note:
1. This inventory does not include private parking spaces that are generally restricted for use by residents, customers and employees of private businesses, or public agencies, however, some of the spaces are in private lots (e.g., churches) that are made available to the public on football game days.
Source: 49ers, 2009.

As indicated in **Table 23,** there are approximately 18,880 off-street parking spaces in the study area. All of the spaces are located in surface parking lots. Approximately 48 percent of the off-street parking spaces are located in the stadium parking lot (9,110 spaces for autos, buses, recreational vehicles, limousines, press and players), 23 percent are located in state park land lots (5,470 spaces), and 29 percent are located in satellite parking lots (4,300 spaces).

In addition to the satellite parking lots, there are a number of parking spaces in private lots that are generally restricted for use by residents, customers and employees of private businesses, or public agencies, however, some of the spaces are made available to the public on football game days. The 49ers estimate that up to 3,000 spaces are available on private land for game day parking.

In general, many football spectators arrive up to five hours before kickoff to prepare and eat food and drink beverages near their vehicles in the parking lots. These "tailgate" parties take place in the car and RV parking lots. Based on previously-collected information on stadium parking accumulation, on a typical game day, up to 40 percent of vehicles arrive between one and two hours prior to kickoff.[13]

On-Street Parking

During game days, parking restrictions are implemented to increase traffic capacity in and out of the facility and to reduce congestion. **Table 24** identifies the streets and segments in the Project vicinity where parking is prohibited between 10:00 a.m. and 6:00 p.m. on game days. In addition to these roadways, on-street parking is also restricted east of Third Street on Salinas Avenue and Gilroy Street.

Table 24
Game Day On-Street Parking Restrictions
Existing Game Day Conditions

Street	Segment	Side of Street
Carroll Avenue	- Jennings Street to Hawes Street - Third Street to Ingalls Street	South side North side
Gilman Avenue	- Third Street to Giants Drive - Giants Drive to a point about 365 feet west of Griffith Street	North side South side
Jamestown Avenue	- Third Street to Redondo Street - Stadium roadway to Third Street	Both sides North side
	- Harney Way to Hunters Pt Expressway	South side
Ingerson Avenue	- Third St to a point about 500 feet east of Griffith Street	Both sides
Paul Avenue	- Third Street to San Bruno Avenue	North side
Third Street	- Jamestown Avenue to Salinas Avenue	West side

Source: SFMTA.

Table 25 presents the parking supply and occupancy during game days for the two parking subareas. On game days between the hours of 10:00 a.m. and 6:00 p.m., the on-street parking supply in the Candlestick Point/Bayview subarea is reduced by about 32 percent due to the parking restrictions identified in **Table 25.** In the Little Hollywood neighborhood, there are no specific on-street parking restriction on game days, and the game day parking supply remains the same as on non game days.

13 from 49ers data provided for the Candlestick Point Stadium and Retail/Entertainment Center EIR – Transportation and Circulation Report, Second Preliminary Draft, February 1998.

Table 25
On-Street Parking Supply and Utilization
Existing Game Day Conditions

Parking Study Area	Supply[1] (spaces)	Game Day – Sunday Midday Occupancy	
		Spaces	% Utilization
Candlestick Point/Bayview	948	815	86%
Little Hollywood	773	849	110%
India Basin	398	87	22%

Note:
1. Game Day on-street parking restrictions on Carroll Avenue, Gilman Avenue, Jamestown Avenue, Ingerson Avenue, Paul Avenue, and Third Street.
Source: CHS Consulting.

On football game Sunday afternoons, approximately 86 percent of the 948 on-street parking spaces in the Candlestick Point/Bayview subarea are occupied. In the Little Hollywood neighborhood, all on-street parking spaces are occupied and a number of vehicles were observed to park illegally, resulting in an inconvenience to residents and their guests.

3.8 EXISTING STADIUM OPERATIONS DURING GAME DAYS

The additional traffic added to the transportation network following a football game at Candlestick Park results in substantial congestion on local streets between parking facilities and the freeway, and on the freeways, particularly where game day traffic merges with other traffic already on the freeway. This section discusses the existing transportation conditions on days when football games are played at Candlestick Park.

3.8.1 Football Game Frequencies

Candlestick Park currently serves as the home of the San Francisco 49ers. The existing Candlestick Park stadium typically hosts up to 12 games per year, including eight regular season games, typically two pre-season games, and for teams that qualify for playoffs, typically two post-season games. Professional football games on the west coast are typically scheduled for 1:00 p.m. (Pacific Time) on Sundays, from September through early December. The post-season runs into January and games can be played on either Saturday or Sunday. At the conclusion of the college football season in late November, a few NFL games are played on Saturdays, as are some pre-season games. Successful teams typically play at least one Monday night (6:00 p.m.) game, and the 49ers have had at least one such home game in each of the past several seasons. Occasionally (no more than once per year), Sunday games are held at 5:00 p.m. The typical duration of a football game is approximately three hours.

3.8.2 Pre-Game and Post-Game Circulation

Ingress and Egress Routes

The major access and egress routes to the existing stadium are shown in **Figure 25** and **Figure 26**, respectively. Vehicles access Candlestick Park by several routes, depending on the level of congestion and their point of origin. Most vehicles arriving from the south (San Mateo and Santa Clara Counties, as well as traffic from Alameda County using the San Mateo or Dumbarton Bridges) use northbound U.S. 101 and enter the site via the Harney Way exit. Vehicles from the north coming from either I-280 or U.S. 101 use the Silver Avenue, Paul Avenue, Bayshore Boulevard/Third or the Alana/Beatty exits to reach the north access routes (Carroll, Gilman, and Jamestown) to the stadium. In order to accommodate peak inbound and outbound traffic volumes generated by the largest special events at Candlestick Park, traffic lanes on Harney Way and on the roadway surrounding the Candlestick Park parking lot (Jamestown Avenue Extension, Hunters Point Expressway and part of Gilman Avenue) are reversed on event days. Overhead Lane Use Control Signals are used to designate the direction of each lane.

On event days, each lane has either a green downward-pointing arrow or a red arrow above it to indicate to drivers in each direction whether they may drive in that lane. The portion of Harney Way between Alana Way near U.S. 101 and Jamestown Avenue operates one-way eastbound (toward Candlestick Park) for several hours before events. Jamestown Avenue Extension and Hunters Point Expressway operate one-way counterclockwise before events. The portion of Gilman Avenue west of Candlestick Park Parking Lot Gate 4 is two-way before events in order to provide access to Gate F from the west. Once the pre-event traffic dies down, these roadways are converted back to two-way operation. In the last 30-60 minutes before the end of the event, the reversible roadways are converted to one-way operation away from the parking lot exits. Gilman Avenue operates one way westbound, while Hunters Point Expressway, Jamestown Avenue Extension and Harney Way operate one-way clockwise and westbound, respectively. During the post-game period, the Candlestick Park exit from northbound U.S. 101 is closed to all traffic, in order to prevent off-ramp traffic from conflicting with the one-way westbound post-event traffic on Harney Way. Additionally, all traffic using the Candlestick Park exit from southbound U.S. 101 is forced to proceed westbound on Beatty Avenue in order to prevent this traffic from having to make a U-turn if it were to proceed eastbound on Alana Way. Once the post-event traffic dies down, the roadways revert to the normal two-way operation.

SOURCE: Fehr & Peers, 2009

FIGURE 25: EXISTING STADIUM INGRESS ROUTES

SOURCE: Fehr & Peers, 2009

FIGURE 26: EXISTING STADIUM EGRESS ROUTES

Traffic Operations

Pre-Game Conditions: For a typical Sunday football game starting at 1:00 PM, vehicle arrival is spread over about six hours with approximately 40 percent of the vehicles arriving between one and two hours prior to the game start time, and 60 percent within the other five hours prior to the game. Since the arrival is spread out over a period of time, the game-related traffic does not substantially affect traffic flow on the study area freeways. During a recent Sunday football game, some localized congestion was observed at U.S. 101 northbound upstream of the Harney Way exit, as vehicles queued up from Harney Way and on U.S. 101 southbound upstream of the Alana/Beatty exit. The vehicles accessing the stadium from Third Street contribute to congestion and queues on the local residential streets, including Third Street, Gilman Avenue, Carroll Avenue and Jamestown Avenue. In September 2009, a pedestrian bridge was installed on Hunters Point Expressway at the location of the pedestrian crossing to the State Park parking lots. Since installation of the pedestrian bridge, pre-game traffic conditions improved.

During pre-game conditions, San Francisco Police Department officers, Parking Control Officers (PCOs) and California Highway Patrol (CHP) officers are posted on roadways leading to the stadium, in particular Harney Way, Hunters Point Expressway, Ingerson Avenue and Gilman Avenue. Officer tasks include: ensuring smooth traffic flow on the one-way inbound Harney Way, directing vehicles to proceed to downstream gates and off-site parking lots, and towing vehicles that obstruct traffic movement. In addition, they are responsible for providing priority to transit vehicles, ensuring pedestrian safety, and orderly queuing at the gates to the internal parking lot. Approximately 60 officers are posted during a football game.

Post-Game Conditions: Immediately following the end of the game, most spectators attempt to leave the stadium parking facilities, although depending on the game outcome, some patrons leave early to avoid congestion and a portion remain for tailgate parties. Players, press, administrative staff, and employees generally remain on-site longer than spectators. Typical clearance times for each of the egress routes following a sell-out football game vary; however, congestion and queues in the vicinity of the stadium generally clear up approximately one and a half to two hours following the end of the game.

During post-game conditions, Harney Way is converted to one-way outbound operation, with two lanes merging to one onto the northbound on-ramp and two lanes continuing onto Alana Way to access the southbound on-ramp and Beatty Avenue. To facilitate flow onto the on-ramps, the U.S. 101 northbound off-ramp is closed at Harney Way, and the allowable movements at the southbound off-ramp are restricted to westbound through onto Beatty Avenue. During post-game conditions, the southbound on-ramp is metered via a ramp metering signal to ensure stable traffic conditions on freeway mainline. Travel lanes on the mainline are also closed to increase the capacity of the on-ramp during post-game conditions. Field observations during recent games indicated that there is some localized congestion on U.S. 101 southbound upstream of and at the ramp merge influence area. Caltrans uses Variable Message Signs (VMS) on southbound U.S. 101 and southbound I-280 upstream of the on-ramp to direct through traffic to southbound I-280 instead of southbound U.S. 101 during post-game conditions.

On U.S. 101 northbound, stadium traffic generally does not have difficulty merging with the freeway mainline traffic, as northbound U.S. 101 traffic volumes approaching Harney Way are generally lower than the southbound volumes. However, as stadium traffic merges with I-80 eastbound traffic leaving downtown San Francisco, congestion and queues extend upstream from the Bay Bridge to the U.S. 101/I-280 merge. This congestion persists long after all congestion and queues dissipate in the vicinity of Candlestick Point.

The surge of vehicles exiting the parking facilities results in queues on the internal roadways and at access roads to Third Street and the on-ramps to U.S. 101. The queues on Jamestown Avenue, Gilman Avenue, and Carroll Avenue are mainly constrained by the capacity of the intersections of the respective street at Third Street. The traffic signals on Third Street are timed to prioritize transit movements along Third Street, including the T-Third light rail, which results in limited capacity for cross-traffic.

During post-game conditions, the San Francisco Police Department officers, PCOs and CHP officers ensure that traffic exits the stadium parking facilities in an orderly fashion and that vehicles access the regional routes as quickly as possible. Responsibilities of the officers include waving vehicles through STOP signs and ensuring that Ingerson Avenue is used by buses, taxis and emergency vehicles. A CHP officer is posted at the intersection of Alana/Beatty to wave vehicles through the STOP sign and onto the U.S. 101 southbound on-ramp. However, many vehicles come to a full stop prior to processing through the intersection.

3.8.3 Transit Services

Muni and Tri-Delta Transit and numerous private charter bus operators provide game day special services to Candlestick Park. BART, AC Transit, and Caltrain do not provide any special game day services. The San Mateo County Transit District (SamTrans), Golden Gate Transit, and the Santa Clara Valley Transportation Authority (VTA) have historically provided transit service to Candlestick Park; however, they have recently stopped providing this service, which will instead be provided by private charter companies.

Muni: On game days, Muni offers express services 75X, 77X, 78X, and 79X to and from the stadium. Line 75X provides express, non-stop shuttle service between Candlestick Park and the Balboa Park BART Station (via Geneva Avenue and Bayshore Boulevard). Line 77X provides express service from the Van Ness corridor, with service between the intersection of California/Van Ness and Candlestick Park (via Van Ness Avenue, South Van Ness Avenue, Mission Street and U.S. 101). Line 78X provides express service along the Park Presidio/19th Avenue corridor, from the Funston/California intersection (via Park Presidio, 19th Avenue, Junipero Serra Boulevard, Ocean Avenue, Geneva Avenue, and Bayshore Boulevard). Line 79X provides express service from downtown, with service between Candlestick Park and the Sutter/Montgomery intersection (via Stockton Street, Fourth Street, Folsom Street and U.S 101). The service starts about three hours prior to the beginning of the football game, and operates at headways of approximately 7 to 10 minutes.

Muni also operates special shuttle services from the Bacon/San Bruno intersection (86-Stadium Shuttle) and from the Gilman/Paul T-Third station (87-Stadium Shuttle). The shuttle service begins about four hours before the game and operates at approximately 5 to 10 minute headways. Approximately 6,500 spectators currently use the special Muni bus services to the stadium.

Tri-Delta Transit: Tri-Delta Transit provides one special game day bus to Candlestick Park from eastern Contra Costa County, with stops in Brentwood, Antioch, and Pittsburg. Tickets may be purchased in advance, or on the bus on the day of the games.

Neither AC Transit not BART provide special game day service. AC Transit riders need to take AC Transit to the San Francisco Transbay Terminal, walk to the intersection of Sutter/Montgomery intersection and transfer to the Muni 9X-Bayshore Express to the stadium. BART riders from East Bay need to take BART to the Montgomery Station and transfer to the Muni 9X-Bayshore Express to the stadium. BART riders from San Mateo County need to take BART to the Balboa Park station and transfer to Muni Line 28X at Geneva Avenue.

Charter Buses: A substantial number of spectators using transit come by private charter buses. Various groups charter buses from private companies including Frontier Tour Charter Bus, Evans, Pro Trav Charter and Sierra Pacific Tours. According to the San Francisco 49ers, approximately 3,000 spectators currently arrive and leave by private charter bus. In addition, private charter service from Santa Clara, San Mateo, Marin, and Sonoma counties will be initiated this season, replacing service previously provided by the VTA, SamTrans, and Golden Gate Transit, respectively. Routes and service are expected to be similar to that previously provided by those operators.

Bus Access and Parking: Buses from the north generally access the stadium by way of Ingerson or Jamestown Avenue, using the Third Street or Paul Avenue exits from U.S. 101 southbound. Buses from the south access the stadium using the Third Street exit. Ingerson Avenue between Third Street and Giants Drive is exclusively used by buses, taxis, and emergency vehicles during pre- and post-game periods.

Southbound buses leaving the stadium generally use westbound Ingerson Avenue to southbound Third Street and take the southbound U.S. 101 on-ramp at Bayshore/Third. Northbound buses use northbound U.S. 101 via the on-ramp at Bayshore/Third. The special Muni shuttle to San Bruno/Bacon turns from Ingerson Avenue onto Third Street northbound, and left at Gilman/Paul.

In general, buses operate inbound on Jamestown Avenue during the pre-game period and outbound on Ingerson Avenue during the post-game period.

Muni buses load and unload passengers along the drop-off roadway (Giants Drive) north of Jamestown Avenue. Other buses (including charters) load and unload in the main parking lot.

Muni buses park free along the drop-off roadway (Giants Drive) parallel to Jamestown Avenue. All other buses park in the main parking lot. The buses in the main lot are parked end-to-end. As a result, some fully loaded buses after the game are delayed until the bus parked in front of them leaves.

3.8.4 Pedestrian Circulation

The number of pedestrians in the vicinity of the stadium is highest during post-game conditions with spectators exiting the stadium at once. The primary pedestrian flows are towards the internal and off-site parking areas east of the stadium, and towards the parking areas along Harney Way and Little Hollywood/Tunnel Avenue, and to the off-site lot along Jamestown Avenue and T-Third line on Third Street.

The two pedestrian overcrossings, one crossing Jamestown at Harney Way, and one crossing the drop-off loop (connecting with Jamestown Avenue approximately 350 feet north of Harney Way), are too narrow to accommodate the surge of pedestrians leaving the stadium. Queues form at the approaches to the pedestrian overcrossings, particularly at Jamestown/Harney. This crossing has fences on either side of the sidewalk to channelize pedestrians and to prevent pedestrians from crossing Jamestown Avenue or Harney Way at-grade.

East of the stadium, pedestrian flows generally spread out throughout the internal lot, and cross Hunters Point Expressway at-grade along the roadway. These uncontrolled crossings often result in conflicts between pedestrians and vehicles, and police occasionally control these crossings. In September 2009, a pedestrian bridge was installed on Hunters Point Expressway at the location of the at-grade pedestrian crossing to the State Park parking lots.

Chapter 4
DEVELOPMENT OF FUTURE CONDITIONS AND SIGNIFICANCE CRITERIA

This chapter describes the methodology used to develop future year cumulative No Project conditions used in the impact analysis, the methodology for determining Project travel demand, and the background transportation network improvements that are anticipated to be implemented by year 2030. This chapter also presents the significance criteria used to identify significant transportation impacts.

The analysis of the Project, Project Variants and Alternatives to the Project was conducted for future year 2030 conditions. Year 2030 was selected as the future analysis year, since the San Francisco County's travel demand model (SF-CHAMP) used in the analysis develops traffic and transit forecasts for cumulative development and growth through the year 2030. The Project impact analysis was conducted for 2030 conditions, rather than existing conditions, to account for the significant roadway and transit network and development changes associated with the Project that would occur over a period of about 20 years (Project construction to be initiated in 2011 and completed by 2029), and to account for the significant changes to the area that are projected to occur. The project impact analysis therefore represents a cumulative growth scenario for the year 2030 that includes growth from development that would occur with implementation of the proposed Project, as well as other, non-project generated growth and transportation network improvements accounted for in the 2030 No Project conditions.

4.1 DEVELOPMENT OF YEAR 2030 NO PROJECT CONDITIONS

Future year 2030 No Project conditions were developed via a two-step process which utilized (1) the San Francisco County's travel demand model (SF-CHAMP) to determine background traffic growth on study area roadways, and (2) traffic volume overlays to reflect traffic volume turning movements associated with nearby developments that are not fully reflected in the SF-CHAMP model output. Future year 2030 No Project conditions are the same as the alternative 1 No Project conditions.

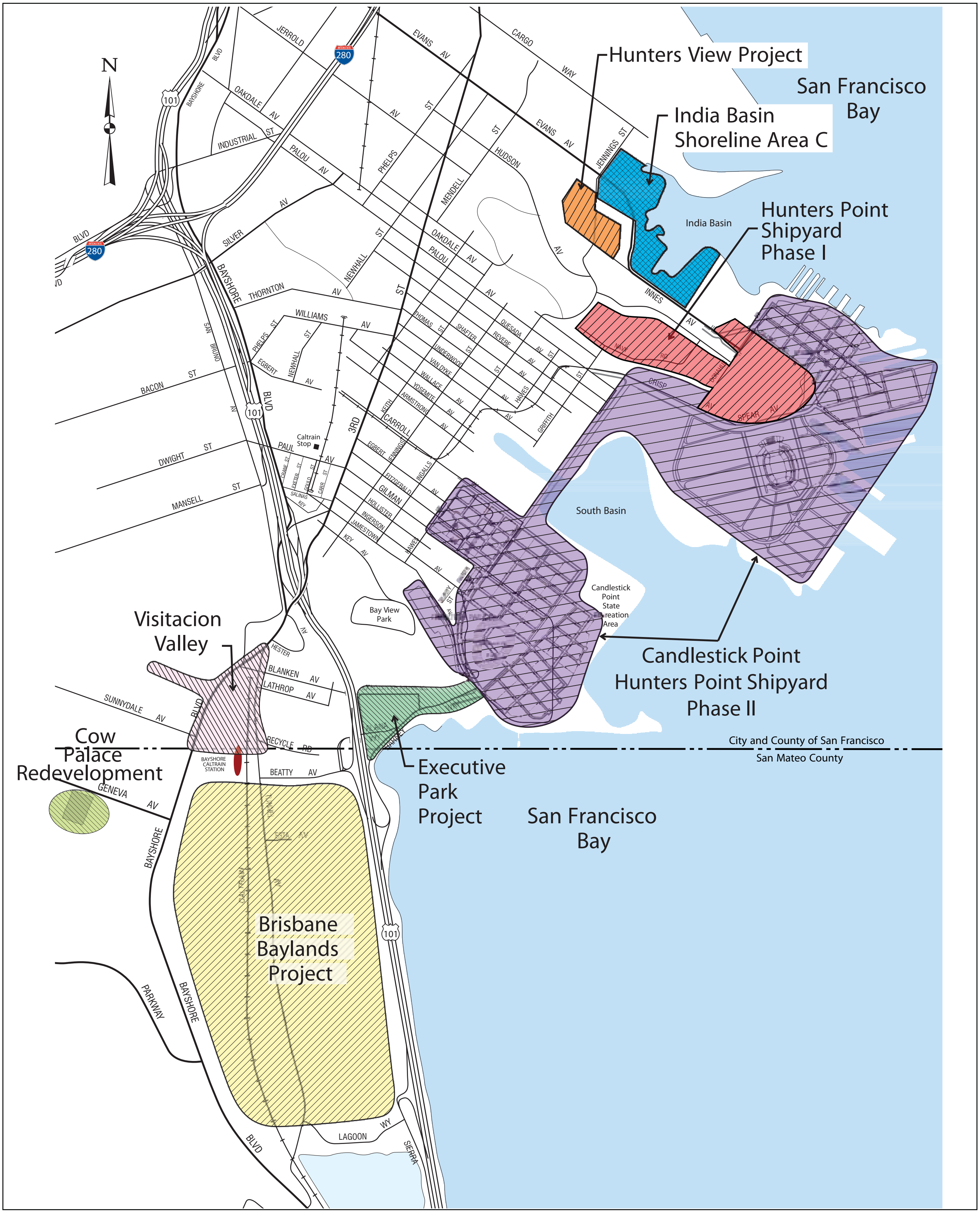
SF-CHAMP Model Growth Projections: Future year 2030 traffic volume forecasts were estimated based on cumulative development and growth identified by SF-CHAMP travel demand model. The SF-CHAMP model is an activity based travel demand model that has been validated to represent future transportation conditions in San Francisco and is updated regularly. The model predicts person travel for a full day based on assumptions of growth in population, housing units and employment, which are then allocated to different periods throughout the day, using time of day sub-models. The SF-CHAMP model predicts future person travel by mode for auto, transit, walk and bicycle trips. The SF-CHAMP model also provides forecasts of vehicular traffic on regional freeways, major arterials and on the study area local roadway network considering the available roadway capacity, origin-destination demand and travel speeds when assigning the future travel demand to the roadway network.

The SFCTA model divides San Francisco into approximately 981 geographic areas, known as Traffic Analysis Zones (TAZs). The SFCTA Model also includes zones outside of the City for which data is obtained through the current Metropolitan Transportation Commission (MTC) Model. For each TAZ, the SFCTA Model estimates the travel demand based on TAZ population and employment growth assumptions developed by the Association of Bay Area Governments (ABAG), determines the origin and destination and mode of travel (auto, transit, walk and bicycle) for each trip, and assigns those trips to the transportation system (roadway network and transit lines). The SFCTA output is developed on a weekday daily and a three-hour AM and PM period basis.

The SFCTA Model travel demand estimates incorporate the ABAG land use and socio-economic database and growth forecasts for the year 2030 (Projections 2007), which provide forecasts of economic and population growth for the County of San Francisco, as well as for the remaining eight Bay Area counties. Within San Francisco, the San Francisco Planning Department is responsible for allocating ABAG's countywide growth forecast to each SFCTA Model TAZ, based upon existing zoning and approved plans, using an area's potential zoning capacity and the anticipated extent of redevelopment of existing uses.

The increase in vehicle trips between existing conditions and 2030 No Project conditions was based on a comparison between model output that represents existing conditions and model output for 2030 conditions. The growth was then added onto existing intersection traffic volumes.

Local Development Traffic Overlays: In the vicinity of the Project, there are a number of development proposals that have recently been approved or are in the environmental review stages. **Figure 27** presents the general location of the planned development within San Francisco and nearby within City of Brisbane limits. While these projects had been included as part of the growth projections used for developing future conditions using the SF-CHAMP model, in order to account for the localized effects of traffic and transit demand, the trip generation associated with these projects was extracted from the SF-CHAMP model output, and travel demand estimates used in the environmental review of these projects were added to the traffic volume estimates developed in the previous step.



SOURCE: Fehr & Peers; AECOM

FIGURE 27: PROPOSED NEARBY DEVELOPMENTS

Specifically, these projects include the Visitacion Valley Redevelopment program (Visitacion Valley Redevelopment Program Final EIR), Hunters View (227-229 West Point Road EIR), Executive Park Development Plan (conversion of office space to residential, neighborhood serving retail and community space – EIR ongoing), and Brisbane Baylands. Travel demand and vehicle assignments for the Visitacion Valley and Hunters View projects were obtained from technical analyses conducted for the EIRs. The analysis of Executive Park is ongoing, and the latest traffic and transit data, including vehicle assignments, was obtained from the Planning Department. Travel demand for the Brisbane Baylands was based on the trip generation analysis conducted by the transportation consultant for the development plan proposed by the Project Applicant in 2008. The 2030 No Project condition also assumes development within Hunters Point Shipyard associated with the approved Phase 1, buildout of the existing Hunters Point Shipyard Redevelopment Plan, and proposed development within India Basin. Travel demand associated with Hunters Point Shipyard and India Basin development was developed consistent with the methodology described below for the Project conditions. No new development was assumed for Candlestick Point, as there are no previously approved plans for the area. The new vehicle and transit trips associated with each development were then manually added to the SFCTA Model 2030 baseline conditions.

Table 26 presents the land use program for the development projects included in determining the future travel demand. For each development proposal, the PM peak hour vehicle travel demand is presented.

Sunday PM Peak Hour Traffic Forecasts: Since the SF-CHAMP model is a weekday travel demand model, future year Sunday PM peak hour conditions were estimated based on the net growth developed for the weekday PM condition. Weekday PM to Sunday PM conversion factors were developed for each intersection, based on the existing relationship between weekday PM and Sunday PM peak hour, as determined from existing traffic counts.

Table 26
Proposed and Approved Nearby Developments Land Use Program and PM Peak Hour Vehicle Trip Generation

Proposed Nearby Developments	Net-New Land Use	PM Peak Hour Vehicle Trip Generation
India Basin Development Plan		
Residential (units)	1,240	1,270
Neighborhood Retail (gsf)	100,000	
Office (gsf)	1,365,000	
Hunters Point Shipyard Phase I		
Residential (units)	1,600	540
Neighborhood Retail (gsf)	20,000	
Hunters View Housing Development		
Residential (units)	800	660
Neighborhood Retail (gsf)	6,400	
Community Services (gsf)	21,600	
Executive Park - Candlestick Cove		
Residential (units)	3,400	3,210
Neighborhood Retail (gsf)	88,500	
Office (gsf)	-320,000	
Visitacion Valley Redevelopment Program		
Residential (units)	1,600	1,685
Regional Retail (gsf)	131,500	
Neighborhood Retail (gsf)	39,500	
Community Services (gsf)	25,000	
Brisbane Baylands Specific Plan		
Retail (gsf)	904,425	13,410
Big Box Retail (gsf)	668,100	
Office (gsf)	3,781,525	
Hotel/Extended Stay (gsf)	1,504,400	
Warehousing & Distribution (gsf)	247,450	
Research & Development (gsf)	601,600	
Exhibition Center (gsf)	373,650	
Auto Park (gsf)	200,000	

Source: San Francisco Redevelopment Agency, Lennar Urban, AECOM, 2009.

4.2 PROJECT TRAVEL DEMAND

This section presents the travel demand methodology and results for the Project, the Project Variants, and the Alternatives to the Project. Details related to travel demand for the Alternatives to the Project are included in Transportation Study Appendix J.

4.2.1 Methodology

The transportation effects of the Project were determined by calculating the daily person trips generated by the different types of land uses in the CP-HPS Phase II areas, and the portion of those trips that would occur during the analysis peak hours. After determining the number of person trips generated by the Project, the trips were distributed to geographical origins/destination areas, including five San Francisco areas (downtown CBD, the rest of Superdistrict 1[14], Superdistrict 2, Superdistrict 3, Superdistrict 4) and three other regions in the Bay Area (South Bay, East Bay and North Bay). The mode split analysis then determined the portion of these trips made via automobile, transit, or any other mode of transportation, based upon the origin/destination of the trips, the purpose of the trips, and the availability of various modes. Finally, automobile occupancy rates were determined, to yield the average number of individuals in a vehicle, and, thus, determine the number of vehicles that would be traveling to and from the Project study area.

The methods commonly used for forecasting trip generation of stand-alone development projects in San Francisco are based on person-trip generation rates, trip distribution information, and mode split data described in the Transportation Impact Analysis Guidelines for Environmental Review, SF Planning Dept, Oct 2002 (*SF Guidelines).* These data are based on a number of detailed travel behavior surveys conducted within San Francisco. The data in the *SF Guidelines* are generally accepted as more appropriate than conventional methods for use on smaller projects in the complex environs of San Francisco because of the relatively unique mix of uses, density, availability of transit, and cost of parking commonly found in San Francisco. Similarly, standard trip generation rates, such as those provided by *Trip Generation,* 7th Edition, 2003, Institute of Transportation Engineers, would not be suitable for the Project, unless appropriate adjustments are made to account for the Project size, mix, and availability of transit. In addition, the methods described in the *SF Guidelines*, or standard vehicle-traffic generation rates provided by *Trip Generation*, 7th Edition, 2003, Institute of Transportation Engineers, cannot be directly applied to the Project since these methods do not take into consideration the fact that all Project trips would not be new trips to the area. Instead, some of the estimated new Project trips would begin and end within the Project area. The standard methodologies for forecasting trip generation would "double-count" these trips.

To account for the trip making patterns of this multi-use development Project, a state-of-the-practice trip generation forecasting method was used in this analysis. This method was originally developed by Fehr & Peers and others for the U.S. Environmental Protection Agency (EPA) and has been endorsed for use in project-specific and planning-level analyses by a number of jurisdictions, including the California Department of Transportation (Caltrans). This method is commonly referred to as the "4D" method, and generally accounts for the following factors that may influence travel behavior:

[14] Superdistricts are travel analysis zones established by the Metropolitan Transportation Commission (MTC). San Francisco is divided into four Superdistricts delineated to capture the different travel characteristics that are associated with the various street network, transit opportunities, and geographical constraints of different areas of San Francisco. Appendix J includes the boundaries that define the superdistricts.

- **Development scale** – the amount of trips generated increases as the amount of development increases
- **Density of the project** – the higher the project's density, the less vehicular traffic generated per unit of development
- **Diversity of uses –** an appropriate mix of uses can lead to internalization of trips and trip-linking within a project
- **Design of project** – a walkable, pedestrian- and bicycle-oriented circulation system can help to reduce automobile dependence within a project site

A detailed description of how these factors can be used to adjust standard traffic generation rates was provided in a letter to the City of San Francisco Planning Department dated August 4, 2008 (included in Transportation Study Appendix K). The general concept behind the 4D method is that projects that deviate from a base case (in this case, ITE trip generation rates) with respect to the four bulleted variables above exhibit different traffic generation patterns. Elasticities have been derived from travel behavior surveys from the Bay Area to help estimate how traffic generation changes as a function of changes in the 4D's. Those elasticities are used to adjust the base case trip generation to account for the project's density, diversity, and pedestrian/bicycle friendliness (i.e., design) compared to typical suburban developments reflected in the ITE trip generation rates. Applying the 4D method results in a percentage reduction in vehicular traffic generation from the base case (i.e., ITE *Trip Generation*).

This approach was determined to be appropriate by the San Francisco Planning Department because the Project:

- Is located in a relatively isolated area within the City and would redevelop an area comparable in size to a number of entire neighborhoods in other parts of San Francisco;
- Includes residential, employment, retail, and recreational opportunities;
- Follows a development pattern designed to facilitate walking and bicycling for internal trips, and bus service for external trips;
- Proposes street design situated around small, pedestrian-oriented blocks to accommodate a variety of modes of travel; and promote slow and moderate vehicular speeds;
- Locates all homes within a five minute walk of a transit stop; and,
- Proposes to make substantial investments in the transit system within the Project site.

The overall 4D method, as applied to the Project, is detailed in Transportation Study Appendix J, and includes the following steps:

1. Trip Generation: The number of weekday and Sunday person trips generated by the land use program was calculated using the 4D methodology. This process calculates the number of person trips generated by the development and estimates the percentage of those trips that occur internal to the Project area. The remaining external trips are then taken and used in the Project off-site impact analysis.

2. Trip Purpose: The external trips calculated in Step 1 are separated into work and non-work trips, as per *SF Guidelines*.

3. Trip Distribution: Once the trips are calculated by purpose, they are distributed to districts throughout San Francisco and the Bay Area. These districts are defined within the San Francisco CHAMP travel demand forecasting model, maintained by the San Francisco Transportation Authority (SFCTA). To account for more nuanced trip patterns within the City of San Francisco, they were further disaggregated into neighborhoods. This trip distribution calibration was done in consultation with the San Francisco Planning Department, San Francisco Municipal Transportation Agency, and the SFCTA.

4. Transit Mode Utility: Using drive and transit travel times between various districts throughout San Francisco, regression-based utility models were developed for work and non-work trips to determine the relationship between travel time and the cost and transit mode share for each trip type. The 4D model assumed the transit improvements that would be provided as part of Project improvements.

5. Auto and Vehicle Trips: Auto person trips are calculated by subtracting transit trips from all external person trips for each destination zone. The number of vehicle trips was determined based on an average vehicle occupancy of 1.6 persons per vehicle *(assumption based on the 1995 National Personal Transportation Survey).*

6. Trip Assignment: After estimating the transit mode share between the Candlestick Point and Hunters Point Shipyard and each of the districts, the number of transit riders were assigned to specific transit routes serving or proposed to serve the study area.

4.2.2 Project Trips by Mode of Travel

Table 27 presents the daily person trip generation for the Project, the two Project Variants, and the five Alternatives for the Project. The greatest number of daily person trips would occur under Project Variant 1, which assumes the Project development program plus an additional 2,500,000 square feet of R&D space. (Project Variant 1 assumes that the 49ers move to Santa Clara and that a new stadium is not constructed in Hunters Point Shipyard).

Alternative 1, the No Project condition, which assumes buildout of Hunters Point Shipyard Phase I, and would generate the fewest number of total person trips. No development would occur within Candlestick Point. Additional trip generation information for the five Alternatives to the Project is included in Transportation Study Appendix J.

Table 27
Daily Person Trip Generation Summary
Project, Project Variants, and Alternatives to the Project

Scenario	Hunters Point Shipyard	Candlestick Point	Total
Project	65,168	154,483	219,651
Project – Variant 1 (R&D)	81,808	154,483	236,291
Project – Variant 2 (Housing)	77,056	141,933	218,989
Alt. 1 – No Project	44,673	0	44,673
Alt. 2 – No Bridge	65,168	154,483	219,651
Alt. 3 – 49ers at Candlestick	77,056	8,870	85,926
Alt. 4 – Lesser Build	47,680	113,699	161,379
Alt. 5 – No Park Agreement	77,056	141,933	218,989

Note:
Does not include travel demand associated with stadium or arena events. See section 4.2.4.
Source: Fehr & Peers.

Table 28 summarizes the daily, weekday AM and PM peak hour, and Sunday PM peak hour person trip generation for the Project and Project Variants. Project Variant 1 (R&D) would generate the greatest number of peak hour person trips during both the AM and PM peak hours.

Table 28
Person Trip Generation Summary
Project and Project Variants

Scenario	Hunters Point Shipyard	Candlestick Point	Total
Project			
Weekday Daily	65,168	154,483	219,651
Weekday AM	5,834	7,749	13,5583
Weekday PM	6,441	13,971	20,412
Sunday PM	4,839	13,289	18,128
Project – Variant 1 (R&D)			
Weekday Daily	81,808	154,483	236,291
Weekday AM	8,504	7,749	16,253
Weekday PM	8,615	13,971	22,586
Sunday PM	6,430	13,289	19,719
Project – Variant 2 (Housing)			
Weekday Daily	77,056	141,933	218,989
Weekday AM	6,691	6,798	13,489
Weekday PM	7,511	12,848	20,359
Sunday PM	5,773	12,348	18,121

Source: Fehr & Peers.

Table 29 presents trip generation by mode for the weekday AM and PM peak hours, while **Table 28** presents this information for the Sunday PM peak hour. Between 28 and 34 percent of weekday AM and PM peak hour person trips would be internal/linked trips that would remain within the Project site and would occur primarily by walking and bicycling. External trips would occur via auto, transit and bicycle modes; approximately 76 percent of peak hour external trips would occur by auto, 21 percent by transit, and 3 percent by bicycling.

Table 29
Weekday AM and PM Peak Hour Trips By Mode
Project and Project Variants

	Person Trips					Vehicle Trips
	Auto	Transit	Bicycle	Internal /Linked	Total	
WEEKDAY AM PEAK						
Project						
Hunters Point Shipyard	3,078	845	121	1,789	5,833	1,924
Candlestick	3,696	966	144	2,942	7,748	2,310
Total	*6,774*	*1,811*	*265*	*4,731*	*13,581*	*4,234*
Project – Variant 1						
Hunters Point Shipyard	4,904	1,349	193	2,057	8,503	3,065
Candlestick	3,696	966	144	2,942	7,748	2,310
Total	*8,600*	*2,315*	*337*	*4,999*	*16,251*	*5,375*
Project – Variant 2						
Hunters Point Shipyard	3,271	904	129	2,388	6,692	2,044
Candlestick	3,502	904	136	2,257	6,799	2,189
Total	*6,773*	*1,808*	*265*	*4,645*	*13,491*	*4,233*
WEEKDAY PM PEAK						
Project						
Hunters Point Shipyard	3,463	1,001	138	1,839	6,441	2,164
Candlestick	7,861	1,889	302	3,920	13,972	4,913
Total	*11,324*	*2,890*	*440*	*5,759*	*20,413*	*7,077*
Project – Variant 1						
Hunters Point Shipyard	5,014	1,482	201	1,917	8,614	3,134
Candlestick	7,861	1,889	302	3,920	13,972	4,913
Total	*12,875*	*3,371*	*503*	*5837*	*22,586*	*8,047*
Project – Variant 2						
Hunters Point Shipyard	3,739	1,082	149	2,540	7,510	2,337
Candlestick	7,708	1,817	295	3,028	12,848	4,817
Total	*11,447*	*2,899*	*444*	*5,568*	*20,358*	*7,154*

Source: Fehr & Peers.

Table 30 presents the Sunday PM peak hour person trips by mode. On Sundays fewer trips would be internal to the Project area, and fewer trips would occur via transit. On Sundays between 20 and 33 percent of trips would be internal/linked. Of the external trips, between 79 and 82 percent would be by auto, between 15 and 18 percent by transit, and about 3 percent by bicycle mode.

Table 30
Sunday PM Peak Hour Trips By Mode
Project and Project Variants

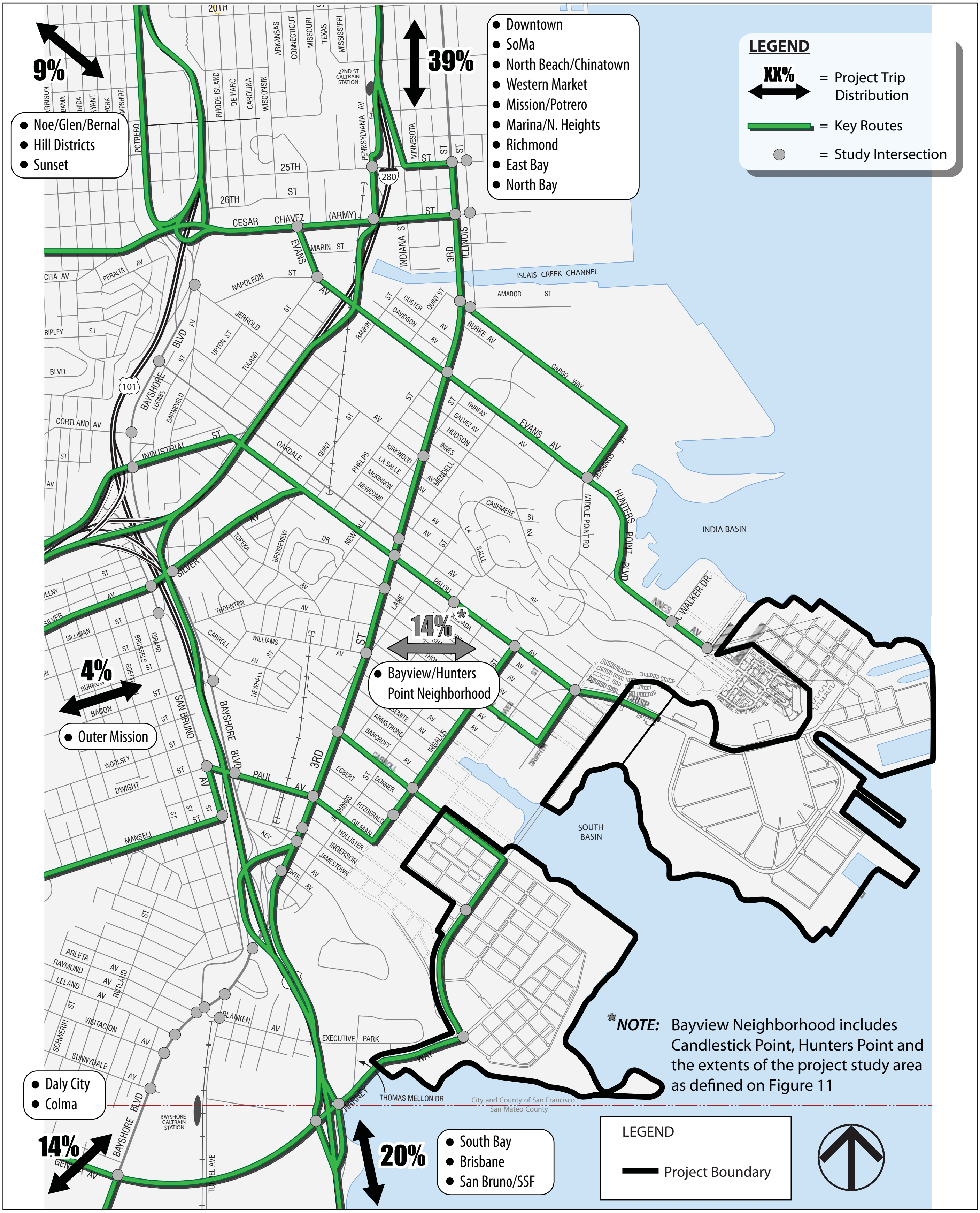
	Person Trips					Vehicle Trips
	Auto	Transit	Bicycle	Internal /Linked	Total	
Project						
Hunters Point Shipyard	2,674	518	99	1,548	4,839	1,666
Candlestick	7,460	1,379	273	4,176	13,288	4,663
Total	*10,134*	*1,897*	*372*	*5,724*	*18,127*	*6,329*
Project – Variant 1						
Hunters Point Shipyard	4,136	814	123	1,356	6,429	2,585
Candlestick	7,280	1,559	273	4,176	13,288	4,550
Total	*11,416*	*2,373*	*396*	*5,532*	*19,717*	*7,135*
Project – Variant 2						
Hunters Point Shipyard	2,765	704	107	2,196	5,772	1,728
Candlestick	7,287	1,538	273	3,250	12,348	4,554
Total	*10,052*	*2,242*	*380*	*5,446*	*18,120*	*6,2,82*

Source: Fehr & Peers.

4.2.3 Project Trip Distribution/Vehicle Assignment

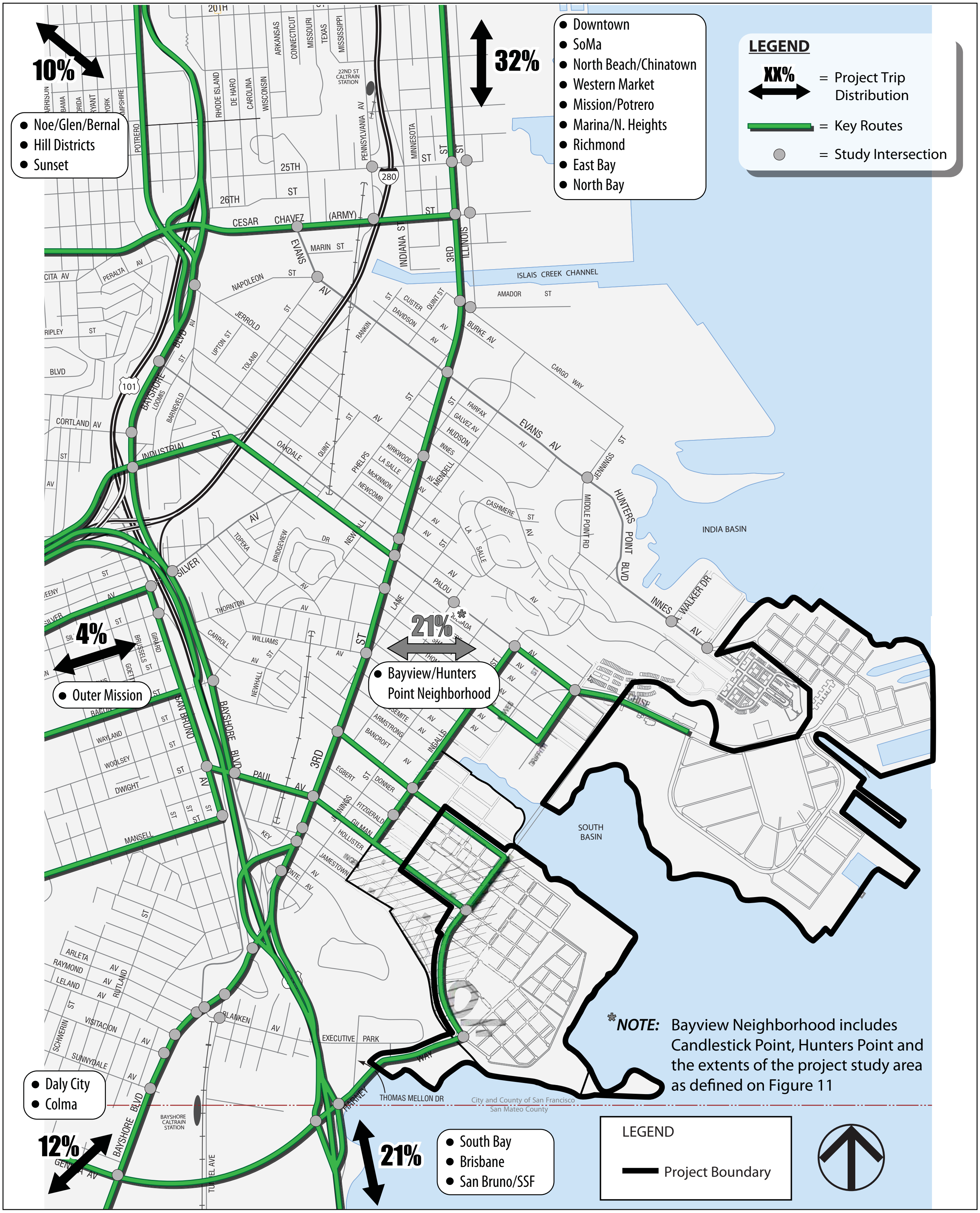
The distribution of the weekday AM and PM transit and vehicle trips to and from San Francisco and areas outside of San Francisco are presented in **Table 31**. The majority of transit trips and about half of vehicle trips would occur within the boundaries of San Francisco, with a greater portion of work trips occurring by transit than non-work trips. Within San Francisco the greatest number of trips would occur between the Project site and Superdistrict 3. Superdistrict 3 is the southeast quadrant of San Francisco and is bounded by the San Mateo County line to the south and the San Francisco Bay to the east, and reaches westward to incorporate the Twin Peaks area. For trips outside of San Francisco, the majority would be to and from nearby Brisbane, Daly City, San Bruno and South San Francisco.

Figure 28 presents the primary assignment routes and distribution percentages for vehicle trips to and from Hunters Point Shipyard, while **Figure 29** presents the routes and distribution percentages for trips to and from Candlestick Point.



SOURCE: Fehr & Peers

FIGURE 28: HUNTERS POINT SHIPYARD TRIP DISTRIBUTION PATTERNS



SOURCE: Fehr & Peers

FIGURE 29: CANDLESTICK POINT TRIP DISTRIBUTION PATTERNS

Table 31
Project Weekday AM and PM Peak Hour Distribution for Vehicles and Transit Trips

	Transit Trips			Vehicle Trips		
	Work	Non-Work	Total	Work	Non-Work	Total
WEEKDAY AM PEAK						
Downtown CBD	17%	10%	15%	1%	2%	2%
Rest of Superdistrict 1	19%	11%	17%	2%	3%	2%
Superdistrict 2	12%	11%	11%	9%	6%	8%
Superdistrict 3	26%	39%	29%	35%	41%	37%
Superdistrict 4	8%	4%	7%	5%	2%	4%
Total San Francisco	*82%*	*75%*	*79%*	*52%*	*54%*	*53%*
Brisbane, Daly City, Colma, San Bruno, South San Francisco	11%	20%	13%	21%	32%	26%
Rest of South Bay	3%	4%	4%	7%	5%	6%
East Bay	4%	1%	4%	17%	8%	13%
North Bay	0%	0%	0%	3%	1%	2%
TOTAL	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***
WEEKDAY PM PEAK						
Downtown CBD	26%	10%	19%	2%	2%	2%
Rest of Superdistrict 1	23%	11%	18%	3%	3%	3%
Superdistrict 2	11%	11%	11%	10%	6%	8%
Superdistrict 3	18%	40%	27%	28%	44%	38%
Superdistrict 4	5%	5%	5%	4%	3%	3%
Total San Francisco	*83%*	*77%*	*80%*	*47%*	*58%*	*53%*
Brisbane, Daly City, Colma, San Bruno, South San Francisco	10%	18%	13%	22%	30%	27%
Rest of South Bay	3%	4%	4%	8%	5%	6%
East Bay	4%	1%	3%	19%	7%	11%
North Bay	0%	0%	0%	4%	1%	2%
TOTAL	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

Source: Fehr & Peers.

4.2.4 Stadium and Arena Travel Demand

This section presents the estimates of trip generation, mode split, trip distribution and traffic assignment for the proposed stadium within Hunters Point Shipyard. Travel demand is presented for sellout conditions for a 49er Sunday event, and for a smaller secondary event occurring during a weekday evening. This section also presents the travel demand associated with a sold-out event at the proposed 10,000-seat arena at Candlestick Point.

49ers Game Day Conditions at the Proposed Stadium

Person-Trip Generation

This analysis considers the impacts of sellout games at the stadium, when all 69,000 seats are sold. The number of person-trips made by spectators to the proposed stadium was estimated based on the number of seats proposed for the new stadium, less the average number of "no-shows." Information provided by the San Francisco 49ers indicates that with a 69,000 seat stadium, there would be approximately 3,450 "no-shows" per game (an average 5 percent no-show rate), resulting in an actual attendance of 65,550 for a sellout game. In addition to the 65,550 spectators, the 49ers have indicated that up to 725 game operations/media personnel attend home games, and that approximately 2,610 other game day employees (concessions, security, janitorial, etc.) are on site each game, for a total on-site population of 68,885 people for a sell-out game.

Mode of Travel

Currently, approximately 19 percent of game day spectators arrive to Candlestick Park by public transit, including approximately:

- 6,500 patrons by Muni (11 percent)
- 3,100 patrons by SamTrans (Silverado Stages since 2008), Golden Gate Transit (California Wine Tours since 2009), Valley Transportation Authority (Silverado Stages since 2009), and Tri-Delta Transit (5 percent)[15]
- 1,900 patrons by other private charter service (3 percent)

It was assumed that a modest rise in transit use would occur with the new stadium, especially in light of the new transit service proposed by the Project:

- Harney Way BRT – The new express transit corridor is proposed to run in dedicated bus lanes from the proposed stadium site to key points west and south. This would greatly improve pre-and post-game transit running times as buses would bypass congested traffic conditions on Harney Way. It would also offer efficient and convenient access to regional transit service, such as Caltrain and BART.

- Palou Avenue Transit Preferential Street – On game days Palou Avenue would be a dedicated transit-only street to allow buses to proceed to the T-Third light rail line and points west and north without mixing in congested pre- and post-game traffic.

- Extension of Existing Transit Routes – In addition to operating "game day express" bus routes from strategic locations throughout San Francisco consistent with current game-day operations, the Project's transit plan calls for extending several existing Muni bus routes (the 24-Divisadero, the 44-O'Shaughnessy, and the 48-Quintara-24th Street) to provide regular service into the Project site. This service would be part of the Project's

15 As noted earlier, game day SamTrans, Golden Gate Transit, and VTA transit service will be replaced by private charter service beginning in the 2009 season. Ridership is expected to remain similar.

regularly scheduled service and would not be special game day service. As a result, patrons would be familiar with the routes.

Due to the dramatic increase in local transit service and improved connectivity to regional transit service, the transit mode share was assumed to increase from 19 percent under existing conditions to 25 percent. Given the extent of transit improvements and demonstrated evidence from other locations that NFL patrons are interested and willing to consider transit as a means to reach games, this increase is a reasonable assumption. This analysis assumes that game operations staff and media personnel would likely use autos. Other game day employees are likely to use transit in a similar fashion as patrons (i.e., 25 percent). **Table 32** summarizes game day travel demand for both spectators and non-spectators.

Table 32
Stadium Game day Attendance - Travel Demand Summary

Spectators	
Total Spectators	69,000
Less 5% No-Shows	*-3,450*
Net Attendance	65,550
Less 25% Transit Usage by Spectators	*-16,388*
Net Auto Person-Trips by Spectators	49,162
Employees/Non-Spectators	
Total Other Employees (Concessions, Security, Etc.)	2,900
Less 10% Other Employee No-Show	*-290*
Net Other Employee Population	2,610
Less 25% Other Employee Transit Usage	*-652*
Net Other Employee Auto Person-Trips	1,958
Total Entertainment/Media/Operations	725
Net Auto Person-Trips by Non-Spectators	2,683

Source: San Francisco 49ers and Fehr & Peers.

Vehicle Occupancy Rates and Vehicle Trip Generation

The average number of spectators in each vehicle is referred to as the vehicle occupancy rate (VOR). Average VORs not only vary by type of vehicle but can also tend to vary depending on the type of stadium seating. For example, existing San Francisco 49ers data indicate that the average VOR for spectators in the club seating sections is 2.0, while the average VOR for spectators in the general seating sections is 3.0.

In order to estimate the number of vehicle-trips under post-game conditions, the number of spectator person-trips was divided by the average VORs. **Table 33** presents auto person-trips generated by various seat types and employees on a typical sellout game, based on the data presented above in **Table 30**, as well as the VORs for the different vehicle types based on existing San Francisco 49ers data, and the resulting number of vehicle trips associated with the new stadium.

Table 33
Stadium Game Day Average VOR[1] by Vehicle Type

	Attendance Type	**Auto Person-Trips**	**Average VOR[1]**	**Vehicle Trips**
Spectators	Club Seat Holder	9,358	2.0	4,679
	Suite Holder	3,606	3.0	1,202
	Hospitality	88	2.0	44
	RVs	220	5.0	44
	Group Sales	39	2.0	20
	Administrative	50	2.0	25
	Players & Families	220	1.0	220
	Owners' Guests	60	1.0	60
	Limousines	50	3.0	17
	General Seating	35,471	3.0	11,824
Spectator Auto Person-Trips		**49,162**	**2.7**	**18,134**
Entertainment/ Operations/ Security/Etc.	Game Operations	225	1.0	225
	Entertainment	60	2.0	30
	Video/Audio	30	1.0	30
	Network	60	1.0	60
	PD, FD, Medical	200	1.0	200
	Media	150	1.0	150
Total Operations/Security Auto Person-Trips		**725**	**1.1**	**695**
Total Other Game day Employees		**2,610**	**1.5**	**1,305**
	Total Game day Travel Demand	***52,497***	***2.6***	***20,134***

Note:
1. VOR – Vehicle occupancy rate.
Source: San Francisco 49ers and Fehr & Peers.

Parking Constraints

The Project would provide 17,415 parking spaces dedicated for game day use. Of this total, 340 spaces adjacent to the stadium would be reserved for buses, and the remaining 17,075 would be for private autos, RVs, limos, etc. Of this total, 16,075 spaces would be adjacent to the stadium and the R & D development, and 1,000 spaces would be provided in Candlestick Point within a parking structure. As a result, 3,059 vehicles of the total unconstrained demand of 20,134 would not be able to park on-site on game days. These vehicles would likely park elsewhere and either walk or take transit into the stadium area. Therefore, although the demand for travel to the project site on game days would be 20,134 vehicles, the actual amount that would park within the project site on game days would be constrained by the 17,075 total parking spaces provided for game day spectators and/or employees.

Departure Patterns

Although the typical end time for a Sunday football game is about 4:00 p.m., there are many factors that influence departure times, including the game score, weather, traffic conditions, and the nature of post-game activities. **Table 34** presents the potential future departure patterns of spectator traffic to reflect the range of conditions likely to occur.

Table 34
Stadium Game Day Post-Game Exit Volumes

Scenario	Assumptions	Peak Hourly Vehicle Exit Demand
Most Conservative	Sold-out event: everyone leaves at end of event	17,075
	Sold-out event: 10% leave early, 5% stay late	14,510
	90% attendance: 10% leave early, 5% stay late	13,060
Average	90% attendance: 15% leave early, 5% stay late	12,290
	80% attendance: 15% leave early, 5% stay late	10,930
	80% attendance: 20% leave early, 5% stay late	10,250
Least Conservative	70% attendance: 20% leave early, 5% stay late	8,960

Note:
1. The Project game day parking supply would be less than the total game day auto travel demand of 20,134 vehicles (including game day employees). There exit demand described above is based on the constrained parking supply of 17,075 vehicles.
2. Although only 20 percent of patrons are shown to depart early in the least conservative scenario, depending on a number of factors, such as weather conditions and game score, the percentage of patrons who leave early may vary substantially from game to game, and may be greater than 20 percent on some occasions.
Source: Fehr & Peers.

An additional factor is the potential synergy after the football game between the stadium and the regional retail development at Candlestick Point, which may result in more spectators electing to stay later than currently do at Candlestick Park. **Table 34** assumes only 5 percent of spectators stay later, which is consistent with the existing stadium departure patterns. Synergies between adjacent attractions may result in higher numbers of patrons arriving earlier or staying late. Regardless, it is likely that the Project's exit routes would continue to function at capacity during the one hour after the end of the game, even with the presence of the nearby retail center and the new stadium location in Hunters Point Shipyard. All transit buses were assumed to leave the Project site during the one hour after the end of the game.

Geographic Distribution

The geographic distribution of spectators was obtained from information provided by the San Francisco 49ers on their season ticket holders. Since a substantial portion of football spectators are season ticket holders, the pattern can be expected to be representative of travel patterns by both season, as well as non-season, ticket holders. The information obtained from the San Francisco 49ers indicates that approximately 40 percent of the season ticket holders reside in the South Bay, 16 percent in the East Bay, 14 percent within San Francisco, and 10 percent in the North Bay counties. The remaining 20 percent reside in locations outside the Bay Area such as the Central Valley and Sacramento, with some living outside of the state.

Secondary (Non-Football) Events at the Proposed Stadium

It is anticipated that other types of events, such as soccer games or concerts, may also be scheduled at the new stadium during the year. A typical secondary event could occur at any time of day and on any day of the week, with an expected crowd ranging from 15,000 (e.g., monster truck rally) to sell-out conditions. For purposes of the transportation analysis, an event with 37,500 spectators was analyzed, which reflects events such as a Metallica concert. Assuming an approximate weekday evening start time of about 7:00 p.m., the weekday PM peak hour (5:00 to 6:00 p.m.) was analyzed for pre-event conditions to address transportation impacts associated with possible secondary events on evening commute traffic conditions. Secondary events would be limited to 20 total occurrences per year.

Trip Generation/Mode Split

Unlike football games, where there would be special transit service to the stadium, it is assumed that for secondary events only regularly scheduled transit service would be provided by Muni and only a small percentage of private charter buses would be expected. Still, the amount of regularly-scheduled transit service serving the new stadium would be substantial, such that transit mode share for a secondary event at the stadium would be approximately 20 percent. It is estimated that the 37,500 spectators would generate about 28,125 persons coming by autos, and 9,375 persons taking transit, including regularly scheduled service and charter buses.

Assuming that the average number of spectators per auto for a secondary event would be similar to that for football spectators in the general seating section (i.e., 3 spectators per auto), the 28,125 persons taking autos would translate to 9,375 vehicles to the stadium, and up to 10,100 vehicles including employees (conservatively estimating similar ratios of employees to spectators as football game days).

Arrival/Departure Patterns

In order to estimate the number of vehicles that would be generated during the weekday PM peak hour (5:00 to 6:00 p.m.), information regarding arrival patterns of non-football events were obtained from a technical paper titled "Understanding the Major Event Traffic Engineering Paradigm", presented in the Institute of Transportation Engineers, 1997 Compendium of Technical Papers. The information contained in this source indicates that approximately 25 percent of the total number of spectators to a non-football event would arrive within the one hour prior to the event start time, 50 percent would arrive within the second hour, and the remaining 25 percent would arrive within the third hour prior to the event start time. As such, about 50 percent, or 4,688 of the spectator vehicles would arrive between 5:00 and 6:00 p.m. for a weekday evening event starting at 7:00 p.m. Employees would arrive earlier to the site.

Geographic Distribution

The geographic distribution of trips associated with a secondary event would vary depending on the event. However, for the purposes of this transportation analysis, it was assumed that the geographic location of the secondary event spectators would be similar to that of the football spectators, where approximately 40 percent would come from the South Bay, 16 percent from the East Bay, 14 percent from within San Francisco, 10 percent from the North Bay, and 20 percent from locations outside of the Bay Area.

Events at the Proposed Arena

The Project also includes a new arena within Candlestick Point that would be used for theater productions, concerts, speaking engagements, educational events, or sporting events. While most events at the arena would be for smaller audiences, the arena would accommodate up to 10,000 attendees. It is anticipated that up to 150 events per year could occur at the arena (e.g., Wednesday, Friday and Saturday every week per year). Similar to the analysis of secondary events at the stadium, assuming an approximate weekday evening start time of 7:00 p.m., the weekday PM peak hour (5:00 to 6:00 p.m.) was analyzed for pre-event conditions to address transportation impacts associated with sold-out events that may occur at the arena. Although no specific program has been developed for events at the arena, sell-out events with 10,000 attendees occurring during weekday evenings would likely be infrequent.

Trip Generation/Mode Split

Similar to the analysis of secondary events at the arena, the analysis of a sold-out event at the arena assumes that only regularly-scheduled transit service would be provided and that only a small number of attendees would arrive by private charter bus. The analysis assumes that 20 percent of attendees would arrive by transit (again, similar to the assumptions for a secondary event at the stadium, and lower than the expected transit ridership to Sunday afternoon 49er games). Therefore, of the 10,000 spectators, 2,000 would be expected to arrive by transit and 8,000 would be expected to arrive via auto. Assuming that the average vehicle occupancy for a sold-out event at the arena would be similar to that of spectators to a 49ers game or for a secondary event at the stadium (i.e., 3 spectators per auto), the 8,000 people arriving via auto would generate an additional 2,667 vehicles to the stadium, and up to 2,860 vehicles including employees (assuming similar ratios of employees to spectators as football game days).

Arrival/Departure Patterns

Arrival and departure patterns for a sold-out event at the arena would likely be similar to those of secondary events at the stadium. Specifically, 50 percent of the attendees, or 1,333 vehicles and 1,000 transit trips, would arrive between 5:00 and 6:00 p.m. for an event that begins at 7:00 p.m. Employees would arrive earlier and would not affect the 5:00 to 6:00 p.m. peak hour.

Geographic Distribution

Similar to secondary events at the stadium, the geographic distribution of trips associated with events at the arena would vary depending on the event. For purposes of this analysis, it was assumed that the geographic location of the attendees would be similar to that of the football spectators, with 40 percent of attendees arriving from the South Bay, 16 percent from the East Bay, 14 percent from within San Francisco, 10 percent from the North Bay, and 20 percent from locations outside the Bay Area.

4.2.5 Parking Demand

The *SF Guidelines* methodology for estimating parking demand was used to calculate the parking demand associated with the land uses for each analysis scenario. For each analysis scenario, parking demand was estimated separately for residential and non-residential uses.

Residential Parking Demand – For individual development projects, residential parking demand is estimated based on the number and type of housing unit (i.e., studios/one bedroom versus two and two-plus bedroom units, and affordable versus market rate housing) that would be constructed.

Non-Residential Parking Demand – Non-residential demand was estimated for both short-term and long-term demand. Long-term demand refers to demand generated by employee trips by auto, while short-term demand refers to demand associated with visitor trips.

Long-term demand was calculated by applying the vehicle mode choice by Project area to the projected number of new employees associated with each land use. Average hour short-term demand was calculated by applying an average turnover of 5.5 vehicles per space to the daily non-work trips by vehicle (one-way trips).

Table 35 presents the residential and non-residential parking demand for the Project, Project Variants and Alternatives. The parking demand calculations are presented in Transportation Study Appendix J.

Table 35
Parking Demand – Project, Project Variants, and Alternatives

Scenario/Project Area	Residential	Non-Residential		Total Demand [1]
	Long Term Demand	Long Term Demand	Short-Term Demand	
Project				
Hunters Point Shipyard	3,110	3,818	996	7,924
Candlestick Point	9,212	1,475	2,622	13,309
Total	*12,322*	*5,293*	*3,618*	*21,233*
Project – Variant 1 (R&D)				
Hunters Point Shipyard	3,110	7,299	1,447	11,856
Candlestick Point	9,212	1,475	2,622	13,309
Total	*12,322*	*8,774*	*4,069*	*25,165*
Project – Variant 2 (Housing)				
Hunters Point Shipyard	4,694	3,811	911	9,416
Candlestick Point	7,627	1,480	2,787	11,894
Total	*12,321*	*5,291*	*3,698*	*21,310*
Alt. 1 - No Project				
Hunters Point Shipyard	2,122	3,929	3,107	9,148
Candlestick Point	--	--	--	--
Total	*2,122*	*3,929*	*3,107*	*9,148*
Alt. 2 – No Bridge				
Hunters Point Shipyard	3,110	3,818	996	7,924
Candlestick Point	9,212	1,475	2,622	13,309
Total	*12,322*	*5,293*	*3,588*	*21,233*
Alt. 3 – 49ers at Candlestick				
Hunters Point Shipyard	4,694	3,810	911	9,415
Candlestick Point	1,420	--	--	1,420
Total	*6,114*	*3,810*	*911*	*10,835*
Alt. 4 – Lesser Build				
Hunters Point Shipyard	2,177	2,717	808	5,702
Candlestick Point	7,627	1,062	2,355	11,044
Total	*9,804*	*3,779*	*3,163*	*16,746*
Alt. 5 – No Park Agreement				
Hunters Point Shipyard	4,694	3,811	911	9,416
Candlestick Point	7,627	1,480	2,787	11,894
Total	*12,321*	*5,291*	*3,698*	*21,310*

Source: CHS Consulting, LCW Consulting.

4.2.6 Loading Demand

The *SF Guidelines* methodology for estimating commercial vehicle and freight loading/loading demand was used to calculate the demand associated with each analysis scenario. Daily truck trips generated per 1,000 square feet were calculated based on the rates contained in the *SF Guidelines*, then converted to hourly demand based on a 9-hour day and a 25-minute average stay. Average hourly demand was converted to a peak hour demand by applying a peaking factor, as specified in the *SF Guidelines*. **Table 36** presents the number of trucks generated on a daily basis, and the demand for loading dock spaces during the peak hour of loading activities. The loading demand calculations are presented in Transportation Study Appendix J.

Table 36
Loading Demand – Project, Project Variants, and Alternatives

Scenario/Project Area	Daily Truck Generation	Peak Hour Loading Dock Space Demand
Project		
Hunters Point Shipyard	713	41
Candlestick Point	507	29
Total	*1,220*	*70*
Project – Variant 1 (R&D)		
Hunters Point Shipyard	1,238	72
Candlestick Point	507	29
Total	*1,745*	*81*
Project – Variant 2 (Housing)		
Hunters Point Shipyard	766	44
Candlestick Point	458	27
Total	*1,224*	*71*
Alt. 1 - No Project		
Hunters Point Shipyard	891	52
Candlestick Point	0	0
Total	*891*	*52*
Alt. 2 – No Bridge		
Hunters Point Shipyard	713	41
Candlestick Point	507	29
Total	*1,220*	*70*
Alt. 3 – 49ers at Candlestick		
Hunters Point Shipyard	766	44
Candlestick Point	53	3
Total	*819*	*47*
Alt. 4 – Lesser Build		
Hunters Point Shipyard	518	30
Candlestick Point	358	21
Total	*876*	*51*
Alt. 5 – No Park Agreement		
Hunters Point Shipyard	766	44
Candlestick Point	458	27
Total	*1,224*	*71*

Source: LCW Consulting.

4.3 FUTURE BASELINE TRANSPORTATION IMPROVEMENTS

In addition to improvements proposed by the Project, the analysis assumes completion of certain planned and reasonably foreseeable roadway and transit improvements in the Project vicinity that, although not part of the Project, could affect circulation. These improvements would be completed by the City and County of San Francisco directly or through development approvals.

4.3.1 Roadway Improvements

Local Roadway Improvements

These improvements were identified as mitigation measures in the EIRs prepared for the Bayview Hunters Point Redevelopment Plan and the Visitacion Valley Redevelopment Plan, and implementation will be assured through conditions of approval placed on the development projects by the Planning Department and the San Francisco Redevelopment Agency.

- **Bayshore/Paul** – At this signalized intersection, as part of the Bayview Hunters Point Redevelopment Plan the signal will be changed from northbound and southbound Bayshore Boulevard operating with permitted left turns (left turns yield to oncoming traffic), to protected left turn movements with an exclusive signal phase.
- **Bayshore/Tunnel** – At this signalized intersection, the Visitacion Valley Redevelopment Plan calls for improvements to the signal timing plan, to redistribute green time from the southbound left turn movement to the northbound/southbound through movements.
- **Bayshore/Arleta/San Bruno** – At this signalized intersection, the Visitacion Valley Redevelopment Plan calls for improvements to the signal timing plan, to redistribute green time from the northbound left turn movement to the southbound through movement.
- **Bayshore/Leland** – At this signalized intersection, the Visitacion Valley Redevelopment Plan calls for improvements to the signal timing plan, to redistribute green time from the northbound left turn movement to the northbound/southbound through movements. As part of this improvement, the westbound approach will be restriped to provide two travel lanes: a left-through lane and an exclusive right-turn lane.
- **Bayshore/Visitacion** – The Visitacion Valley Redevelopment Plan calls for reconfiguration of this signalized intersection to extend the southbound left turn pocket by 80 feet. As part of this improvement, the west-side Bayshore/Leland Muni bus stop would be relocated to the south of Leland Avenue.
- **Bayshore/Sunnydale** – The Visitacion Valley Redevelopment Plan calls for reconfiguration of this signalized intersection to extend the southbound left turn pocket by 100 feet. In addition, the Plan calls for improvements to the signal timing plan, to redistribute green time from the northbound/southbound left turn movements to the eastbound/westbound through movements. The westbound and eastbound approaches

will be restriped to provide two travel lanes: a shared left-through lane and an exclusive right-turn lane.

- **Tunnel/Blanken** – The Visitacion Valley Redevelopment Plan calls for reconfiguration of this intersection to eliminate the all-way STOP-sign controls and install new traffic signal poles, masts and signal heads. In addition, the approaches to the intersection would be restriped to provide for two travel lanes for each approach.
- **Bayshore/Blanken** – At this signalized intersection, the Visitacion Valley Plan calls for restriping of the westbound approach of Blanken Avenue at Bayshore Boulevard to two lanes, to provide for an exclusive left turn lane, and an exclusive right turn lane.
- **Executive Park Improvements** —The Executive Park Property Owners are also required to make local roadway improvements when warranted by poor operating conditions. These include the following short-term and long-term improvements:
    - Signalization of Harney Way/Executive Park Boulevard East
    - Signalization and reconfiguration of Harney Way/Alana Way/Thomas Mellon Drive intersection
    - Widening of Harney Way by one lane
    - Signalization of Executive Park Boulevard West/Alana Way and the restriping of the southbound approach from one shared lane to one exclusive left lane and one exclusive right lane
    - Widening of Alana Way by one lane and two lanes
    - Signalization of Alana Way/Beatty Road

Planned Regional Improvements

Two regional roadway improvement were included as part of the future year analysis. These improvements are currently being designed and analyzed to accommodate the travel demand associated with the areawide projects identified in section 4.1 (**Table 26)** in both San Francisco and San Mateo counties. Implementation of these improvements would be based on fair-share funding measures through inter-jurisdictional study and cooperation, such as the ongoing inter-jurisdictional Bi-County Transportation Study effort led by the San Francisco County Transportation Authority. Within San Francisco, the Planning Department and the Redevelopment Agency will require project developer fair share contributions to these identified funding needs as a condition of development approval or as a condition of any Owner Participation Agreement. These regional roadway improvements are:

- **Geneva Avenue/Harney Way Extension** – Geneva Avenue which currently ends at Bayshore Boulevard, would be extended east to meet Harney Way, improving east-west access in the area. The Geneva Avenue Extension would have three eastbound and three westbound travel lanes between Bayshore Boulevard and a new interchange with U.S.

101. Currently, the nearest east-west access road is Blanken Avenue, which is designed as a neighborhood collector roadway and could not accommodate the additional east-west traffic generated by area projects. The lead agency for this project is the City of Brisbane, with the Caltrans Project Study Report (PSR) expected to be completed in early 2010.Extension from its current terminus at Bayshore Boulevard to a new interchange with U.S. 101.

- **New U.S. 101 Interchange at Geneva/Harney** – In conjunction with the extension of Geneva Avenue east, the existing Harney Way interchange would be redesigned as a typical diamond interchange. Caltrans and the City of Brisbane are the lead agencies for this project, and a PSR report is currently being prepared. Two alternatives are currently being assessed; one with Geneva Avenue/Harney Way crossing under U.S. 101, and one with Geneva Avenue/Harney Way crossing over U.S. 101.

  On the Geneva Avenue/Harney Way crossing of U.S. 101 there would be six lanes eastbound (three left turn lanes and three through lanes) and five lanes westbound (three left turn lanes and three through lanes), for a total of eleven lanes. The intersections of the northbound and southbound ramps with Geneva Avenue/Harney Way would be signalized. For both alternatives, a new bypass to the existing northbound Third Street off-ramp would be constructed, with the intention of diverting traffic on the existing off-ramp from the northbound mainline and improving conditions at the weave section where the new proposed northbound on-ramp from Harney Way would join the mainline. Preliminary drawings for each of the alternatives are included in Transportation Study Appendix L.

4.3.2 Transit Improvements

SFMTA has proposed changes to several of the lines that would serve the study area as part of its Transit Effectiveness Project (TEP). The TEP is a comprehensive review of Muni operations, with numerous proposals for service and street network changes to address issues related to reliability, travel times and service areas. Service planning changes are budget-neutral, while additional funding will be required for capital needs (e.g., additional buses). SFMTA will pursue Proposition K funds and federal grants for capital funding. The changes affecting the study area include:

- Eliminating 19-Polk service to the Hunters Point Shipyard.
- Increasing frequency on the 24-Divisadero from 8.5 minutes in the AM peak hour and 10 minutes in the PM peak hour to 7.5 minutes in the AM and PM peak hours.
- Increasing frequency on the 44-O'Shaughnessey to 6 minutes in the PM peak hour.
- Increasing frequency on the 54-Felton from 30 minutes to 20 minutes in the AM and PM peak hours.

- Extending the 48-Quintara-24th Street would be extended from 25th Street and Connecticut Street in Potrero Hill into the Hunters Point Shipyard in order to offset the elimination of the 19-Polk service to Hunters Point Shipyard. Frequencies on the 48-Quintara-24th Street would be reduced from 12 minutes to 15 minutes in the AM and PM peak hours.
- Rerouting and extending the 28L-19th Avenue Limited from its current terminus at the Daly City BART station up to Geneva Avenue, terminating just east of Mission Street. The 28L-19th Avenue Limited would maintain its current 10-minute frequency in the AM and PM peak hours.
- Extending/rerouting the T-Third light rail line north of the station at Fourth and King Streets. Currently the T-Third continues north along The Embarcadero, entering the Market Street subway just north of Folsom Street. As described earlier, as part of the Central Subway project, beginning in approximately year 2016, the T-Third line will continue north on Fourth Street, entering a new subway under Fourth Street just south of Harrison Street. The new terminus will be in Chinatown, underneath Stockton Street. The Central Subway operating plan calls for single-car trains at 7.5-minute frequencies during peak hours between Chinatown and Bayview, as well as a two-car short-line train between Chinatown and Mariposa Street operating at 7.5-minute frequencies.

While not included in the assumptions for future transit conditions, the objectives of the ongoing Bayshore Intermodal Station Access Study would complement the TEP improvements, as well as Project transit improvements. The SFCTA is conducting the Bayshore Intermodal Station Access Study to develop multi-jurisdictional consensus around a vision and conceptual design for new intermodal transit connections and passenger access to the Bayshore Caltrain Station. Multiple planning processes are proceeding to develop projects that would connect new transit services to the Bayshore Station, including an extension of the T-Third light rail line from its current nearby terminus, the extension of the BRT line to Hunters Point Shipyard, and a new local street connection across Bayshore Boulevard, the Caltrain tracks, and U.S. 101 as a Geneva Avenue extension. The SFCTA is partnering with stakeholder agencies to develop the proposed station connections in a seamless fashion and to promote strong multimodal access to the station. The end result will be a set of conceptual designs for the station and the new connections to serve as a vision that the individual projects will implement as they progress through their planning and preliminary engineering phases.

4.3.3 Bicycle Improvements

The certification of the San Francisco Bicycle Plan Final EIR was affirmed by the Board of Supervisors in August 2009. The San Francisco Bicycle Plan identifies near-term improvements that could be implemented within the next five years, as well as policy goals, objectives and actions to support these improvements. It also includes long-term improvements, and minor improvements that would be implemented to facilitate bicycling in San Francisco. The injunction to stop implementation of the Bicycle Plan improvements that was issued on June 2006 by the Superior Court of California would be lifted, and that implementation of near-term improvements would be contracted. Funds for Bicycle Plan improvements would be available from the State Bicycle Transportation Account and San Francisco Measure C funding. The SFMTA, the San Francisco Recreation and Park Department (RDP), or the San Francisco Department of Public Works (under the direction of SFMTA or RPD), would implement improvements, depending on which entity has jurisdiction. The *San Francisco Bicycle Plan* includes six short-term projects within the study area (see **Figure 21**):

- San Francisco Bicycle Plan Project 4-2: Cargo Way Bicycle Lanes, will involve the installation of Class II bicycle lanes in both directions on Cargo Way between Third Street and Jennings Street. On-street parking on the south side of Cargo Way will be removed, and a Class II left-turn bicycle lane will be installed on eastbound Cargo Way approaching Illinois Street and Amador Street. Cargo Way is not currently part of the citywide bicycle route network.
- San Francisco Bicycle Plan Project 4-3: Illinois Street Bicycle Lanes, would involve the installation of Class II bicycle lanes in both directions on Bicycle Route #5 on Illinois Street between 16th Street and Cargo Way. On-street parking on the east side of Illinois Street north of 22nd Street will be removed, and additional on-street parking spaces will be provided on Tennessee Street, 22nd Street, and 24th Street.
- San Francisco Bicycle Plan Project 4-4: Innes Avenue Bicycle Lanes, will involve the installation of Class II or Class III bicycle facilities in both directions on Bicycle Route #68 on Innes Avenue between Donahue Street and Hunters Point Boulevard. Two options have been identified for this segment and a preferred option was not included in the Bicycle Plan Final EIR: Option 1 would add Class II bicycle lanes in both directions, and remove on-street parking on the south side of Innes Avenue between Hunters Point Boulevard and Earl Street, and on both sides of Innes Street between Earl Street and Donahue Street. Option 2 would be similar to Option 1, except for the segment from Hunters Point Boulevard to Earl Street, where sharrows would be added to the existing Class III bicycle route in both directions. There would be no parking or travel lane removals associated with Option 2 between Hunters Point Boulevard and Earl Street.
- San Francisco Bicycle Plan Project 5-4: Bayshore Boulevard Bicycle Lanes, will involve the installation of Class II bicycle lanes in both directions of travel along most of Bayshore Boulevard between Cesar Chavez Street and Silver Avenue (Bicycle Route #25). Sharrows would be added in each direction between Cesar Chavez Street and approximately the beginning of the couplet split (i.e., at Jerrold Avenue). On-street parking will be removed on both sides of Bayshore Boulevard from the couplet split to Industrial Street, and one northbound lane will be removed beginning midblock between Helena and Industrial Streets. Sharrows will be added on northbound Bayshore Boulevard to Oakdale Avenue, Loomis Street, Barnveld Avenue and Jerrold Avenue, and

the northbound curbside bicycle lane from Helena Street to Marengo Street will be a shared transit and bicycle lane.

- San Francisco Bicycle Plan Project 5-5: Cesar Chavez Bicycle Lanes, will involve the installation of Class II bicycle lanes in both directions on Bicycle Route #25 on Cesar Chavez Street between Kansas Street (near U.S. 101) and Mississippi Street (near I-280). To accommodate the bicycle lanes, one of the two eastbound travel lanes will be removed.
- *San Francisco Bicycle Plan* Project 5-13: San Bruno Bicycle Lanes will involve the installation of Class II bicycle lanes in both directions on Bicycle Route #25 on San Bruno Avenue between Silver Avenue and Paul Avenue. To accommodate the bicycle lanes, on-street parking would need to be removed in the segment between Silliman Street and Silver Avenue.

The Bicycle Plan includes 24 long-term improvements that are proposed to be designed and implemented citywide over time. These improvements would complete the bicycle route network envisioned in the Bicycle Plan, close network gaps, refine and rationalize the bicycle route network, and improve safety and the bicyclists experience. Five long-term improvements have been identified within the study area for further design, environmental review and possible implementation. With the exception of the Bay Trail improvements which involve construction of a Class I off-street path, and Mendell Street which is currently a plaza, the long-term improvements generally involve implementation of Class II or Class III bicycle facilities. Design of these improvements would occur within the context of the bicycle route network, planned development characteristics, and roadway network configuration at the initiation of the design and review process for each improvement. The five long term improvements include:

- Long-Term Improvement L-3: Bay Trail Improvements in the vicinity of Hunters Point
- Long-Term Improvement L-4: Bayview Transportation Improvements Project
- Long-Term Improvement L-11: Industrial St between Loomis St and Oakdale Ave
- Long-Term Improvement L-12: Jennings St between Cargo Way and Evans Ave
- Long-Term Improvement L-15: Mendell St between Oakdale Ave and Palou Ave

4.4 SIGNIFICANCE CRITERIA

The City and Agency have not formally adopted significance standards for impacts related to transportation, but generally consider that implementation of the Project would have significant impacts on these resources if it were to:

- Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections)

- Exceed, either individually or cumulatively, an LOS standard established by the county congestion management agency for designated roads or highways (unless it is practical to achieve the standard through increased use of alternative transportation modes)
- Result in a change in air traffic patterns, including either an increase in traffic levels, obstructions to flight, or a change in location, that causes substantial safety risks
- Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses
- Result in inadequate parking capacity that could not be accommodated by alternative solutions
- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., conflict with policies promoting bus turnouts, bicycle racks, etc.), or cause a substantial increase in transit demand that cannot be accommodated by existing or proposed transit capacity or alternative travel modes

The transportation and circulation impact findings herein are also based on the following significance criteria used by the San Francisco Planning Department for the determination of impacts associated with a proposed project.

- Traffic – In San Francisco, the threshold for a significant adverse impact on traffic has been established as deterioration in the LOS at a signalized intersection from LOS D or better to LOS E or LOS F, or from LOS E to LOS F. The operational impacts on unsignalized intersections are considered potentially significant if project-related traffic causes the level of service at the worst approach to deteriorate from LOS D or better to LOS E or LOS F and Caltrans signal warrants would be met, or causes Caltrans signal warrants to be met when the worst approach is already at LOS E or LOS F.[16]

  For an intersection that operates at LOS E or LOS F under existing conditions, there may be a significant adverse impact depending upon the magnitude of the project's contribution to the worsening of delay. In addition, a project would have a significant adverse effect if it would cause major traffic hazards, or would contribute considerably to the cumulative traffic increases that would cause the deterioration in LOS to unacceptable levels (i.e., to LOS E or LOS F).

  The operational impacts on freeway mainline segments and freeway on-ramp merge and off-ramp diverge operations are considered significant when project-related traffic causes the level of service to deteriorate from LOS D or better to LOS E or LOS F, or from LOS

[16] Five of the study intersections are within the City of Brisbane. The level of service standard for all arterial streets within the City of Brisbane is LOS D, except for the intersections on Bayshore Boulevard at Old County Road and San Bruno Avenue, which shall not be less than LOS C.

E to LOS F. In addition, a project would have a significant effect on the environment if it would contribute substantially to congestion at unacceptable levels.

- Parking – Parking supply is not considered to be a part of the permanent physical environment in San Francisco[17]. Parking conditions are not static, as parking supply and demand varies day to night, day to day, month to month, etc. Hence, the availability of parking spaces (or lack thereof) is not a permanent physical condition, but changes over time as people change their modes and patterns of travel.

  Parking deficits are considered to be social effects, rather than impacts on the physical environment as defined by CEQA. Under CEQA, a project's social impacts need not be treated as significant impacts on the environment. Environmental documents should, however, address the secondary physical impacts that could be triggered by a social impact. (CEQA Guidelines § 15131(a).) The social inconvenience of parking deficits, such as having to hunt for scarce parking spaces, is not an environmental impact, but there may be secondary physical environmental impacts, such as increased traffic congestion at intersections, air quality impacts, safety impacts, or noise impacts caused by congestion. The absence of a ready supply of parking spaces, combined with available alternatives to auto travel (e.g., transit service, taxis, bicycles or travel by foot) and a relatively dense pattern of urban development, induces many drivers to seek and find alternative parking facilities, shift to other modes of travel, or change their overall travel habits. Any such resulting shifts to transit service in particular, would be in keeping with the City's "Transit First" policy. The City's Transit First Policy, established in the City's Charter Section 16.102 provides that "parking policies for areas well served by public transit shall be designed to encourage travel by public transportation and alternative transportation."

  The transportation analysis accounts for potential secondary effects, such as cars circling and looking for a parking space in areas of limited parking supply, by assuming that all drivers would attempt to find parking at or near the project site and then seek parking farther away if convenient parking is unavailable.

- Transit – The project would have a significant effect on the environment if it would cause a substantial increase in transit demand that could not be accommodated by adjacent transit capacity, resulting in unacceptable levels of transit service; or cause a substantial increase in operating costs or delays such that significant adverse impacts in transit service levels could result.

[17] Under California Public Resources Code, Section 21060.5, "environment" can be defined as "the physical conditions which exist within the area which will be affected by a Project, including land, air, water, minerals, flora, fauna, noise and objects of historic or aesthetic significance."

The project would also have a significant effect on the environment if it would increase transit travel times on a particular route such that existing (or proposed) headways could not be maintained based on the existing (or proposed) vehicle fleet.

- Pedestrians – The project would have a significant effect on the environment if it would result in substantial overcrowding on public sidewalks, create potentially hazardous conditions for pedestrians, or otherwise interfere with pedestrian accessibility to the site and adjoining areas.
- Bicycles – The project would have a significant effect on the environment if it would create potentially hazardous conditions for bicyclists or otherwise substantially interfere with bicycle accessibility to the site and adjoining areas.
- Loading – The project would have a significant effect on the environment if it would result in a loading demand during the peak hour of loading activities that could not be accommodated within the proposed on-site loading facilities or within convenient on-street loading zones, and if it would create potentially hazardous traffic conditions or significant delays affecting traffic, transit, bicycles or pedestrians.
- Emergency Vehicle Access – The project would have a significant impact on the environment if it would hinder emergency vehicle access.
- Construction – Construction-related impacts generally would not be considered significant due to their temporary and limited duration. However, in circumstances involving large development plans where construction would occur over long periods of time, construction-related impacts may be considered significant.

Project impacts were assessed by comparing future year 2030 conditions with the Project to 2030 No Project conditions. The 2030 No Project condition includes development within Hunters Point Shipyard associated with approved Phase I, as well as buildout of the existing Hunters Point Shipyard Redevelopment Plan, which would be replaced by the Project. However, for purposes of defining and assessing effectiveness of proposed mitigation measures, the total effect of the Project was considered (i.e., total vehicle, transit, bicycle and pedestrian trips generated by the Project were considered, not just the increase from the 2030 No Project condition which assumes development within the Hunters Point Shipyard component of the Project). Further, for purposes of determining the Project's contribution to cumulative impacts, the total Project effect was considered.

The Project was determined to have a significant traffic impact at an intersection if Project-generated trips would cause an intersection operating at LOS D or better under 2030 No Project conditions to operate at LOS E or LOS F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions. At intersections that would operate at LOS E or LOS F under 2030 No Project conditions, and would continue to operate at LOS E or LOS F under Project conditions, the increase in Project vehicle trips were reviewed to determine whether the increase would contribute considerably (i.e., five percent or more) to critical movements operating at LOS E or LOS F.

For freeway mainline and ramp analyses, locations where the Project would result in a change from LOS D or better under 2030 No Project conditions to LOS E or LOS F, or from LOS E or LOS F, with the Project are identified as Project impacts. At locations that would operate at LOS E or LOS F under 2030 No Project conditions, and would continue to operate at LOS E or LOS F under Project conditions, the Project trips, as a percentage of total traffic volumes on the facility were reviewed to determine whether the increase would contribute considerably (i.e., five percent or more) to total volumes on the facility.

The Project was determined to have a significant impact if it would increase transit travel times such that additional transit vehicles would be required to maintain the proposed headways. This was assumed to be the case if either the Project's travel time increases to a particular route would be greater than ½ its proposed headway or if the number of required vehicles estimated using SFMTA's cost/scheduling model, which takes into account scheduled breaks and extra time built into schedules, increases by one or more vehicles with the addition of the Project characteristics. The Project would have a significant contribution to a cumulative impact if it was determined to have a significant Project impact. In a few circumstances, although no Project impact was identified, the Project contribution to the cumulative scenario was determined to be considerable when a transit line travels through intersections that would operate at LOS E or LOS F due to Project traffic.

Chapter 5
YEAR 2030 NO PROJECT CONDITIONS

This chapter presents the year 2030 No Project (without the Project development program, but assumes the approved development for HPS Phase I) conditions, and compares the analysis results to existing conditions, as presented in Chapter 3. The 2030 No Project condition represents the cumulative baseline condition for the impact analysis. Comparison to existing conditions was conducted to determine whether the 2030 No Project scenario would have significant cumulative impacts due to background development anticipated in the project study area, regardless of any Project development scenario. In Chapter 6, the Project, Project Variants, and Project Alternatives are compared to the 2030 No Project conditions to determine the impacts of the Project.

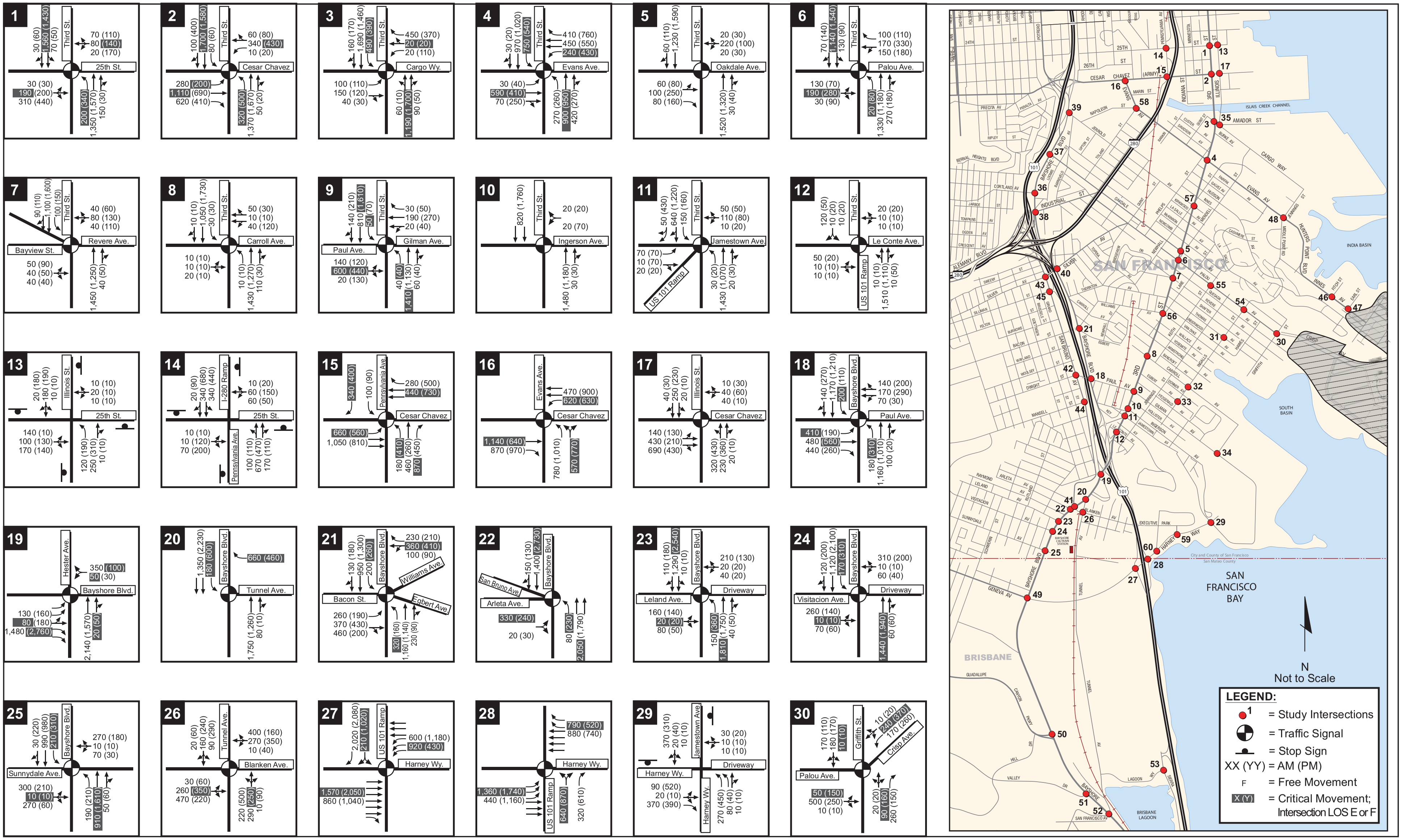
Under the 2030 No Project conditions, the vicinity of the Project is anticipated to experience growth of about 7,000 new housing units, and about 9.8 million square feet (see **Table 26** in Chapter 4) of development. The remainder of San Francisco is also projected to experience an increase in both jobs and housing units. Within the rest of San Francisco, total daily person trips via all modes are projected to increase by about 14 percent over existing conditions, and the total daily vehicle trips are projected to increase by about 8 percent over existing conditions. (SF-CHAMP, 2009)

5.1 TRAFFIC IMPACTS

5.1.1 Intersection Operations

Future year 2030 No Project traffic volumes at the 60 study intersections are presented on **Figure 30A** and **Figure 30B** for the weekday AM and PM peak hours, and on **Figure 30C** and **Figure 30D** for the Sunday PM peak hour conditions. Transportation Study Appendix E contains intersection turning movement volume summaries.

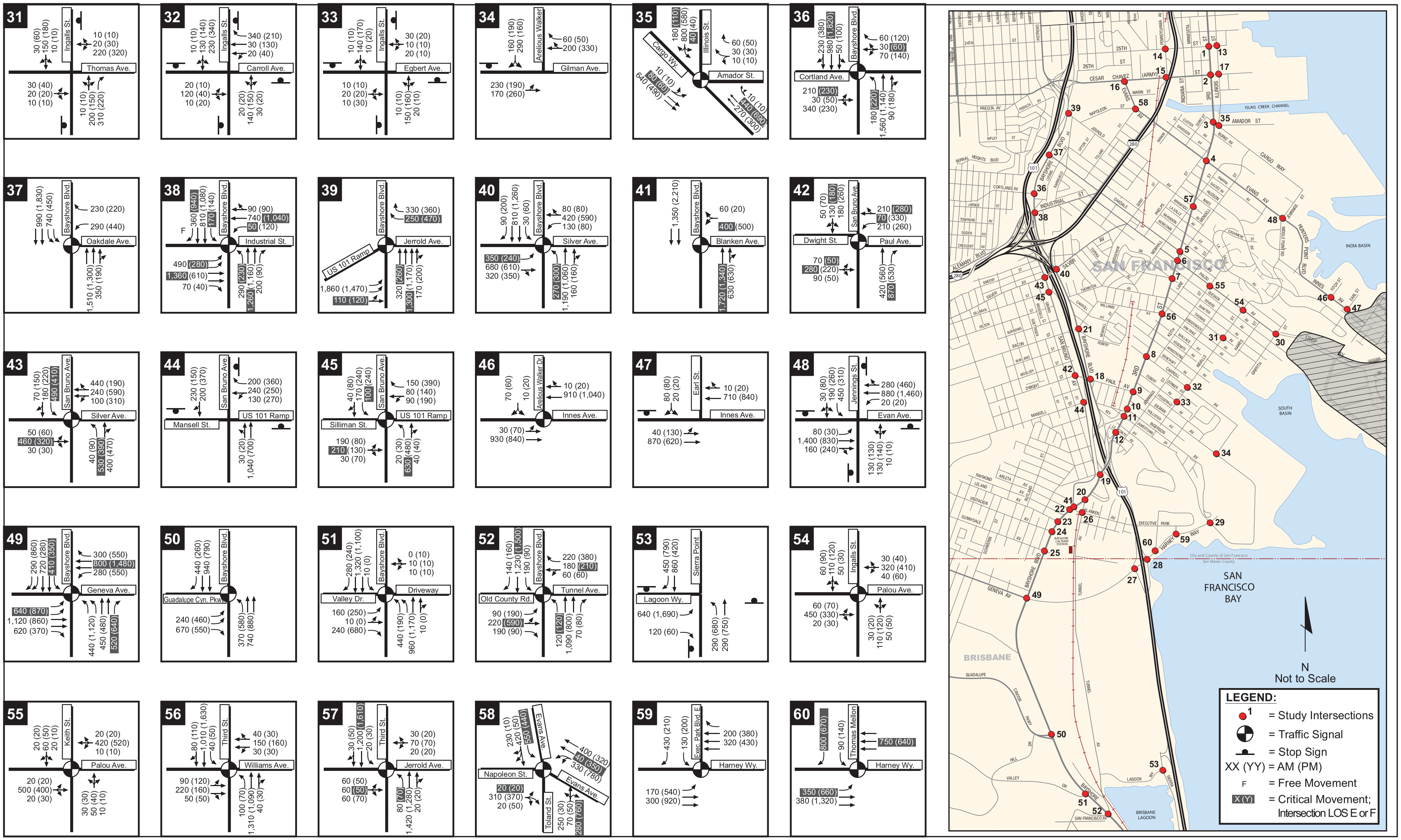
Table 37 presents a comparison of the weekday AM and PM peak hour intersection LOS analysis for the existing and 2030 No Project conditions. **Table 38** presents this comparison for Sunday PM peak hour conditions. As traffic volumes in the study area are anticipated to increase as a result of development in the area and within San Francisco, average vehicle delays at both signalized and unsignalized intersections would increase, and operating conditions would become more constrained.



CP-HPS Phase II Development Plan Transportation Study

NO PROJECT WEEKDAY
PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS

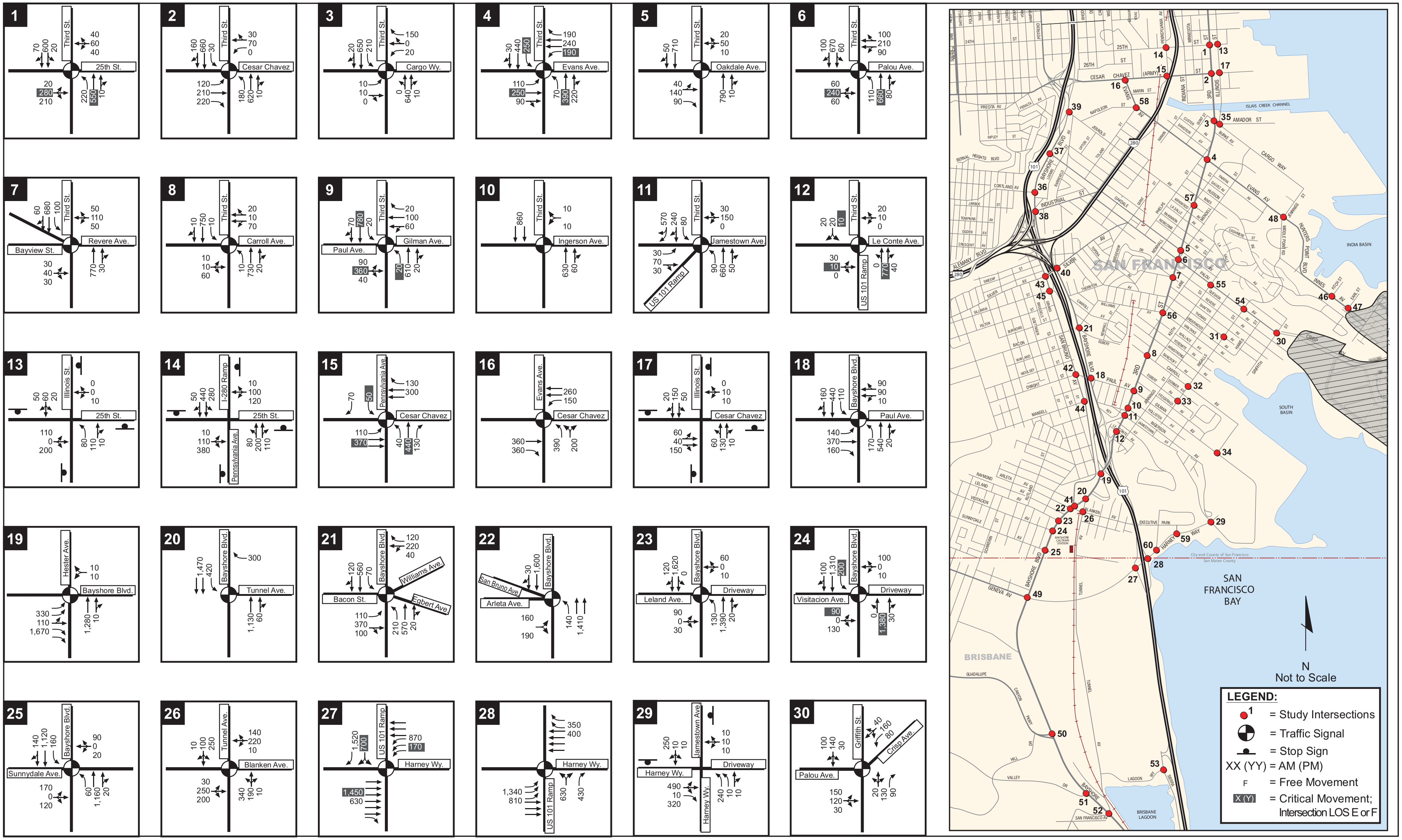
FIGURE 30A



CP-HPS Phase II Development Plan Transportation Study

NO PROJECT
PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS

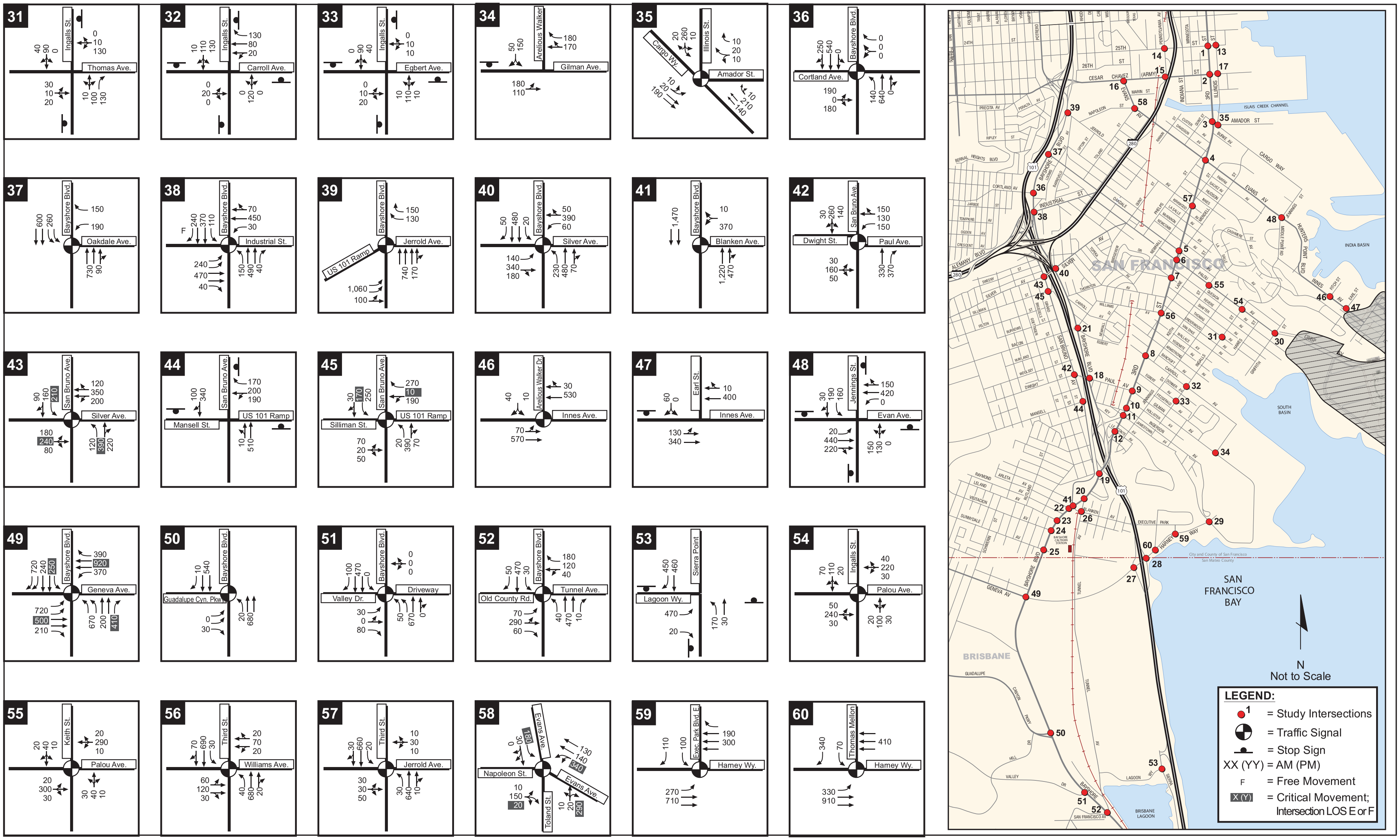
FIGURE 30B



CP-HPS Phase II Development Plan Transportation Study

NO PROJECT SUNDAY PM PEAK HOUR (NO FOOTBALL GAME) TRAFFIC VOLUMES AND LANE CONFIGURATIONS

FIGURE 30C



CP-HPS Phase II Development Plan Transportation Study

NO PROJECT SUNDAY PM PEAK HOUR
(NO FOOTBALL GAME) TRAFFIC VOLUMES AND LANE CONFIGURATIONS

FIGURE 30D

Table 37
Intersection LOS
Existing and 2030 No Project Conditions – Weekday AM and PM Peak Hours

	Intersection	AM Peak Hour				PM Peak Hour			
		Existing		2030 No Project		Existing		2030 No Project	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS
1	Third St/25th St	14	B	**>80**	**F**	16	B	**>80**	**F**
2	Third St/Cesar Chavez St	36	D	**>80**	**F**	31	C	**>80**	**F**
3	Third St/Cargo Way	23	C	**>80**	**F**	20	B	**>80**	**F**
4	Third St/Evans Ave	35	C	**>80**	**F**	34	C	**>80**	**F**
5	Third St/Oakdale Ave	17	B	21	C	19	B	30	C
6	Third St/Palou Ave	15	B	**>80**	**F**	30	C	**>80**	**F**
7	Third St/Revere Ave	19	B	35	D	31	C	37	D
8	Third St/Carroll Ave	12	B	12	B	14	B	14	B
9	Third St/Paul Ave	27	C	**>80**	**F**	24	C	**>80**	**F**
10	Third St/Ingerson Ave	5	A	5	A	5	A	7	A
11	Third St/Jamestown Ave	13	B	29	C	14	B	30	C
12	Third/Le Conte/US 101 nb off	11	B	50	D	11	B	24	C
13	25th St/Illinois St	7	A	14	B	7	A	14	B
14	25th St/Pennsylvania Ave	9	A	26	D	12	B	**>80**	**F**
15	Cesar Chavez/Penns/I-280	**78**	**E**	**>80**	**F**	39	D	**>80**	**F**
16	Cesar Chavez St/Evans Ave	21	C	**>80**	**F**	21	C	**>80**	**F**
17	Cesar Chavez St/Illinois St	13	B	25	C	19	A	22	C
18	Bayshore Blvd/Paul Ave	21	C	**61**	**E**	17	B	**>80**	**F**
19	Bayshore/Hester/US 101 sb off	28	C	**>80**	**F**	13	B	**>80**	**F**
20	Bayshore Blvd/Tunnel Ave	19	B	**>80**	**F**	16	B	**>80**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold.**

Source: Fehr & Peers.

Table 37 (continued)
Intersection LOS
Existing and 2030 No Project Conditions – Weekday AM and Peak Hours

	Intersection	AM Peak Hour				PM Peak Hour			
		Existing		2030 No Project		Existing		2030 No Project	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS
21	Bayshore Blvd/Bacon St	**76**	**E**	**>80**	**F**	22	C	**>80**	**F**
22	Bayshore Blvd/Arleta St	25	C	**>80**	**F**	25	C	**>80**	**F**
23	Bayshore Blvd/Leland Ave	21	C	**>80**	**F**	22	B	**>80**	**F**
24	Bayshore Blvd/Visitacion Ave	17	B	**>80**	**F**	15	B	**>80**	**F**
25	Bayshore Blvd/Sunnydale Ave	20	C	**>80**	**F**	19	B	**>80**	**F**
26	Tunnel Ave/Blanken	11	B	43	D	9	A	**>80**	**F**
27	Alana Way/Beatty Ave [3]	10	A	**>80**	**F**	9	A	**>80**	**F**
28	Alana Way/Harney Way/Mellon [3]	8	A	**>80**	**F**	8	A	**>80**	**F**
29	Harney Way/Jamestown Ave	8	A	12	B	8	A	**40**	**E**
30	Crisp Ave/Palou Ave	11.4 (nb)	B	**57**	**E**	11.6(nb)	B	**58**	**E**
31	Ingalls St/Thomas Ave	11.3(wb)	B	19.0(wb)	C	11.5(wb)	B	27.9(wb)	C
32	Ingalls St/Carroll Ave	8	A	15	B	8	A	17	C
33	Ingalls St/Egbert Ave	8	A	8	A	8	A	9	A
34	A.Walker/Gilman Ave [4]	9.1(sb)	A	**>50 (eb)**	**F**	9.2(sb)	A	**>50(eb)**	**F**
35	Amador St/Cargo Way	28	C	**65**	**E**	24	C	**60**	**E**
36	Bayshore Blvd/Cortland Ave	19	B	37	D	25	C	**>80**	**F**
37	Bayshore Blvd/Oakdale Ave	30	C	43	D	26	C	33	C
38	Bayshore/Alemany/Industrial	44	D	**>80**	**F**	**58**	**E**	**>80**	**F**
39	Bayshore/US 101 nb off to Cesar	43	D	**74**	**E**	48	D	**>80**	**F**
40	Bayshore Blvd/Silver Ave	50	D	**>80**	**F**	50	D	**>80**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold.**
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
Source: Fehr & Peers.

Table 37 (continued)
Intersection LOS
Existing and 2030 No Project Conditions – Weekday AM and PM Peak Hours

	Intersection	AM Peak Hour				PM Peak Hour			
		Existing		No Project		Existing		2030 No Project	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore Blvd/Blanken Ave	12	B	**>80**	**F**	11	B	**>80**	**F**
42	San Bruno Ave/Paul Ave	20	B	**>80**	**F**	20	B	**>80**	**F**
43	San Bruno Ave/Silver Ave	**75**	**E**	**>80**	**F**	46	D	**>80**	**F**
44	San Bruno/Mansell/101 sb off	17	C	**>50**	**F**	33	D	**>50**	**F**
45	San Bruno/Silliman/101 sb off	24	C	**>80**	**F**	20	B	38	D
46	Innes Ave/A.Walker Drive	8.6(sb)	A	5	A	8.7(sb)	A	5	A
47	Innes Ave/Earl St	8.5(sb)	A	17.3(sb)	C	8.6(sb)	A	23.1(sb)	C
48	Evans Ave/Jennings St	9	A	**>80**	**F**	10	A	**>80**	**F**
49	Bayshore Blvd/Geneva Ave	24	C	**>80**	**F**	25	C	**>80**	**F**
50	Bayshore/Guadalupe Pkwy	16	B	21	C	14	B	50	D
51	Bayshore Blvd/Valley Dr	23	C	20	C	16	B	40	D
52	Bayshore Blvd/Old County Rd	28	C	40	D	29	C	**>80**	**F**
53	Sierra Pt/Lagoon Way	12	B	**>50**	**F**	16	B	**>50**	**F**
54	Ingalls St/Palou Ave	9	A	16	B	9	A	16	B
55	Keith St/Palou Ave	9	A	10	A	9	A	8	A
56	Third/Williams/Van Dyke	22	C	18	B	22	C	17	B
57	Third St/Jerrold Ave	22	C	49	D	23	C	**>80**	**F**
58	Evans/Napoleon/Toland	37	D	**>80**	**F**	46	D	**>80**	**F**
59	Harney/Executive Park East	9.1 (sb)	A	25	C	8.9 (sb)	A	25	C
60	Harney/Thomas Mellon	--	--	30	C	--	--	19	B

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold.**
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
Source: Fehr & Peers.

Table 38
Intersection LOS
Existing and 2030 No Project Conditions – Sunday PM Peak Hour

Intersection		Existing		2030 No Project	
		Delay [1]	LOS [2]	Delay	LOS
1	Third St/25th St	13	B	**63**	**E**
2	Third St/Cesar Chavez St	23	C	31	C
3	Third St/Cargo Way	17	B	30	C
4	Third St/Evans Ave	32	C	**57**	**E**
5	Third St/Oakdale Ave	15	B	14	C
6	Third St/Palou Ave	29	C	**>80**	**F**
7	Third St/Revere Ave	22	C	20	B
8	Third St/Carroll Ave	9	A	10	B
9	Third St/Paul Ave	21	C	**64**	**E**
10	Third St/Ingerson Ave	3	A	3	A
11	Third St/Jamestown Ave	21	C	24	C
12	Third/Le Conte/US 101 nb off	12	B	14	B
13	25th St/Illinois St	7	A	10	A
14	25th St/Pennsylvania Ave	10	A	**45**	**E**
15	Cesar Chavez/Penns/I-280	28	C	**61**	**E**
16	Cesar Chavez St/Evans Ave	15	B	18	B
17	Cesar Chavez St/Illinois St	14	A	18	B
18	Bayshore Blvd/Paul Ave	12	B	14	B
19	Bayshore/Hester/US 101 sb off	14	B	14	B
20	Bayshore Blvd/Tunnel Ave	8	A	53	D
21	Bayshore Blvd/Bacon St	12	B	17	B
22	Bayshore Blvd/Arleta St	24	C	54	D
23	Bayshore Blvd/Leland Ave	18	B	41	D
24	Bayshore Blvd/Visitacion Ave	15	B	**64**	**E**
25	Bayshore Blvd/Sunnydale Ave	19	B	55	D
26	Tunnel Ave/Blanken	8	A	30	C
27	Geneva/U.S. 101 SB ramps [3]	8	A	**>80**	**F**
28	Harney/U.S. 101 NB ramps [3]	9	A	54	D
29	Harney Way/Jamestown Ave	7	A	22	C
30	Crisp Ave/Palou Ave	11.1(sb)	B	37	D

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold.**
Source: Fehr & Peers.

Table 38 (continued)
Intersection LOS
Existing and 2030 No Project Conditions – Sunday PM Peak Hour

Intersection		Existing		2030 No Project	
		Delay [1]	LOS [2]	Delay	LOS
31	Ingalls St/Thomas Ave	9.9(wb)	A	11.8 (wb)	B
32	Ingalls St/Carroll Ave	7	A	9	A
33	Ingalls St/Egbert Ave	7	A	8	A
34	A.Walker/Gilman Ave	8.9(sb)	A	**>50 (eb)**	**F**
35	Amador St/Cargo Way	28	B	21	C
36	Bayshore Blvd/Cortland Ave	17	B	23	C
37	Bayshore Blvd/Oakdale Ave	24	C	21	C
38	Bayshore/Alemany/Industrial	35	C	40	D
39	Bayshore/US 101 nb off to Cesar	25	C	25	C
40	Bayshore Blvd/Silver Ave	15	B	19	B
41	Bayshore Blvd/Blanken Ave	9	A	51	D
42	San Bruno Ave/Paul Ave	16	B	39	D
43	San Bruno Ave/Silver Ave	41	D	**>80**	**F**
44	San Bruno/Mansell/US 101 sb off	16	C	27	D
45	San Bruno/Silliman/US 101 sb off	17	B	**78**	**E**
46	Innes Ave/A.Walker Drive	8.5(sb)	A	4	A
47	Innes Ave/Earl St	8.5(sb)	A	9.9 (sb)	A
48	Evans Ave/Jennings St	8	A	33	D
49	Bayshore Blvd/Geneva Ave	20	B	44	D
50	Bayshore/Guadalupe Pkwy	10	A	9	A
51	Bayshore Blvd/Valley Dr	11	B	10	A
52	Bayshore Blvd/Old County Rd	26	C	43	D
53	Sierra Pt/Lagoon Way	8	A	43	D
54	Ingalls St/Palou Ave	8	A	16	B
55	Keith St/Palou Ave	8	A	10	B
56	Third/Williams/Van Dyke	22	C	14	B
57	Third St/Jerrold Ave	21	C	23	C
58	Evans/Napoleon/Toland	32	C	**57**	**E**
59	Harney/Executive Park East	8.8 (eb)	A	18	B
60	Harney/Thomas Mellon	--	--	15	B

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold.**
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
Source: Fehr & Peers.

Under the 2030 No Project conditions, 38 of the 60 intersections would operate at LOS E or LOS F (as compared with three intersections under existing conditions). The intersections include:

- Third/25th
- Third/Cargo
- Third/Evans
- Third/Palou

- Third/Gilman/Paul
- 25th/Pennsylvania
- Cesar Chavez/Pennsylvania/I-280 northbound off-ramp
- Cesar Chavez/Evans
- Bayshore/Paul
- Bayshore/Hester/U.S. 101 southbound off-ramp
- Bayshore/Tunnel
- Bayshore/Bacon/Egbert/Phelps
- Bayshore/Arleta
- Bayshore/Leland
- Bayshore/Visitacion
- Bayshore/Sunnydale
- Tunnel Blanken
- Geneva/U.S. 101 southbound ramps (existing Alana/Beatty)
- Harney/U.S. 101 northbound ramps (existing Alana/Harney/Thomas Mellon)
- Harney/Jamestown
- Crisp/Palou/Griffith
- Arelious Walker/Gilman
- Amador/Cargo/Illinois
- Bayshore/Cortland
- Bayshore/Alemany/Industrial
- Bayshore/U.S. 101 northbound off-ramp/Jerrold
- Bayshore/Silver
- Bayshore/Blanken
- San Bruno/Paul
- San Bruno/Silver
- San Bruno/Mansell/U.S. 101 southbound off-ramp
- San Bruno/Silliman/U.S. 101 southbound ramps
- Evans/Jennings
- Bayshore/Geneva
- Bayshore/Old County
- Sierra Point Parkway/U.S. 101 southbound ramps/Lagoon Way
- Third/Jerrold
- Evans/Napoleon/Toland

As indicated in section 4.3, a number of intersection improvements would be implemented as part of conditions of approval placed on development projects by the Planning Department and the Redevelopment Agency. For the intersections of Cesar Chavez/Evans and Third/Evans, the Hunters Point Shipyard Development Plan's Mitigation Monitoring and Reporting Program included an improvement at the intersection of Cesar Chavez/Evans, which have not been assumed for the 2030 No Project condition due to its infeasibility.

Cesar Chavez/Evans – The Hunters Point Shipyard Redevelopment Plan's mitigation measure identified reconfiguration of the northbound approach of Evans Avenue to Cesar Chavez Street to provide exclusive northbound left and right turn lanes, and changing the signal timing plan to include the exclusive left turn and right turn movements. The measure identified that the southeast corner curb return would require structural modifications to the existing viaduct. DPW, as part of the BTI Project analysis, identified widening of the existing structure supporting the Evans Avenue and Cesar Chavez Street intersection as infeasible.

With the planned construction of a Class II bicycle lane on Cesar Chavez Street, which would remove an eastbound travel lane on Cesar Chavez Street, the operations at this intersection are expected to deteriorate even further. As a result, widening the Evans Avenue viaduct to provide an additional lane on Evans Avenue may not offer a substantial benefit, since the primary constraint would be on Cesar Chavez Street.

Third/Evans – The Hunters Point Shipyard Redevelopment Plan included a mitigation measure at the intersection of Third/Evans which proposed that the southbound left turn lane be eliminated and left turns be rerouted via Phelps Street to Evans Avenue. The mitigation measure also called for signalization of the intersection of Phelps/Evans and removal of on-street parking on Phelps Street and Evans Avenue. The intersection of Phelps Street and Evans Avenue has recently been signalized and on-street parking has been removed along Phelps Street and Evans Avenue, although the removal of the southbound left-turn movement from Third Street to Evans Avenue has not been implemented. Evaluation of intersection operating conditions with the rerouting of southbound left turns indicated that the elimination of the southbound left turn lane and rerouting of traffic to Phelps Street would not substantially improve intersection operating conditions and overall intersection operations would remain at LOS F.

5.1.2 Freeway Operations

The regional freeway and ramp analysis discusses traffic impacts on freeway segments and ramp locations that would be affected by cumulative development in the region. Five freeway locations (10 segments) and 15 ramp junctions along U.S. 101 and I-280 within the study area were analyzed. Transportation Study Appendix E contains a summary of freeway and ramp traffic volumes.

As described in Chapter 4, traffic forecasts were derived from the SF-CHAMP travel demand forecasting model. These forecasts were developed assuming the planned roadway improvements discussed in Section 4.3 would be in place, including the Geneva Avenue extension and the proposed new interchange with Geneva Avenue/Harney Way/U.S. 101. Without the proposed Geneva Avenue Extension and the Geneva/Harney/U.S. 101 interchange improvements, existing roadways serving the Harney interchange (Bayshore Boulevard, Harney Way, Blanken, Alana Way, Tunnel Road) would not be able to accommodate the projected traffic demand and would become oversaturated. Development of a number of the proposed and approved development projects would be constrained, and the existing roadway system would not be able to accommodate full buildout of these developments. Without the interchange the significant levels of congestion on area roadways due to proposed development would be considered a significant impact.

Future traffic demand associated with growth in the region and, in particular the study area, would increase congestion during the 2030 No Project weekday AM and PM peak periods. A discussion of the mainline and ramp analysis results is provided below. Locations operating at LOS E, indicating that the mainline segment is approaching capacity, and locations operating at LOS F, indicating that the segment is exceeding capacity, are noted.

Mainline and Weaving Segments

Table 39 presents the results of the freeway mainline and weaving section analysis for the 2030 No Project conditions. Traffic demand associated with cumulative development in the region would result in poor (i.e., LOS E or LOS F) operating conditions at all analysis segments during the weekday AM and/or PM peak hours. Weekday AM and PM peak hour traffic impacts on these ten freeway mainline segments would be considered significant cumulative impacts under 2030 No Project conditions. Study freeway segments generally operate at acceptable levels of service during the Sunday PM peak hour.

Table 39
Mainline and Weaving Segment LOS
Existing and 2030 No Project Conditions
Weekday AM and (PM) Peak Hour

Mainline Segment	Existing		2030 Cumulative No Project	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101				
NB - Cesar Chavez to Vermont	**E** (D)	**44.6** (26.8)	**F** (**F**)	**>45** (**>45**)
NB – Harney Way to Third/Bayshore	D (**E**)	33.8 (**42.3**)	**F** (**F**)	**>45** (**>45**)
NB – Sierra Point to Harney Way	D (**E**)	33.8 (**42.9**)	**E** (**F**)	**40.5** (**>45**)
SB – I-80 Merge to Cesar Chavez	D (D)	33.4 (33.8)	**F** (**F**)	**>45** (**>45**)
SB – Third/Bayshore to Alana Way	**E** (**E**)	**43.0** (**36.0**)	**F** (**F**)	**>45** (**>45**)
SB – Alana Way to Sierra Point	**E** (**E**)	**42.2** (**36.8**)	**F** (**F**)	**>45** (**>45**)
I-280				
NB – Alemany Off to Alemany On	**E** (C)	**39.1** (23.9)	**F** (D)	**>45** (33.3)
SB – Alemany On to Alemany Off	C (**F**)	23.9 (**>45**)	D (**F**)	34.6 (**>45**)
Weaving Segment	**LOS**	**Service Volume[2] (pc/h)**	**LOS**	**Service Volume (pc/h)**
I-280				
NB – 25th Street to Mariposa Street	**E** (C)	**1,680** (1,350)	**F** (**F**)	**> 1,900** (**>1,900**)
SB – Mariposa Street to 25th Street	B (**E**)	810 (**1,630**)	**E** (**F**)	**1,710** (**>1,900**)

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
3. Segments operating at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Ramp Junctions

Table 40 presents the results of the ramp junction merge (on-ramp) and diverge (off-ramp) analysis for the 2030 No Project conditions. Traffic demand associated with cumulative development in the region would result in poor (i.e., LOS E or LOS F) operating conditions all of the study ramps during the weekday AM and/or PM peak hours, with the exception of U.S. 101 northbound on-ramp from Bayshore Boulevard and the U.S. 101 southbound on-ramp from Alemany/San Bruno.

Table 40
Ramp Junction LOS
Existing and 2030 No Project Conditions
Weekday AM and (PM) Peak Hour

Ramp Location	Existing		2030 No Project	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101				
NB on from Sierra Point Parkway	C (C)	27.0 (29.7)	C **(F)**	27.5 **(>45)**
NB on from Harney Way[2]	C (D)	20.2 (30.0)	**F (F)**	**>45 (>45)**
NB on from Bayshore	D (D)	31.2 (28.6)	C (C)	22.5 (27.9)
NB on from Alemany/Industrial	**E** (D)	**36.4** (30.2)	**F (E)**	**>45 (35.9)**
NB on from Bayshore/Cesar Chavez	**F** (B)	**>45** (19.6)	**F (F)**	**>45** (>45)
SB off to Bayshore/Cesar Chavez	**F (F)**	**>45 (>45)**	**F (F)**	**>45 (>45)**
SB on from Cesar Chavez/Potrero	**F (F)**	**>45 (>45)**	**F (F)**	**>45 (>45)**
SB on from Alemany/San Bruno	C (C)	24.1 (24.5)	D (D)	28.8 (29.6)
SB on from Third/Bayshore	D (C)	30.0 (26.5)	**F** (D)	**>45 (>45)**
SB on from Alana Way[2]	D (C)	29.7 (24.2)	**F** (D)	**>45 (**31.9**)**
SB on from Sierra Point/Lagoon	C (C)	27.7 (26.5)	**F** (C)	**>45 (**22.7**)**
I-280				
NB off to Cesar Chavez	**F** (D)	**>45** (28.4)	**F (F)**	**>45 (>45)**
NB on from Indiana/25th	D (C)	33.4 (27.4)	**F (F)**	**>45 (>45)**
SB off to Pennsylvania/25th	C **(E)**	23.6 **(36.7)**	**E (F)**	**37.0 (>45)**
SB on from Pennsylvania/25th	C **(E)**	22.9 **(38.5)**	**E (F)**	**36.3 (>45)**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

The following ramps would operate at LOS E or LOS F during the Sunday PM peak hour:

- U.S. 101 northbound on-ramp from Bayshore Boulevard/Cesar Chavez (LOS F)
- U.S. 101 southbound off-ramp to Bayshore Boulevard/Cesar Chavez (LOS E)

Traffic impacts at these ramp junctions would be considered significant cumulative impacts under 2030 No Project conditions. Providing additional on-ramp lanes would simply increase the volume of traffic entering the freeway mainline segment, and may exacerbate conditions. Further, increasing mainline capacity is not feasible, as discussed above. To be effective, reducing impacts at off-ramps would require not only additional lanes on the off-ramps, but additional right-of-way on the mainline approaching the off-ramp, which is not feasible as discussed above. Therefore, cumulative impacts to ramp junctions would be considered *significant and unavoidable*.

Table 41 presents the results of the freeway diverge (off-ramp) queue storage analysis for the 2030 No Project conditions. This analysis was conducted to determine whether queues at ramp terminal intersections would back onto freeway mainline segments. Under 2030 No Project conditions, queues may extend onto study freeway mainline segments during the weekday AM and PM peak hours at the following five off-ramps:

- U.S. 101 northbound off-ramp to Geneva/Harney (PM)
- U.S. 101 northbound off-ramp to Bayshore/Cesar Chavez (AM)
- U.S. 101 southbound off-ramp to Alana Way (AM and PM)
- U.S. 101 southbound off-ramp to Sierra Point Parkway/Lagoon Way (AM)
- I-280 northbound off-ramp to Cesar Chavez (AM)

Table 41
Freeway Diverge Queue Storage
Existing and 2030 No Project Conditions
Weekday AM and (PM) Peak Hour

Ramp Location	Ramp Storage	Existing	2030 No Project
		95th % Queue[1]	95th % Queue
U.S. 101			
NB off to Harney Way[2]	2,800	< 100 (<100)	1,725 **(Spillback)**
NB off to Bayshore/Cesar Chavez	750	400 (375)	**Spillback** (525)
SB off to San Bruno/Silliman	600	225 (225)	175 (425)
SB off to San Bruno/Mansell	650	< 100 (150)	< 100 (350)
SB off to Bayshore/Hester	1,700	225 (325)	275 (125)
SB off to Alana Way[2]	1,000	< 100 (<100)	**Spillback (Spillback)**
SB off to Sierra Point/Lagoon	1,250	< 100 (<100)	**Spillback** (1,000)
I-280			
NB off to Cesar Chavez	2,500	1,500 (650)	**Spillback** (900)
SB off to Pennsylvania/25th	900	< 100 (<100)	< 100 (875)

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.
Source: Fehr & Peers.

During the Sunday PM peak hour, vehicle queues may also back onto freeway mainline at the following location:

- U.S. 101 southbound off-ramp to Alana Way

The analysis described above is based on travel demand volumes, and is not necessarily constrained to the amount of traffic that may actually arrive at ramp terminal intersections. As described earlier, many freeway segments would be congested, operating below free-flow speeds during peak hours, reducing the amount of traffic that can reach the off-ramp terminal intersections. Therefore, actual conditions may be better than presented in **Table 41.** Further, since mainline traffic would likely be moving at relatively slow (congested) speeds, safety and capacity issues caused by vehicle queues extending onto freeway mainline segments during peak hours are reduced compared to the same condition when freeway mainline segments are operating at higher free-flow speeds. However, potential queues spilling back onto freeway mainline segments would be considered significant cumulative impacts.

5.2 TRANSIT IMPACTS

This section describes the transit impacts associated with the 2030 No Project conditions. Transit impacts were evaluated for the weekday AM and PM peak hours, similar to the analysis conducted for traffic impacts. The transit impacts analysis focuses both on local transit service provided by Muni and on regional service provided by BART, Golden Gate Transit, SamTrans, Caltrain, and the Water Emergency Transit Authority (WETA).

The analysis of impacts to local Muni transit service was conducted at the same cordon and screenline locations described in the Project setting chapter (Chapter 3). As shown in **Table 42,** ridership on Muni cordons is expected to increase substantially under 2030 No Project conditions, as compared to existing conditions. During the AM peak hour, the North cordon is expected to exceed its capacity by 17 percent in the inbound direction and 7 percent in the outbound direction (relative to downtown). The West cordon is expected to exceed the capacity utilization standard in the inbound direction by 7 percentage points. In the PM peak hour, the North cordon is expected to be over-capacity by 16 percent in the inbound direction and exceed the 85 percent utilization standard by 7 percentage points in the outbound direction.

The large increases in north-south Muni ridership in the study area would be due to the large amount of development anticipated along the Third Street corridor, including Brisbane Baylands, Mission Bay, and the Central Waterfront/Eastern Neighborhoods as well as anticipated completion of the Central Subway project, which is expected to increase ridership on the T-Third light rail route. Since the East, North, and West cordons would all operate at more than the capacity utilization standard in one or more peak hours, there would be significant transit impacts at these cordons under 2030 No Project conditions.

Table 42
Muni Ridership and Capacity Utilization at Study Area Cordons
Existing and 2030 No Project Conditions – Weekday AM and PM Peak Hours

Cordon/Peak Hour	Existing		2030 No Project [1]	
	Ridership	Capacity Utilization	Ridership	Capacity Utilization
AM Peak Hour				
East of Third Cordon				
Inbound	686	40%	1,353	79%
Outbound	319	19%	1,577	92%
North Cordon				
Inbound	859	41%	2,065	117%
Outbound	754	36%	1,901	107%
West Cordon				
Inbound	1,348	68%	2,053	92%
Outbound	722	36%	1,536	69%
PM Peak Hour				
East of Third Cordon				
Inbound	389	23%	1,382	81%
Outbound	253	15%	848	49%
North Cordon				
Inbound	846	41%	2,049	116%
Outbound	626	30%	1,628	92%
West Cordon				
Inbound	711	36%	1,196	54%
Outbound	824	42%	1,249	56%

Note:
1. Year 2030 No Project analysis reflects implementation of TEP recommendations for lines serving the study area. 19-Polk will no longer serve the study area, but will be replaced by the 48-Quintara-24th Street, and the 56-Rutland will be eliminated.
Source: SFMTA, Fehr & Peers.

Table 43 presents the 2030 No Project conditions transit ridership at the Muni downtown screenlines. Although ridership through the screenlines is expected to increase by approximately 30 percent between existing conditions and year 2030, transit capacity is also expected to increase, such that the expected transit ridership would not exceed Muni's 85 percent capacity utilization standard on any of the downtown screenlines.

Table 43
Muni Ridership and Capacity Utilization at Downtown Screenlines
Existing and 2030 No Project Conditions – Weekday AM and PM Peak Hours

Cordon/Peak Hour	Existing		2030 No Project [1]	
	Ridership	Capacity Utilization	Ridership	Capacity Utilization
AM Peak Hour				
Northeast	1,882	50%	3,008	78%
Northwest	7,434	65%	8,949	75%
Southeast	4,248	67%	7,248	71%
Southwest	6,627	76%	7,674	76%
Total All Screenlines	20,191	67%	26,879	74%
PM Peak Hour				
Northeast	1,886	52%	3,140	67%
Northwest	6,621	65%	8,155	70%
Southeast	4,668	66%	7,733	78%
Southwest	7,434	77%	8,829	82%
Total All Screenlines	20,609	68%	27,857	75%

Source: SFMTA, Planning Department, AECOM, Fehr & Peers.

Table 44 presents the ridership and capacity utilization for existing and 2030 No Project conditions at the regional screenlines. The analysis of regional transit impacts under the 2030 No Project conditions shows that during the AM peak hour, the overall transit travel demand to the East Bay would be approximately 50 percent higher than the total seated capacity and the travel demand to the North Bay would be just over the expected capacity. The BART system would be the most heavily congested of the transit providers, operating at 85 percent above its seated hourly capacity in the AM peak hour through the transbay tube. Travel on BART between the Project site and the South Bay would remain below the total capacity under 2030 No Project conditions.

Table 44
Ridership and Capacity Utilization at Regional Screenlines
Existing and 2030 No Project Conditions – Weekday AM and PM Peak Hours

Cordon/Peak Hour	Existing		2030 No Project	
	Ridership	Capacity Utilization	Ridership	Capacity Utilization
AM Peak Hour				
East Bay				
BART	18,064	123%	36,202	185%
AC Transit	1,670	55%	3,347	61%
Ferries	667	56%	1,971	83%
subtotal	20,401	108%	41,520	151%
North Bay				
Golden Gate Transit	1,510	57%	2,623	106%
Ferries	949	56%	1,647	97%
subtotal	2,459	56%	4,268	102%
South Bay				
BART	11,185	105%	12,409	89%
Caltrain	2,128	65%	4,454	70%
SamTrans	686	65%	794	75%
	--	--	152	51%
Subtotal	13,999	94%	17,809	82%
Total All Screenlines	*36,859*	*96%*	*63,597*	*119%*
PM Peak Hour				
East Bay				
BART	16,985	120%	30,241	154%
AC Transit	2,517	60%	4,485	68%
Ferries	702	46%	2,147	79%
subtotal	20,204	102%	36,873	128%
North Bay				
Golden Gate Transit	1,397	63%	2,513	114%
Ferries	906	53%	1,630	96%
subtotal	2,303	59%	4,143	106%
South Bay				
BART	9,545	92%	10,631	76%
Caltrain	1,986	61%	3,959	62%
SamTrans	575	61%	362	39%
Ferries	--	--	75	25%
Subtotal	12,106	83%	15,027	69%
Total All Screenlines	***34,613***	***90%***	***56,043***	***103%***

Source: SFMTA, AECOM, Fehr & Peers.

Under 2030 No Project, weekday PM peak hour conditions would be slightly less congested than during the AM peak hour, with overall transit travel demand to the East Bay exceeding capacity by 28 percent. Similar to the AM peak hour, BART between San Francisco and the East Bay would be the most heavily congested system, operating at 55 percent above its capacity. Travel between San Francisco and the North Bay would exceed available capacity by six percent, and travel between San Francisco and the South Bay would remain within the available capacity.

Since the East Bay and North Bay regional screenlines would operate at more than the capacity utilization standard, there would be significant cumulative transit impacts at these regional screenlines under the No Project conditions.

Transit travel times would also increase under 2030 No Project conditions due to increased traffic congestion and transit ridership associated with cumulative development (including development that would occur at the project site under the currently approved Hunters Point Shipyard Development Plan). A discussion of potential Project impacts to transit travel times is included in Chapter 6, section 6.2.1.

Chapter 6
YEAR 2030 PROJECT IMPACT ANALYSIS

6.1 TRAFFIC IMPACTS

Consistent with the Significance Criteria presented in section 4.4, intersections where the Project, Project Variants, or Project Alternatives would result in a change in intersection operations from LOS D or better under the 2030 No Project condition to LOS E or LOS F, or from LOS E to LOS F, with the proposed Project are identified as Project impacts. At intersections that would operate at LOS E or LOS F under 2030 No Project conditions, and would continue to operate at LOS E or LOS F under Project conditions, the Project trips were reviewed to determine whether the increase would contribute considerably to critical movements operating at LOS E or LOS F. Transportation Study Appendix E includes the percent contributions of the resulting traffic increases at the critical movements at intersections operating at LOS E or LOS F under 2030 No Project conditions.

For freeway mainline and ramp analyses, locations where the Project, Project Variants, or Project Alternatives would result in a change from LOS D or better under 2030 No Project conditions to LOS E or LOS F, or from LOS E or LOS F, with the proposed Project are identified as Project impacts. At locations that would operate at LOS E or LOS F under 2030 No Project conditions, and would continue to operate at LOS E or LOS under Project conditions, the Project trips, as a percentage of total traffic volumes on the facility were reviewed to determine whether the increase would contribute considerably to total volumes on the facility. Transportation Study Appendix G includes the freeway mainline and ramp analyses and the percent contributions calculations.

6.1.1 Project and Project Variants

Overview

The travel demand analysis presented above and the number of vehicle trips assumed in the traffic impact analysis reflects implementation of the Project TDM Plan to encourage transit use and discourage use of single-occupant vehicles. The results of the traffic impact analysis presented in the traffic and freeway analysis below indicate that implementation of the Project would result in significant increases in traffic volumes, and at some locations impacts would be significant and unavoidable. The Project also would make a significant contribution to cumulative impacts at some locations. To minimize the potential for an increase in Project-generated vehicles and the Project's contribution to significant cumulative impacts, implementation of the Project TDM Plan would be required.

The final TDM Plan has not been formally approved yet and therefore Project Mitigation Measure 1 is required to ensure the final TDM Plan will be prepared and implemented. Thus, Mitigation Measure 1 below requires preparation, approval, and implementation of the final TDM Plan.

> ***Project Mitigation Measure 1***: The Project Applicant shall prepare and implement a final TDM plan, which shall include the following elements:

- Visitor Variable, Market-Rate Parking Pricing
- Maximum Permitted Parking Ratios
- Flexible Parking Management Strategies
- Unbundled Residential Parking
- Transit Strategies and Support Strategies
- Central Transit Hub
- Enhanced Transit Service and Bicycle Facilities
- Bicycle Support Facilities
- Wayfinding Signs
- EcoPass for Residents
- Carshare Services
- Employee TDM Programs
    - Information Boards/Kiosks
    - In-building Real-Time transit monitors with sightlines of transit hubs
    - Commuter Benefits
    - Employee EcoPass
    - Carpool/Vanpools
    - Guaranteed Ride Home Program
    - Compressed Work Weeks, Flex Time, and Telecommuting
- CP-HPS Transportation Management Association
- On-Site Transportation Coordinator and Website
- Targeted Marketing
- Monitoring of Transportation Demand
- Monitoring Effectiveness of Congestion-Reducing and Traffic-Calming Efforts

The final TDM plan shall be approved as part of the Disposition and Development Agreement (DDA).

With implementation of the Project Mitigation Measure 1, alternative modes would be encouraged, the use of single-occupant vehicles would be discouraged, and the impact of additional vehicles generated by the Project would be lessened. However, as described in Impact discussions below, the Project would still result in significant and unavoidable impacts on traffic and transit operations, and would still make considerable contributions to cumulative impacts related to substantial increases in traffic. Thus, the Project and Project's contribution to traffic would remain *significant and unavoidable.*

Intersection Operations

Project vehicle trips at the 60 study intersection are presented on **Figure 31A** and **Figure 31B** for the weekday AM and PM peak hours, and on **Figure 31C** and **Figure 31D** for the Sunday PM peak hour conditions. Future 2030 Cumulative (including Project trips) traffic volumes at the 60 study intersection are presented on **Figure 32A** and **Figure 32B** for the weekday AM and PM peak hours, and on **Figure 32C** and **Figure 32D** for the Sunday PM peak hour conditions. Transportation Study Appendix E contains intersection turning movement volume summaries.

Tables 45 and 46 on pages 167 to 172 present a comparison of the intersection LOS analysis for the existing, 2030 No Project, and 2030 Project and Project Variant conditions for the weekday AM and PM peak hours, respectively. **Table 47** on pages 173 to 175 presents this comparison for Sunday PM peak hour conditions. **Table 48** on pages 176 to 178 presents the summary table of Project traffic impacts for Project, Project Variants, and Alternatives to the Project.

On **Table 48**, Project impacts (PI) were identified where the Project would result in a change in intersection operations from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives, or from LOS E under 2030 No Project conditions to LOS F with the Project, Project Variants or Alternatives. In addition, where the Project, Project Variants or Project Alternatives were determined to contribute significantly to intersections that would be operating at LOS E or LOS F under 2030 No Project conditions, this was also determined to be a Project impact, and noted as Significant Contribution/Project Impact (SC/PI). Where the Project would *not* contribute significantly to intersections operating at LOS E or LOS F under 2030 No Project conditions, this was noted as No Significant Contribution (NSC).

For 203 No Project conditions, where intersection operations change from LOS D or better under existing conditions to LOS E or LOS F under 2030 No Project conditions, or from LOS E under existing conditions to LOS F under 2030 No Project conditions this was identified as a No Project Impact (NP Impact).

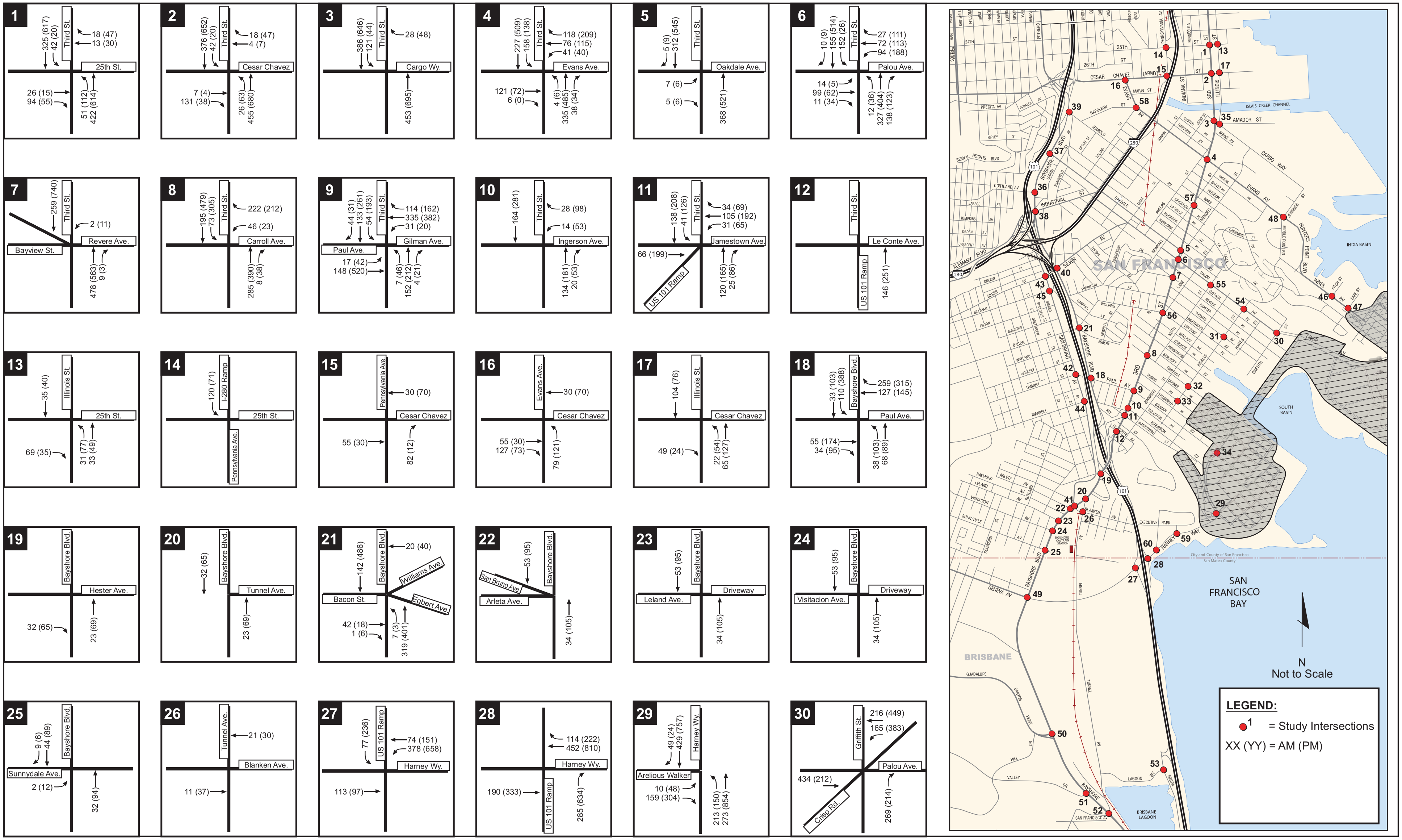
In general, with the addition of Project-generated vehicle trips to the study area roadway network congestion levels would increase. However, due to project roadway improvements, operating conditions at some locations would improve over year 2030 No Project conditions. The number of study area intersections that would operate at LOS E or LOS F conditions would remain at 33 intersections during the AM peak hour and 38 intersections during the PM peak hour.

Because the HCM delay calculations break down in typical LOS F conditions, delays above 80 seconds per vehicle are simply reported as >80. This makes a comparison between scenarios difficult. For these cases, an additional measure was calculated, the volume to capacity (v/c) ratio. When intersections are operating at failing or breakdown conditions they lack the capacity to accommodate any more vehicles. One way of understanding the magnitude of the intersections lack of capacity is to calculate its v/c ratio. Intersections with a v/c ratio below 1.0 for the most part operate acceptably. As the ratio is increased, breakdown conditions will appear as there is more demand (vehicles) than capacity. Three ranges of v/c ratio have been identified in **Figure 33 and Figure 34**, for the AM and PM peak hours, respectively; less than 1.0, 1.0-2.0, and greater than 2.0, respectively, to provide for a useful comparison of the relative magnitudes of congestion at intersections operating at LOS F. The figures indicate where the 2030 No Project and Project v/c are in a different range when compared.

Project-Specific Traffic Impacts

Under Project conditions, a total of 39 of the 60 study intersections would operate at LOS E or LOS F conditions during the weekday AM or PM, or Sunday PM peak hours. At 10 of the 39 intersections the Project would result in Project-specific impacts (i.e., Project trips would cause intersections expected to operate at LOS D or better under 2030 No Project conditions to operate at LOS E or F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions). A discussion of traffic operations at these 10 intersections, and potential mitigation measures, follows:

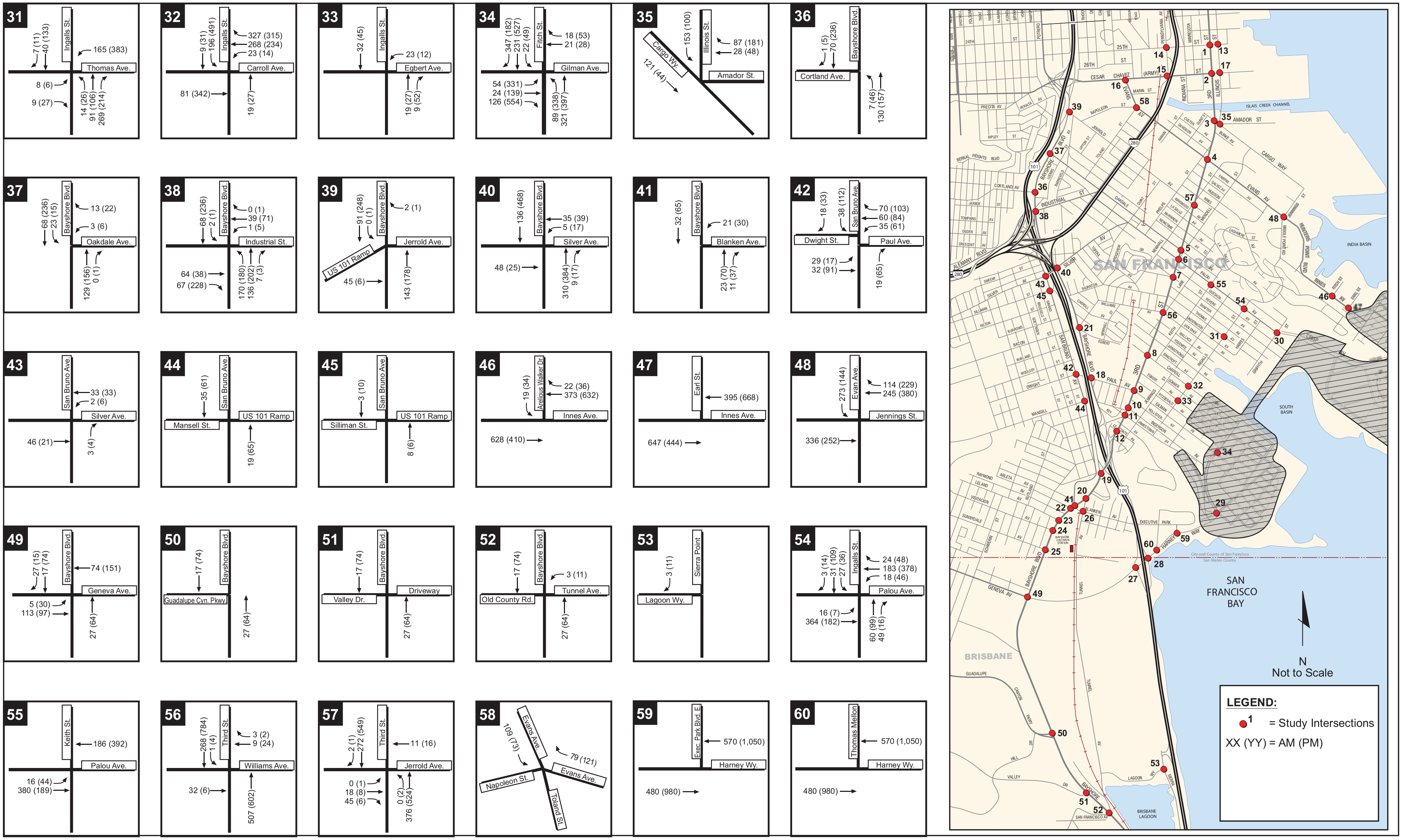
5. Third/Oakdale – At the signalized intersection of Third/Oakdale, the intersection operating conditions would worsen in the PM peak hour from LOS C under 2030 No Project conditions to LOS E with the Project. The degradation in level of service would be primarily due to forecasted substantial traffic volume increases on Third Street. Due to the presence of the Third Street light rail, space for additional travel lanes could not be taken from the center median. Parking is generally permitted on either side of the street; however, it is not permitted at the intersections. Instead, sidewalks are extended to increase the pedestrian waiting area at the intersection and reduce the pedestrian crossing distances.



CP-HPS Phase II Development Plan Transportation Study

PROJECT TRIPS - WEEKDAY

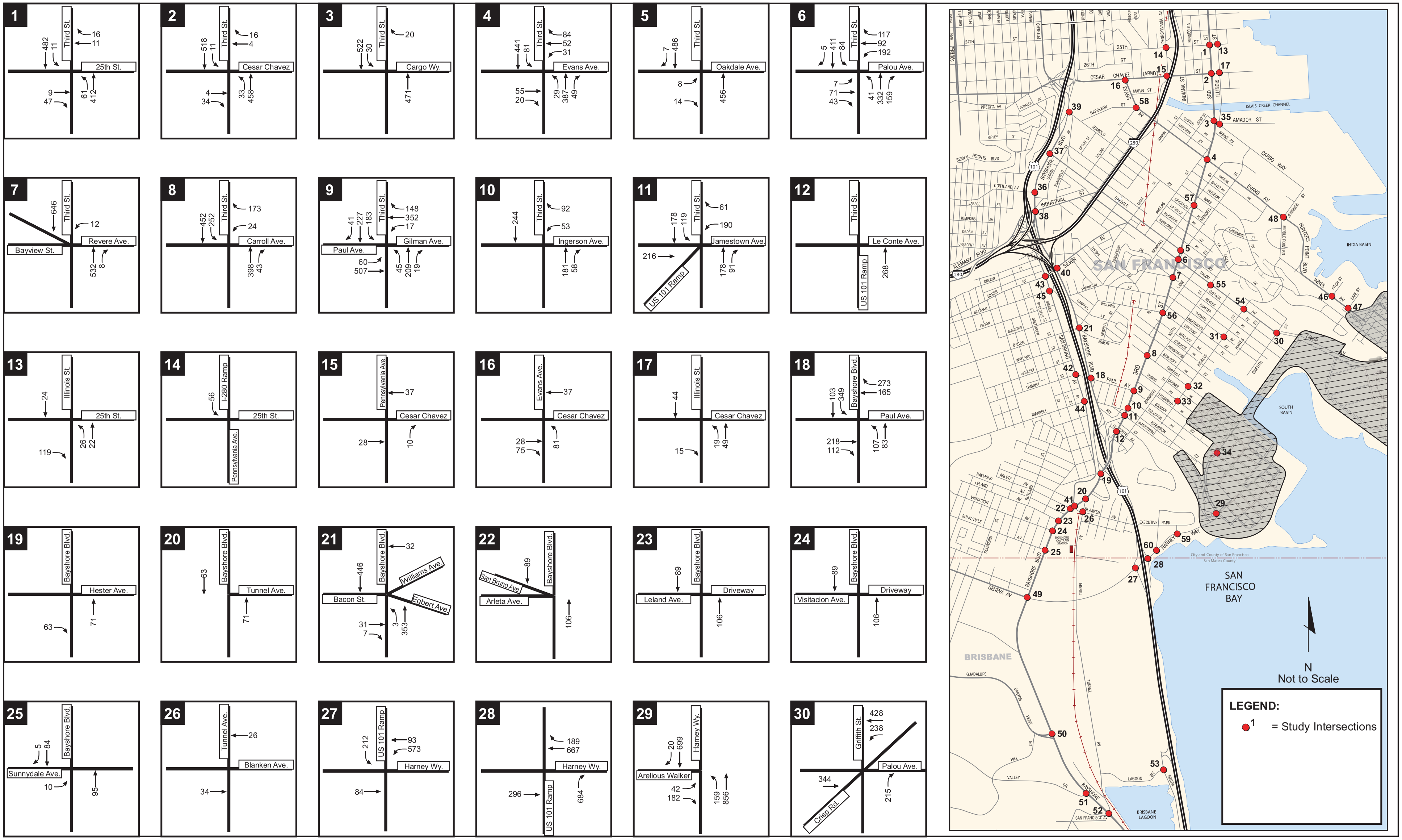
FIGURE 31A



CP-HPS Phase II Development Plan Transportation Study

PROJECT TRIPS - WEEKDAY

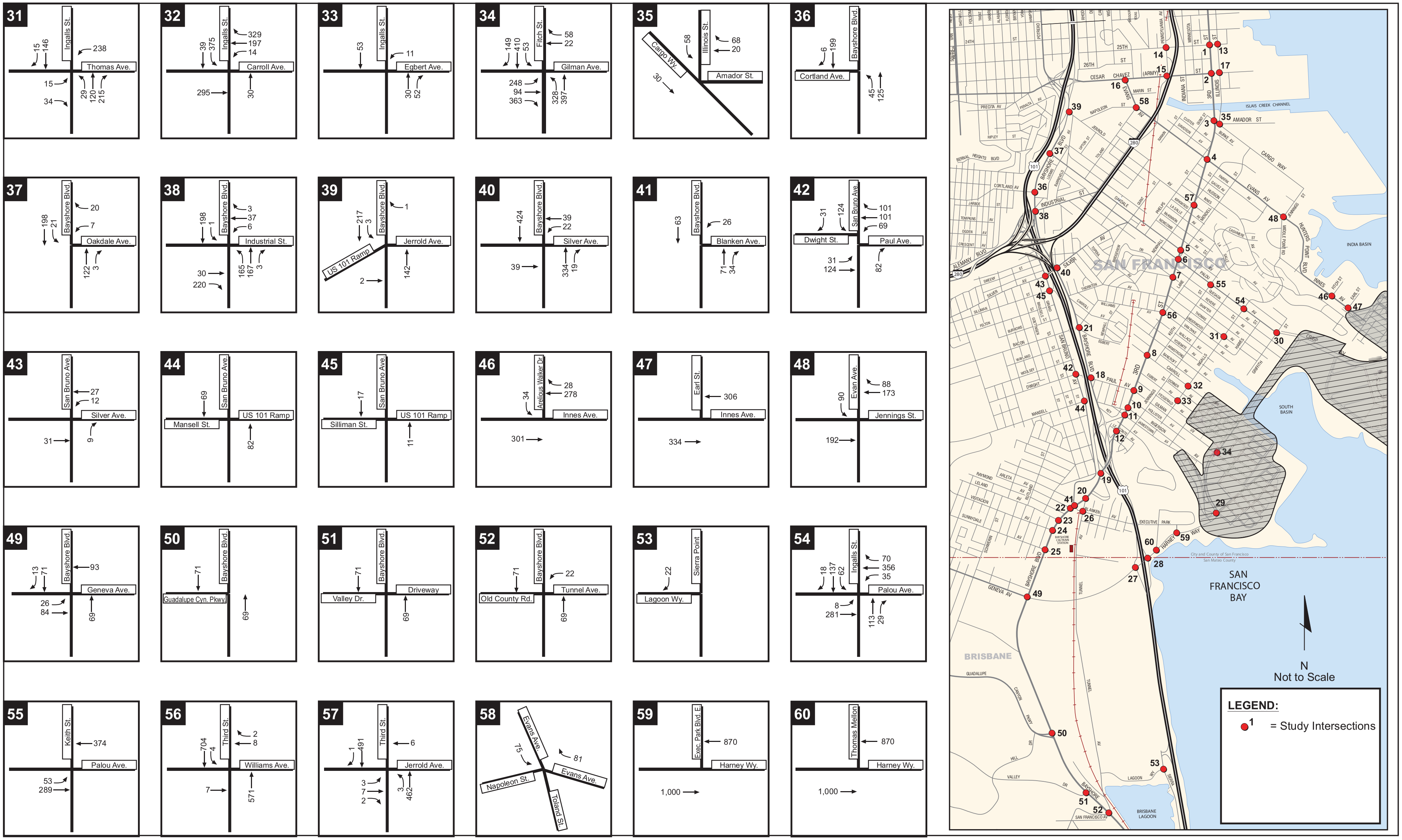
FIGURE 31B



CP-HPS Phase II Development Plan Transportation Study

PROJECT TRIPS - SUNDAY

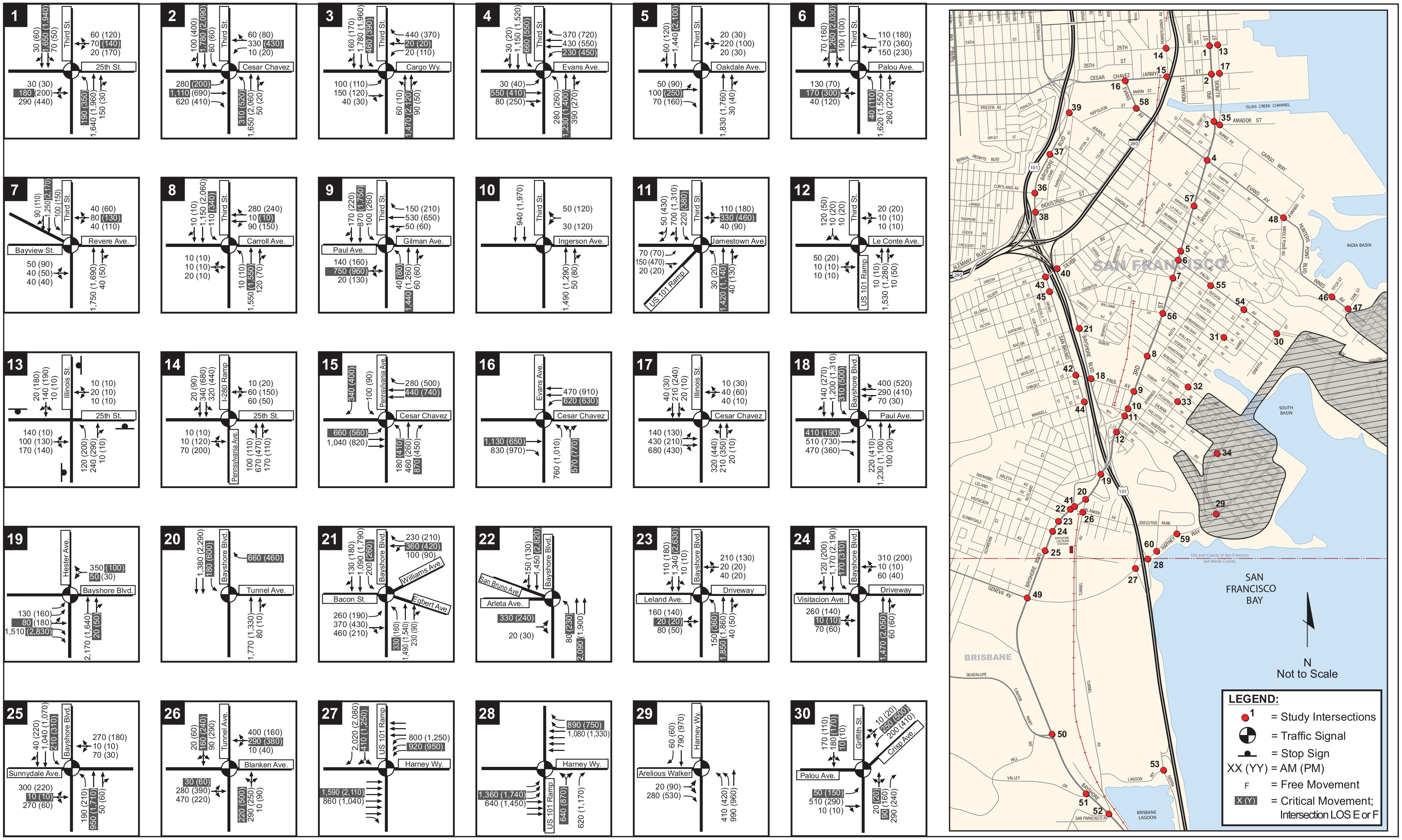
FIGURE 31C



CP-HPS Phase II Development Plan Transportation Study

PROJECT TRIPS - SUNDAY

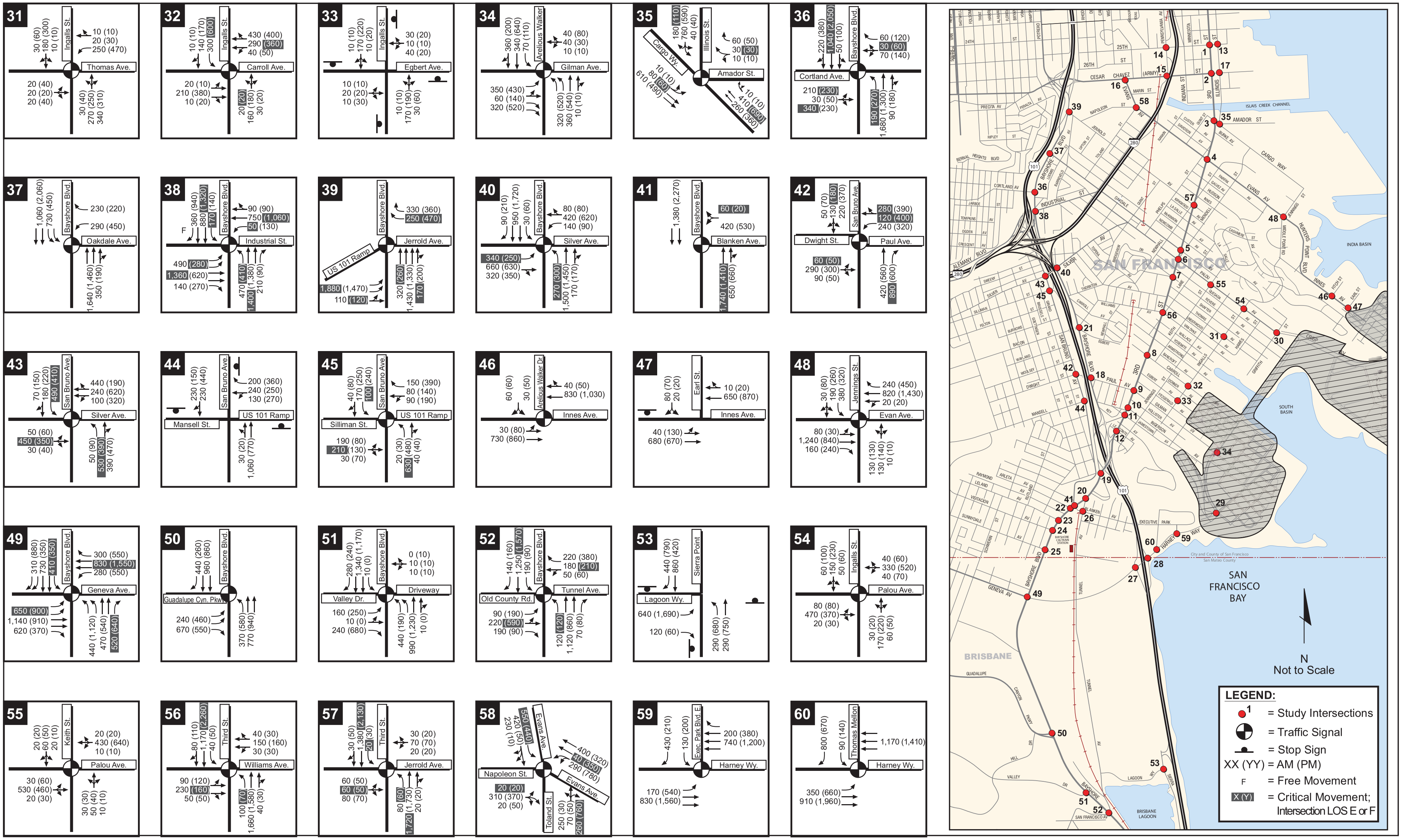
FIGURE 31D



CP-HPS Phase II Development Plan Transportation Study

CUMULATIVE CONDITIONS WEEKDAY
PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS

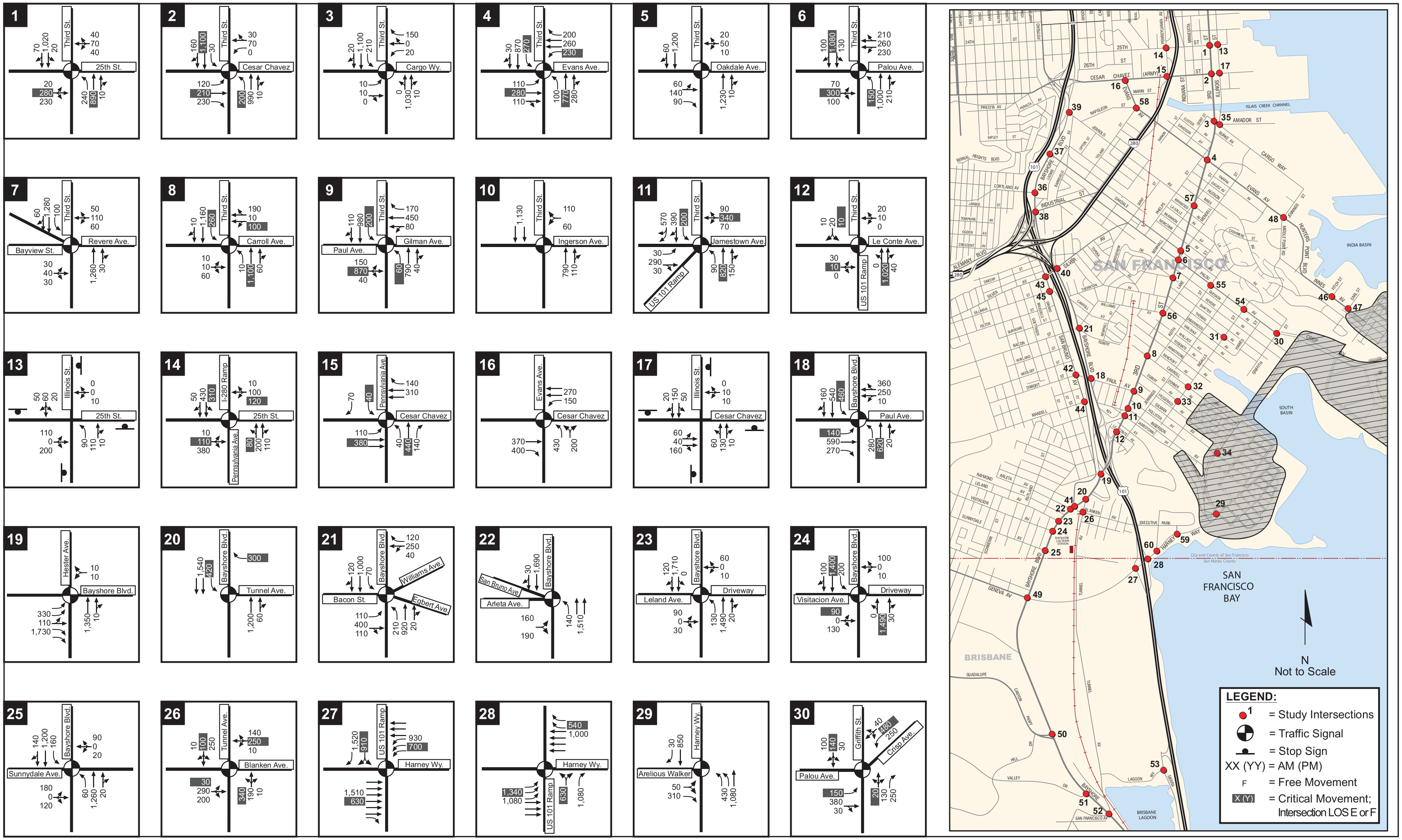
FIGURE 32A



CP-HPS Phase II Development Plan Transportation Study

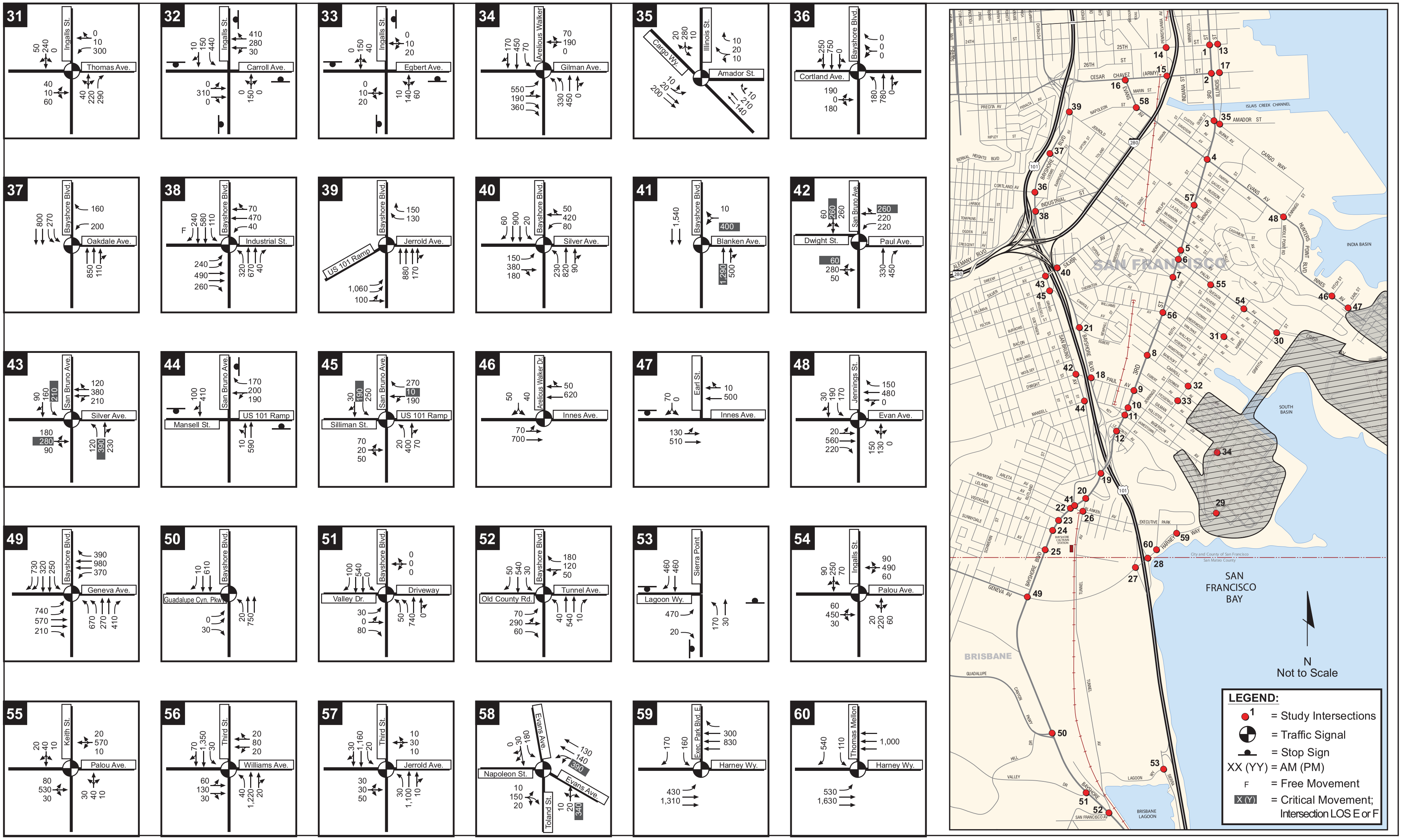
CUMULATIVE CONDITIONS WEEKDAY PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS

FIGURE 32B



CUMULATIVE CONDITIONS SUNDAY PM PEAK HOUR
(NO FOOTBALL GAME) TRAFFIC VOLUMES AND LANE CONFIGURATIONS

FIGURE 32C



CUMULATIVE CONDITIONS SUNDAY PM PEAK HOUR (NO FOOTBALL GAME) TRAFFIC VOLUMES AND LANE CONFIGURATIONS

FIGURE 32D

Table 45
Intersection LOS
Project and Project Variants – Weekday AM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project (Alt 1)		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Third St/25th St	14	B	**>80/1.43**	**F**	**>80/1.54**	**F**	**>80/1.90**	**F**	**>80/1.53**	**F**
2	Third St/Cesar Chavez St	36	D	**>80/1.61**	**F**	**>80/1.63**	**F**	**>80/1.70**	**F**	**>80/1.63**	**F**
3	Third St/Cargo Way	23	C	**>80/1.36**	**F**	**>80/1.90**	**F**	**>80/1.98**	**F**	**>80/1.90**	**F**
4	Third St/Evans Ave	35	C	**>80/1.41**	**F**	**>80/1.43**	**F**	**>80/1.59**	**F**	**>80/1.44**	**F**
5	Third St/Oakdale Ave	17	B	21	C	25	C	26	C	24	C
6	Third St/Palou Ave	15	B	**>80/1.77**	**F**	**>80/1.91**	**F**	**>80/2.22**	**F**	**>80/1.97**	**F**
7	Third St/Revere Ave	19	B	35	C	51	D	**65/0.91**	**E**	46	D
8	Third St/Carroll Ave	12	B	12	B	23	C	24	C	19	B
9	Third St/Paul Ave	27	C	**>80/1.23**	**F**	**>80/2.00**	**F**	**>80/2.02**	**F**	**>80/1.89**	**F**
10	Third St/Ingerson Ave	5	A	5	A	6	A	7	A	6	A
11	Third St/Jamestown Ave	13	B	29	C	**>80/1.03**	**F**	**76/1.02**	**E**	**77/0.99**	**E**
12	Third/Le Conte/US 101 nb off	11	B	50	D	50	D	50	D	50	D
13	25th St/Illinois St	7	A	14	B	13	B	15	B	13	B
14	25th St/Pennsylvania Ave	9	A	26	D	29	C	30	C	29	C
15	Cesar Chavez/Penns/I-280	**78**	**E**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**
16	Cesar Chavez St/Evans Ave	21	C	**>80/1.92**	**F**	**>80/1.91**	**F**	**>80/1.96**	**F**	**>80/1.92**	**F**
17	Cesar Chavez St/Illinois St	13	B	25	C	34	C	27	C	24	C
18	Bayshore Blvd/Paul Ave	21	C	**61/1.56**	**E**	**>80/2.64**	**F**	**>80/2.69**	**F**	**>80/2.63**	**F**
19	Bayshore/Hester/US 101 sb off	28	C	**>80/1.34**	**F**	**>80/1.36**	**F**	**>80/1.36**	**F**	**>80/1.36**	**F**
20	Bayshore Blvd/Tunnel Ave	19	B	**>80/2.00**	**F**	**>80/2.05**	**F**	**>80/2.05**	**F**	**>80/2.05**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.

Source: Fehr & Peers.

Table 45 (continued)
Intersection LOS
Project and Project Variants – Weekday AM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
21	Bayshore Blvd/Bacon St	**76**	**E**	**>80/4.05**	**F**	**>80/4.08**	**F**	**>80/4.18**	**F**	**>80/4.18**	**F**
22	Bayshore Blvd/Arleta St	25	C	**>80/1.21**	**F**	**>80/1.23**	**F**	**>80/1.22**	**F**	**>80/1.23**	**F**
23	Bayshore Blvd/Leland Ave	21	C	**>80/1.24**	**F**	**>80/1.26**	**F**	**>80/1.25**	**F**	**>80/1.26**	**F**
24	Bayshore Blvd/Visitacion Ave	17	B	**>80/1.55**	**F**	**>80/1.56**	**F**	**>80/1.56**	**F**	**>80/1.56**	**F**
25	Bayshore Blvd/Sunnydale Ave	20	C	**>80/1.32**	**F**	**>80/1.34**	**F**	**>80/1.33**	**F**	**>80/1.34**	**F**
26	Tunnel Ave/Blanken	11	B	43	D	**>80/1.06**	**F**	**>80/1.06**	**F**	**>80/1.06**	**F**
27	Geneva/U.S. 101 SB Ramps [3]	10	A	**>80/2.17**	**F**	**>80/2.31**	**F**	**>80/2.34**	**F**	**>80/2.31**	**F**
28	Harney/U.S. 101 NB Ramps [3]	8	A	**>80/1.20**	**F**	**>80/1.35**	**F**	**>80/1.39**	**F**	**>80/1.35**	**F**
29	Harney Way/Jamestown Ave [4]	8	A	12	B	20	B	25	B	22	B
30	Crisp Ave/Palou Ave [4]	11.4 (nb)	B	**57/0.99**	**E**	44	D	**>80/1.12**	**F**	42	D
31	Ingalls St/Thomas Ave [4]	11.3 (wb)	B	19.0 (wb)	C	22	C	29	C	22	C
32	Ingalls St/Carroll Ave [4]	8	A	15	B	28	C	31	C	28	C
33	Ingalls St/Egbert Ave	8	A	8	A	9	A	9	A	9	A
34	A.Walker/Gilman Ave [4]	9.1 (sb)	A	**>60 (eb)**	**F**	30	C	30	C	31	C
35	Amador St/Cargo Way	28	C	**65/1.06**	**E**	54	D	**74/1.10**	**E**	**56/1.02**	**E**
36	Bayshore Blvd/Cortland Ave	19	B	37	D	**>80/1.18**	**F**	**>80/1.19**	**F**	**>80/1.18**	**F**
37	Bayshore Blvd/Oakdale Ave	30	C	43	D	51	D	52	D	50	D
38	Bayshore/Alemany/Industrial	44	D	**>80/1.00**	**F**	**>80/1.05**	**F**	**>80/1.06**	**F**	**>80/1.04**	**F**
39	Bayshore/US 101 nb off to Cesar	43	D	**74/0.91**	**E**	**>80/0.94**	**F**	**>80/0.94**	**F**	**>80/0.93**	**F**
40	Bayshore Blvd/Silver Ave	50	D	**>80/1.58**	**F**	**>80/1.70**	**F**	**>80/1.75**	**F**	**>80/1.75**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 45 (continued)
Intersection LOS
Project and Project Variants – Weekday AM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore Blvd/Blanken Ave	12	B	**>80/1.48**	**F**	**>80/1.51**	**F**	**>80/1.51**	**F**	**>80/1.51**	**F**
42	San Bruno Ave/Paul Ave	20	B	**>80/1.21**	**F**	**>80/1.23**	**F**	**>80/1.25**	**F**	**>80/1.23**	**F**
43	San Bruno Ave/Silver Ave	75	E	**>80/1.43**	**F**	**>80/1.41**	**F**	**>80/1.44**	**F**	**>80/1.41**	**F**
44	San Bruno/Mansell/101 sb off	17	C	**>80/1.08**	**F**	**>80/1.11**	**F**	**>80/1.11**	**F**	**>80/1.11**	**F**
45	San Bruno/Silliman/101 sb off	24	C	**>80/1.08**	**F**	**>80/1.08**	**F**	**>80/1.08**	**F**	**>80/1.07**	**F**
46	Innes Ave/A.Walker Drive [4]	8.6 (sb)	A	5	A	6	A	5	A	5	A
47	Innes Ave/Earl St	8.5 (sb)	A	17.3 (sb)	C	13.3 (sb)	B	15.0 (sb)	B	15.0 (sb)	B
48	Evans Ave/Jennings St	9	A	**>80/1.96**	**F**	28	C	**61/1.17**	**E**	30	C
49	Bayshore Blvd/Geneva Ave	24	C	**>80/1.39**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**
50	Bayshore/Guadalupe Pkwy	16	B	21	C	21	C	21	C	21	C
51	Bayshore Blvd/Valley Dr	23	C	20	C	20	C	20	C	20	C
52	Bayshore Blvd/Old County Rd	28	C	40	D	39	D	39	D	39	D
53	Sierra Pt/Lagoon Way	12	B	**>80/1.85**	**F**	**>80/1.85**	**F**	**>80/1.85**	**F**	**>80/1.85**	**F**
54	Ingalls St/Palou Ave [4]	9	A	16	B	18	B	23	C	18	B
55	Keith St/Palou Ave [4]	9	A	10	A	9	A	9	A	10	A
56	Third/Williams/Van Dyke	22	C	18	B	30	C	35	D	29	C
57	Third St/Jerrold Ave	22	C	49	D	**>80/0.74**	**F**	**>80/0.79**	**F**	**>80/0.73**	**F**
58	Evans/Napoleon/Toland	37	D	**>80/1.45**	**F**	**>80/1.50**	**F**	**>80/1.53**	**F**	**>80/1.50**	**F**
59	Harney/Executive Park East	9.1 (sb)	A	25	C	25	C	25	C	25	C
60	Harney/Thomas Mellon	--	--	30	C	34	C	35	C	34	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 46
Intersection LOS
Project and Project Variants – Weekday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project (Alt 1)		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Third St/25th St	16	B	**>80/2.45**	**F**	**>80/2.92**	**F**	**>80/3.04**	**F**	**>80/2.93**	**F**
2	Third St/Cesar Chavez St	31	C	**>80/1.56**	**F**	**>80/1.76**	**F**	**>80/1.82**	**F**	**>80/1.75**	**F**
3	Third St/Cargo Way	20	B	**>80/1.44**	**F**	**>80/1.74**	**F**	**>80/1.83**	**F**	**>80/1.74**	**F**
4	Third St/Evans Ave	34	C	**>80/1.36**	**F**	**>80/1.53**	**F**	**>80/1.59**	**F**	**>80/1.56**	**F**
5	Third St/Oakdale Ave	19	B	30	C	**60/1.12**	**E**	**67/1.14**	**E**	**60/1.12**	**E**
6	Third St/Palou Ave	30	C	**>80/4.71**	**F**	**>80/5.99**	**F**	**>80/5.97**	**F**	**>80/6.07**	**F**
7	Third St/Revere Ave	31	C	37	D	**>80/1.14**	**F**	**>80/1.20**	**F**	**>80/1.14**	**F**
8	Third St/Carroll Ave	14	B	14	B	**75/0.93**	**E**	**78/0.95**	**E**	**67/0.92**	**E**
9	Third St/Paul Ave	24	C	**>80/1.37**	**F**	**>80/3.36**	**F**	**>80/3.40**	**F**	**>80/3.32**	**F**
10	Third St/Ingerson Ave	5	A	7	A	43	D	43	D	52	D
11	Third St/Jamestown Ave	14	B	30	C	**>80/6.64**	**F**	**>80/1.45**	**F**	**>80/6.15**	**F**
12	Third/Le Conte/US 101 nb off	11	B	24	C	23	C	23	C	23	C
13	25th St/Illinois St	7	A	14	B	14	B	15	C	14	B
14	25th St/Pennsylvania Ave	12	B	**>80/1.42**	**F**	40	D	40	D	40	D
15	Cesar Chavez/Penns/I-280	39	D	**>80/1.36**	**F**	**>80/1.37**	**F**	**>80/1.39**	**F**	**>80/1.37**	**F**
16	Cesar Chavez St/Evans Ave	21	C	**>80/1.83**	**F**	**>80/1.84**	**F**	**>80/1.86**	**F**	**>80/1.84**	**F**
17	Cesar Chavez St/Illinois St	19	B	22	C	23	C	24	C	23	C
18	Bayshore Blvd/Paul Ave	17	B	**>80/2.00**	**F**	**>80/2.90**	**F**	**>80/2.90**	**F**	**>80/2.93**	**F**
19	Bayshore/Hester/US 101 sb off	13	B	**>80/1.25**	**F**	**>80/1.28**	**F**	**>80/1.28**	**F**	**>80/1.28**	**F**
20	Bayshore Blvd/Tunnel Ave	16	B	**>80/2.30**	**F**	**>80/2.51**	**F**	**>80/2.51**	**F**	**>80/2.51**	**F**

Notes:
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Source: Fehr & Peers.

Table 46 (continued)
Intersection LOS
Project and Project Variants – Weekday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
21	Bayshore Blvd/Bacon St	22	C	**>80/1.87**	**F**	**>80/1.91**	**F**	**>80/1.99**	**F**	**>80/1.95**	**F**
22	Bayshore Blvd/Arleta St	25	C	**>80/1.36**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**
23	Bayshore Blvd/Leland Ave	22	C	**>80/1.58**	**F**	**>80/1.67**	**F**	**>80/1.67**	**F**	**>80/1.67**	**F**
24	Bayshore Blvd/Visitacion Ave	15	B	**>80/1.43**	**F**	**>80/1.47**	**F**	**>80/1.47**	**F**	**>80/1.47**	**F**
25	Bayshore Blvd/Sunnydale Ave	19	B	**>80/1.15**	**F**	**>80/1.19**	**F**	**>80/1.19**	**F**	**>80/1.19**	**F**
26	Tunnel Ave/Blanken	9	A	**>80/1.46**	**F**	**>80/1.45**	**F**	**>80/1.45**	**F**	**>80/1.45**	**F**
27	Geneva/U.S. 101 SB Ramps [3]	9	A	**>80/2.94**	**F**	**>80/3.25**	**F**	**>80/3.28**	**F**	**>80/3.25**	**F**
28	Harney/U.S. 101 NB Ramps [3]	8	A	**>80/1.43**	**F**	**>80/1.74**	**F**	**>80/1.75**	**F**	**>80/1.74**	**F**
29	Harney Way/Jamestown Ave [4]	8	A	**40/1.03**	**E**	41	D	53	D	41	D
30	Crisp Ave/Palou Ave [4]	11.6 (nb)	B	**58/0.97**	**E**	54	D	**>80/1.18**	**F**	55	D
31	Ingalls St/Thomas Ave [4]	11.5 (wb)	B	27.9 (wb)	C	33	C	49	D	33	C
32	Ingalls St/Carroll Ave [4]	8	A	17	C	38	D	**59/1.01**	**E**	38	D
33	Ingalls St/Egbert Ave	8	A	9	A	9	A	9	A	9	A
34	A.Walker/Gilman Ave [4]	9.2 (sb)	A	**>80 (eb)**	**F**	36	D	38	D	36	D
35	Amador St/Cargo Way	24	C	**60/1.05**	**E**	**59/1.04**	**E**	**79/1.13**	**E**	**60/1.05**	**E**
36	Bayshore Blvd/Cortland Ave	25	C	**>80/1.48**	**F**	**>80/1.87**	**F**	**>80/1.88**	**F**	**>80/1.87**	**F**
37	Bayshore Blvd/Oakdale Ave	26	C	33	C	55	D	**56/1.05**	**E**	**55/1.05**	**E**
38	Bayshore/Alemany/Industrial	**58/**	**E**	**>80/1.23**	**F**	**>80/1.18**	**F**	**>80/1.20**	**F**	**>80/1.18**	**F**
39	Bayshore/US 101 nb off to Cesar	48	D	**>80/0.88**	**F**	**>80/0.91**	**F**	**>80/0.92**	**F**	**>80/0.91**	**F**
40	Bayshore Blvd/Silver Ave	50	D	**>80/2.64**	**F**	**>80/2.91**	**F**	**>80/2.91**	**F**	**>80/2.91**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 46 (continued)
Intersection LOS
Project and Project Variants – Weekday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore Blvd/Blanken Ave	11	B	**>80/1.33**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**
42	San Bruno Ave/Paul Ave	20	B	**>80/2.10**	**F**	**>80/2.71**	**F**	**>80/2.76**	**F**	**>80/2.75**	**F**
43	San Bruno Ave/Silver Ave	46	D	**>80/1.46**	**F**	**>80/1.56**	**F**	**>80/1.60**	**F**	**>80/1.57**	**F**
44	San Bruno/Mansell/101 sb off	33	D	**64/1.15**	**F**	**>80/1.22**	**F**	**>80/1.22**	**F**	**>80/1.20**	**F**
45	San Bruno/Silliman/101 sb off	20	B	38	D	38	D	38	D	38	D
46	Innes Ave/A.Walker Drive [4]	8.7 (sb)	A	5	A	6	A	6	A	6	A
47	Innes Ave/Earl St	8.6 (sb)	A	23.1 (sb)	C	19.4 (sb)	C	**36.0 (sb)**	**E**	19.7 (sb)	C
48	Evans Ave/Jennings St	10	A	**>80/2.41**	**F**	31	C	43	D	33	C
49	Bayshore Blvd/Geneva Ave	25	C	**>80/1.73**	**F**	**>80/1.76**	**F**	**>80/1.78**	**F**	**>80/1.76**	**F**
50	Bayshore/Guadalupe Pkwy	14	B	50	D	49	D	49	D	49	D
51	Bayshore Blvd/Valley Dr	16	B	40	D	40	D	40	D	40	D
52	Bayshore Blvd/Old County Rd	29	C	**>80/1.10**	**F**	**>80/1.13**	**F**	**>80/1.13**	**F**	**>80/1.13**	**F**
53	Sierra Pt/Lagoon Way	16	C	**>80/4.38**	**F**	**>80/4.38**	**F**	**>80/4.38**	**F**	**>80/4.38**	**F**
54	Ingalls St/Palou Ave [4]	9	A	16	B	22	C	33	C	22	C
55	Keith St/Palou Ave [4]	9	A	8	A	8	A	8	A	8	A
56	Third/Williams/Van Dyke	22	C	17	B	**>80/0.98**	**F**	**>80/1.02**	**F**	**>80/0.98**	**F**
57	Third St/Jerrold Ave	23	C	**>80/0.72**	**F**	**>80/0.88**	**F**	**>80/0.91**	**F**	**>80/0.89**	**F**
58	Evans/Napoleon/Toland	46	D	**>80/1.53**	**F**	**>80/1.61**	**F**	**>80/1.65**	**F**	**>80/1.62**	**F**
59	Harney/Executive Park East	8.9 (sb)	A	25	C	26	C	27	C	27	C
60	Harney/Thomas Mellon	--	--	19	B	26	C	28	C	26	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 47
Intersection LOS
Project and Project Variants – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project (Alt 1)		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Third St/25th St	13	B	**63/0.57**	**E**	**58/0.70**	**E**	**63/0.76**	**E**	**61/0.74**	**E**
2	Third St/Cesar Chavez St	23	C	31	C	**66/0.73**	**E**	**>80/0.80**	**F**	**>80/0.78**	**F**
3	Third St/Cargo Way	17	B	30	C	30	C	36	D	33	C
4	Third St/Evans Ave	32	C	**57/0.65**	**E**	**59/0.87**	**E**	**63/0.92**	**E**	**67/0.91**	**E**
5	Third St/Oakdale Ave	15	B	14	C	15	B	15	B	15	B
6	Third St/Palou Ave	29	C	**>80/0.92**	**F**	**>80/4.03**	**F**	**>80/4.03**	**F**	**>80/2.51**	**F**
7	Third St/Revere Ave	22	C	20	B	24	C	24	C	24	C
8	Third St/Carroll Ave	9	A	10	B	**55/0.66**	**E**	**70/0.66**	**E**	**60/0.65**	**E**
9	Third St/Paul Ave	21	C	**64/0.73**	**E**	**>80/1.89**	**F**	**>80/1.84**	**F**	**>80/1.82**	**F**
10	Third St/Ingerson Ave	3	A	3	A	27	C	27	C	27	C
11	Third St/Jamestown Ave	21	C	24	C	**>80/1.24**	**F**	**>80/1.12**	**F**	**>80/1.14**	**F**
12	Third/Le Conte/US 101 nb off	12	B	14	B	13	B	14	B	14	B
13	25th St/Illinois St	7	A	10	A	10	A	10	B	10	A
14	25th St/Pennsylvania Ave	10	A	**45/1.01**	**E**	34	C	34	C	34	C
15	Cesar Chavez/Penns/I-280	28	C	**61/0.65**	**E**	**60/0.65**	**E**	**60/0.65**	**E**	**60/0.65**	**E**
16	Cesar Chavez St/Evans Ave	15	B	18	B	19	B	20	B	19	B
17	Cesar Chavez St/Illinois St	14	B	18	B	18	B	18	B	18	B
18	Bayshore Blvd/Paul Ave	12	B	14	B	54	D	**57/1.25**	**E**	55	D
19	Bayshore/Hester/US 101 sb off	14	B	14	B	14	B	14	B	14	B
20	Bayshore Blvd/Tunnel Ave	8	A	53	D	**60/1.59**	**E**	**60/1.59**	**E**	**60/1.59**	**E**
21	Bayshore Blvd/Bacon St	13	B	**63/0.57**	**E**	**58/0.70**	**E**	**63/0.76**	**E**	**61/0.74**	**E**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.

Source: Fehr & Peers,

Table 47 (continued)
Intersection LOS
Project and Project Variants – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
22	Bayshore Blvd/Arleta St	12	B	17	B	30	C	30	C	30	C
23	Bayshore Blvd/Leland Ave	24	C	54	D	49	D	49	D	49	D
24	Bayshore Blvd/Visitacion Ave	18	B	41	D	38	D	38	D	38	D
25	Bayshore Blvd/Sunnydale Ave	15	B	**64/0.98**	**E**	**70/1.03**	**E**	**69/1.02**	**E**	**69/1.02**	**E**
26	Tunnel Ave/Blanken	19	B	55	D	55	D	55	D	55	D
27	Geneva/U.S. 101 SB Ramps [3]	8	A	30	C	51	D	51	D	51	D
28	Harney/U.S. 101 NB Ramps [3]	8	A	**>80/2.04**	**F**	**>80/2.34**	**F**	**>80/2.37**	**F**	**>80/2.36**	**F**
29	Harney Way/Jamestown Ave [4]	9	A	54	D	**>80/1.36**	**F**	**>80/1.35**	**F**	**>80/1.28**	**F**
30	Crisp Ave/Palou Ave [4]	7	A	22	C	24	C	25	C	24	C
31	Ingalls St/Thomas Ave [4]	11.1 (sb)	B	37	D	46	D	52	D	44	D
32	Ingalls St/Carroll Ave [4]	9.9 (wb)	A	11.8 (wb)	B	26	C	28	C	25	C
33	Ingalls St/Egbert Ave	7	A	9	A	28	C	29	C	27	C
34	A.Walker/Gilman Ave [4]	7	A	8	A	8	A	8	A	8	A
35	Amador St/Cargo Way	8.9 (sb)	A	**72.5 (eb)**	**F**	36	D	36	D	36	D
36	Bayshore Blvd/Cortland Ave	28	C	21	C	20	B	20	B	20	C
37	Bayshore Blvd/Oakdale Ave	17	B	23	C	25	C	25	C	25	C
38	Bayshore/Alemany/Industrial	24	C	21	C	21	C	21	C	21	C
39	Bayshore/US 101 nb off to Cesar	35	D	40	D	52	D	51	D	51	D
40	Bayshore Blvd/Silver Ave	25	C	25	C	26	C	26	C	26	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 47 (continued)
Intersection LOS
Project and Project Variants – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 1 (R&D)		Project – Variant 2 (Housing)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore Blvd/Blanken Ave	9	A	51	D	**68/1.16**	**E**	**68/1.16**	**E**	**68/1.16**	**E**
42	San Bruno Ave/Paul Ave	16	B	39	D	**>80/1.46**	**F**	**>80/1.37**	**F**	**>80/1.36**	**F**
43	San Bruno Ave/Silver Ave	41	D	**>80/1.29**	**F**	**>80/1.40**	**F**	**>80/1.38**	**F**	**>80/1.37**	**F**
44	San Bruno/Mansell/101 sb off	16	C	27	D	**38/1.00**	**E**	**36/0.98**	**E**	**36/0.98**	**E**
45	San Bruno/Silliman/101 sb off	17	B	**78/0.36**	**E**	**70/0.37**	**E**	**77/0.36**	**E**	**77/0.36**	**E**
46	Innes Ave/A.Walker Drive [4]	8.5 (sb)	A	4	A	6	A	5	A	5	A
47	Innes Ave/Earl St	8.5 (sb)	A	9.9 (sb)	A	10 (sb)	B	11.0 (sb)	B	10.5 (sb)	B
48	Evans Ave/Jennings St	8	A	33	D	20	C	21	C	20	C
49	Bayshore Blvd/Geneva Ave	20	C	44	D	43	D	43	D	43	D
50	Bayshore/Guadalupe Pkwy	10	B	9	A	9	A	9	A	9	A
51	Bayshore Blvd/Valley Dr	11	B	10	A	10	A	10	A	10	B
52	Bayshore Blvd/Old County Rd	26	C	43	D	42	D	42	D	42	D
53	Sierra Pt/Lagoon Way	8	A	43	D	**44/1.01**	**E**	**44/1.01**	**E**	**44/1.01**	**E**
54	Ingalls St/Palou Ave [4]	8	A	16	B	22	C	21	C	20	C
55	Keith St/Palou Ave [4]	8	A	10	B	7	A	7	A	8	A
56	Third/Williams/Van Dyke	22	C	14	B	23	C	23	C	23	C
57	Third St/Jerrold Ave	21	C	23	C	31	C	37	D	34	C
58	Evans/Napoleon/Toland	32	C	**57/0.50**	**E**	**60/0.57**	**E**	**60/0.58**	**E**	**60/0.58**	**E**
59	Harney/Executive Park East	8.8 (eb)	A	18	B	22	C	16	B	15	B
60	Harney/Thomas Mellon	--	--	15	B	19	B	16	B	15	B

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 48
Summary of Impacts at Intersections Operating at LOS E or LOS F

	Intersection	Project	P-Var 1 (R&D)	P-Var 2 (Housing)	Alt 1 No Project	Alt 2 No Bridge	Alt. 3 49ers at Stick	Alt 4 Lesser Build	Alt 5 No Park Agree
1	Third St/25th St	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
2	Third St/Cesar Chavez St	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
3	Third St/Cargo Way	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
4	Third St/Evans Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
5	Third St/Oakdale Ave	PI	PI	PI	--	PI	--	--	PI
6	Third St/Palou Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
7	Third St/Revere Ave	PI	PI	PI	--	PI	--	PI	PI
8	Third St/Carroll Ave	PI	PI	PI	--	PI	--	PI	PI
9	Third St/Paul Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
10	Third St/Ingerson Ave	--	--	--	--	--	--	--	--
11	Third St/Jamestown Ave	PI	PI	PI	--	PI	--	PI	PI
12	Third/Le Conte/US 101 nb off	--	--	--	--	--	--	--	--
13	25th St/Illinois St	--	--	--	--	--	--	--	--
14	25th St/Pennsylvania Ave	--	--	--	NP Impact	--	--	--	--
15	Cesar Chavez/Penns/I-280	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
16	Cesar Chavez St/Evans Ave	NSC	SC/PI	SC/PI	NP Impact	NSC	SC/PI	NSC	SC/PI
17	Cesar Chavez St/Illinois St	--	--	--	--	--	--	--	--
18	Bayshore Blvd/Paul Ave	PI	PI	PI	NP Impact	PI	SC/PI	PI	PI
19	Bayshore/Hester/US 101 sb off	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
20	Bayshore Blvd/Tunnel Ave	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC

Notes:
1. PI – Project Impact. Project results in a change in intersection operations from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives, or from LOS E under 2030 No Project conditions to LOS F with the Project, Project Variants or Alternatives.
2. NSC – No Significant Contribution. Project would not contribute significantly to intersections operating at LOS E or LOS F under 2030 No Project conditions. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to intersections that would be operating at LOS E or LOS F under 2030 No Project conditions, resulting in a Project Impact.
4. NP Impact – No Project Impact. Intersection operations change from LOS D or better under existing conditions to LOS E or LOS F under 2030 No Project conditions, or from LOS E under existing conditions to LOS F under 2030 No Project conditions.
Source: Fehr & Peers.

Table 48 (continued)
Summary of Impacts at Intersections Operating at LOS E or LOS F

	Intersection	Project	P-Var 1 (R&D)	P-Var 2 (Housing)	Alt 1 No Project	Alt 2 No Bridge	Alt. 3 49ers at Stick	Alt 4 Lesser Build	Alt 5 No Park Agree
21	Bayshore Blvd/Bacon St	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
22	Bayshore Blvd/Arleta St	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
23	Bayshore Blvd/Leland Ave	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
24	Bayshore Blvd/Visitacion Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	NSC	NSC	SC/PI
25	Bayshore Blvd/Sunnydale Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	NSC	NSC	SC/PI
26	Tunnel Ave/Blanken	PI	PI	PI	NP Impact	PI	--	PI	PI
27	Geneva/U.S. 101 SB Ramps	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
28	Harney/U.S. 101 NB Ramps	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	NSC	SC/PI	SC/PI
29	Harney Way/Jamestown Ave	--	--	--	NP Impact	--	PI	--	--
30	Crisp Ave/Palou Ave	--	PI	--	NP Impact	--	--	--	--
31	Ingalls St/Thomas Ave	--	--	--	--	--	PI	--	--
32	Ingalls St/Carroll Ave	--	PI	--	--	--	--	--	--
33	Ingalls St/Egbert Ave	--	--	--	--	--	--	--	--
34	A.Walker/Gilman Ave	--	--	--	NP Impact	--	SC/PI	--	--
35	Amador St/Cargo Way	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	--	SC/PI
36	Bayshore Blvd/Cortland Ave	PI	PI	PI	NP Impact	PI	NSC	PI	PI
37	Bayshore Blvd/Oakdale Ave	--	PI	PI	--	--	--	--	PI
38	Bayshore/Alemany/Industrial	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
39	Bayshore/US 101 nb off to Cesar	PI	PI	PI	NP Impact	PI	NSC	SC/PI	PI
40	Bayshore Blvd/Silver Ave	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC

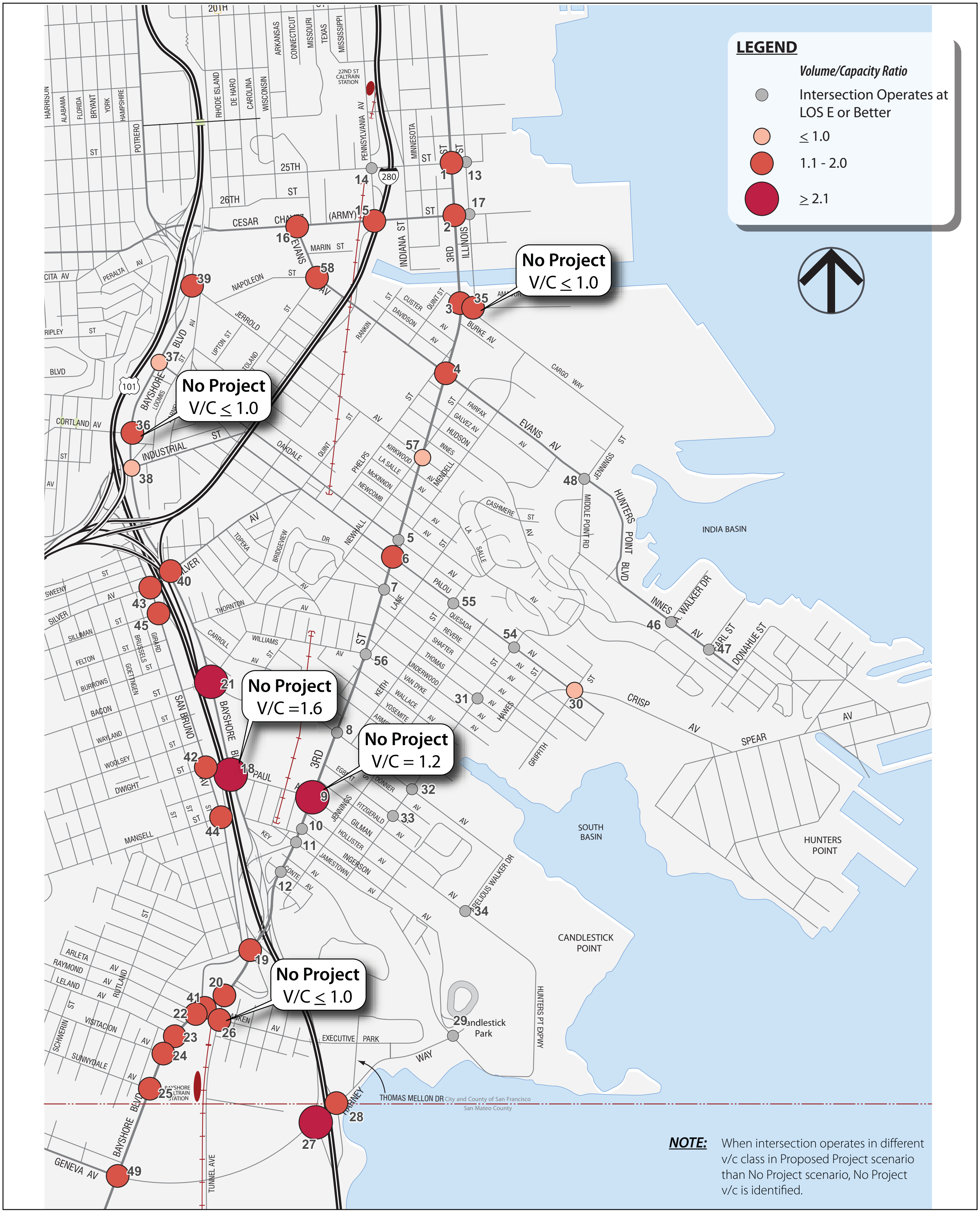
Notes:
1. PI – Project Impact. Project results in a change in intersection operations from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives, or from LOS E under 2030 No Project conditions to LOS F with the Project, Project Variants or Alternatives.
2. NSC – No Significant Contribution. Project would not contribute significantly to intersections operating at LOS E or LOS F under 2030 No Project conditions. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to intersections that would be operating at LOS E or LOS F under 2030 No Project conditions, resulting in a Project Impact.
4. NP Impact – No Project Impact. Intersection operations change from LOS D or better under existing conditions to LOS E or LOS F under 2030 No Project conditions, or from LOS E under existing conditions to LOS F under 2030 No Project conditions.
Source: Fehr & Peers.

Table 48 (continued)
Summary of Impacts at Intersections Operating at LOS E or LOS F

	Intersection	Project	P-Var 1 (R&D)	P-Var 2 (Housing)	Alt 1 No Project	Alt 2 No Bridge	Alt. 3 49ers at Stick	Alt 4 Lesser Build	Alt 5 No Park Agree
41	Bayshore Blvd/Blanken Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	NSC	NSC	SC/PI
42	San Bruno Ave/Paul Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	NSC	SC/PI	SC/PI
43	San Bruno Ave/Silver Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
44	San Bruno/Mansell/101 sb off	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	NSC	SC/PI	SC/PI
45	San Bruno/Silliman/101 sb off	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
46	Innes Ave/A.Walker Drive	--	--	--	--	--	--	--	--
47	Innes Ave/Earl St	--	PI	--	--	--	--	--	--
48	Evans Ave/Jennings St	--	SC/PI	--	NP Impact	--	--	--	--
49	Bayshore Blvd/Geneva Ave	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
50	Bayshore/Guadalupe Pkwy	--	--	--	--	--	--	--	--
51	Bayshore Blvd/Valley Dr	--	--	--	--	--	--	--	--
52	Bayshore Blvd/Old County Rd	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
53	Sierra Pt/Lagoon Way	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
54	Ingalls St/Palou Ave [4]	--	--	--	--	--	--	--	--
55	Keith St/Palou Ave [4]	--	--	--	--	--	--	--	--
56	Third/Williams/Van Dyke	PI	PI	PI	--	PI	--	PI	PI
57	Third St/Jerrold Ave	PI	PI	PI	NP Impact	PI	PI	PI	PI
58	Evans/Napoleon/Toland	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
59	Harney/Executive Park East	--	--	--	--	--	--	--	--
60	Harney/Thomas Mellon	--	--	--	--	--	--	--	--

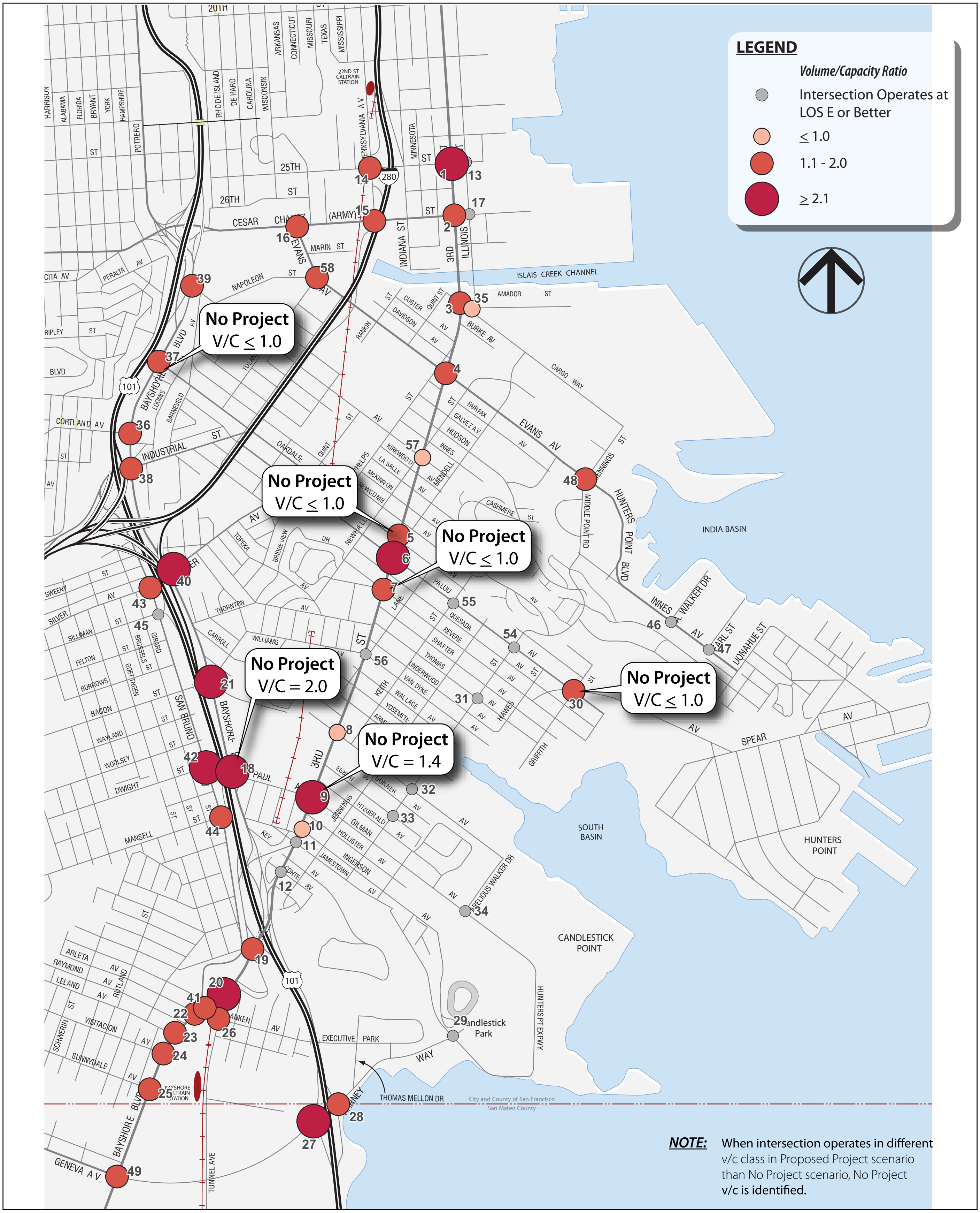
Notes:
1. PI – Project Impact. Project results in a change in intersection operations from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives, or from LOS E under 2030 No Project conditions to LOS F with the Project, Project Variants or Alternatives.
2. NSC – No Significant Contribution. Project would not contribute significantly to intersections operating at LOS E or LOS F under 2030 No Project conditions. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to intersections that would be operating at LOS E or LOS F under 2030 No Project conditions, resulting in a Project Impact.
4. NP Impact – No Project Impact. Intersection operations change from LOS D or better under existing conditions to LOS E or LOS F under 2030 No Project conditions, or from LOS E under existing conditions to LOS F under 2030 No Project conditions.

Source: Fehr & Peers.



SOURCE: Fehr & Peers

FIGURE 33: LOS OPERATING CONDITIONS AT STUDY INTERSECTIONS - WEEKDAY AM PEAK HOUR NO PROJECT AND PROPOSED PROJECT CONDITIONS



SOURCE: Fehr & Peers

FIGURE 34: LOS OPERATING CONDITIONS AT STUDY INTERSECTIONS - WEEKDAY PM PEAK HOUR NO PROJECT AND PROPOSED PROJECT CONDITIONS

Traffic signals at intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels of LOS D or better.

To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition, or reduction in corner sidewalk width and prohibition of on-street parking along Third Street. Widening Third Street or reducing the corner sidewalk space at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions, the measure was not further considered. Traffic impacts at this intersection under the Project conditions would remain *significant and unavoidable*.

7. Third/Revere - At the signalized intersection of Third/Revere, the intersection operating conditions would worsen in the PM peak hour from LOS D under 2030 No Project conditions to LOS F with the Project.

The degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Third Street. Due to the presence of the Third Street light rail, space for additional travel lanes could not be taken from the center median. Parking is generally permitted on either side of the street; however, it is not permitted at the intersections. Instead, sidewalks are extended to increase the pedestrian waiting area at the intersection and reduce the pedestrian crossing distances.

Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels.

To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition, or reduction in corner sidewalk width and prohibition of on-street parking along Third Street. Widening Third Street or reducing the corner sidewalk space at this location would be inconsistent with the pedestrian environment created by the Third Street

Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions, the measure was not further considered. Traffic impacts at this intersection under the Project conditions would remain *significant and unavoidable*.

8. Third/Carroll - At the signalized intersection of Third/Carroll, the intersection operating conditions would worsen in the PM peak hour from LOS B under 2030 No Project conditions to LOS E with the Project.

The degradation in level of service would primarily be due to Project-related traffic increases on Carroll Avenue and Third Street. Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels. To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition, or reduction in corner sidewalk width and prohibition of on-street parking along Third Street. Widening Third Street or reducing the corner sidewalk space at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions, the measure was not further considered. Traffic impacts at this intersection under the Project conditions would remain *significant and unavoidable*.

11. Third/Jamestown - At the signalized intersection of Third/Jamestown, the intersection operating conditions would worsen in the AM and PM peak hours from LOS C under 2030 No Project conditions to LOS F with the Project.

The degradation in level of service would primarily be due to project-related traffic increases on Jamestown Avenue and Third Street. Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels.

To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition, or reduction in corner sidewalk width and prohibition of on-street parking along Third Street. Widening Third Street or reducing the corner sidewalk space at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions, the measure was not further considered. Traffic impacts at this intersection under the Project conditions would remain *significant and unavoidable*.

18. Bayshore/Paul – At the signalized intersection of Bayshore/Paul, the intersection operating conditions would worsen in the AM peak hour from LOS E under 2030 No Project conditions to LOS F with the Project. In the PM peak hour, intersection conditions would remain at LOS E.

The degradation in level of service would primarily be due to forecasted traffic volume increases on Paul Avenue. Paul Avenue is one of a relatively few number of streets in the area that connects between the east and west side of U.S. 101. As a result, east-west travel in the area is concentrated to the few streets that provide connections across the freeway, including Paul Avenue. Widening Paul Avenue at this intersection would create the need for major right-of-way acquisition and likely require reconstruction of the U.S. 101 overpass to accommodate a wider Paul Avenue cross section, which would be infeasible. Therefore Project-related impacts at this intersection would remain *significant and unavoidable*.

26. Tunnel/Blanken – At the signalized intersection of Tunnel/Blanken (currently unsignalized and required to be signalized as part of the Visitacion Valley Redevelopment), the intersection operating conditions would worsen in the AM peak hour from LOS D under 2030 No Project conditions to LOS F with the Project. In the PM peak hour, the intersection would operate at LOS F under 2030 No Project and with the Project conditions.

> ***Project Mitigation Measure 2***: Reconfigure the northbound and southbound approaches to the intersection of Tunnel/Blanken to provide dedicated left-turn lanes adjacent to shared through/right-turn lanes. This reconfiguration would require prohibition of parking for 160 feet in the southbound approach (loss of eight parking spaces) and for 100 feet in the northbound approach (loss of five parking spaces).
>
> Implementation of the intersection reconfiguration shall be the responsibility of SFMTA, and shall be implemented when intersection improvements associated with the Visitacion Valley Redevelopment Plan (i.e., signalization) are no longer sufficient to maintain acceptable intersection level of service conditions. Since these improvements were determined to be required even without the Project under 2030 No Project conditions, the Project Applicant shall contribute its fair-share toward the cost of improvements. Prior to payment of the contribution, the City shall create a mechanism to determine and receive

fair share contributions from the Project Applicant. The SFMTA and DPW shall design and implement the measure as necessary.

With implementation of ***Project Mitigation Measure 2***, operations at this intersection would improve, but not to acceptable LOS D or better conditions in the AM and PM peak hours. Therefore, Project-related impacts at this intersection would be *significant and unavoidable*.

36. Bayshore/Cortland - At the signalized intersection of Bayshore/Cortland, the intersection operating conditions would worsen in the AM peak hour from LOS D under 2030 No Project conditions to LOS F with the Project. In the PM peak hour, the intersection would operate at LOS F under 2030 No Project and with the Project conditions.

The degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Bayshore Boulevard. Mitigation for this impact would require increasing capacity on Bayshore Boulevard. There is not sufficient right-of-way to provide additional lanes on Bayshore Boulevard without widening the roadway. Roadway widening would require major right-of-way acquisition along the entire Bayshore Boulevard corridor, at great cost and displacement of existing homes and businesses. Therefore, Project-related impacts at this intersection would remain *significant and unavoidable*.

39. Bayshore/US 101 Northbound off-ramp/Jerrold - At the signalized intersection of Bayshore/US 101 Northbound off-ramp to Cesar Chavez, the intersection operating conditions would worsen in the AM peak hour from LOS E under 2030 No Project conditions to LOS F with the Project. The intersection would operate at LOS F in the PM peak hour under 2030 No Project with the Project conditions.

The degradation in level of service would primarily be due to forecasted substantial traffic volume increases on all approaches to the intersection. Mitigation for this impact would involve increasing capacity on Bayshore Boulevard, the U.S. 101 Northbound Off-ramp, and Jerrold Street. There is not adequate right-of-way to provide additional lanes on Bayshore Boulevard or Jerrold Street without widening the roadway. Roadway widening to provide measurable improvements at this intersection would require major right-of-way acquisition along the entire Bayshore Boulevard and Jerrold Street corridor, at great cost and displacement of existing homes and businesses (It may be possible to widen the U.S. 101 Northbound off-ramp, but only for the last 150 to 200 feet of the approach to the intersection. This would not likely result in a substantial improvement to the intersection capacity.) Therefore, Project-related impacts at this intersection would remain *significant and unavoidable*.

56. Third/Williams/Van Dyke - At the signalized intersection of Third/Williams/Van Dyke, the intersection operating conditions would worsen in the PM peak hour from LOS B under 2030 No

Project conditions to LOS F with the Project. The Project would create a significant traffic impact at this intersection.

The degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Third Street. Due to the presence of the Third Street light rail, space for additional travel lanes could not be taken from the center median, and parking is not permitted on either side of the street. Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels.

To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Third Street at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and the right-of-way constraints, the measure was not further considered. The Project's traffic impacts at this intersection would remain *significant and unavoidable*.

57. Third/Jerrold - At the signalized intersection of Third/Jerrold, the intersection operating conditions would worsen in the AM peak hour from LOS D under 2030 No Project conditions to LOS F with the Project. In the PM peak hour, the intersection would operate at LOS F under 2030 No Project and with the Project conditions.

The degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Third Street. Due to the presence of the Third Street light rail, space for additional travel lanes could not be taken from the center median, and parking is not permitted on either side of the street. Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels.

To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Third Street at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and right-of-way constraints, the measure was not further considered. Therefore, Project-related impacts at this intersection would remain *significant and unavoidable*.

Project Cumulatively-Considerable Traffic Impacts

At the remaining 29 of the 39 intersections that would operate at LOS E or LOS F under Project conditions, Project contributions were determined to be significant at 20 intersections, and less than significant at 9 intersections (as identified in **Table 48**).

At the following four intersections, feasible mitigation measures were identified:

27. Geneva/U.S. 101 southbound ramps (existing Alana/Beatty)
28. Harney/U.S. 101 northbound ramps (existing Alana/Harney/Thomas Mellon)
35. Amador/Cargo/Illinois
49. Bayshore/Geneva

27. Geneva/U.S. 101 Southbound Ramps (existing Alana/Beatty)
28. Harney/U.S. 101 Northbound Ramps (existing Alana/Harney/Thomas Mellon)

The City of Brisbane, in consultation with the City of San Francisco, is currently evaluating a proposal to extend Geneva Avenue from its current terminus at Bayshore Boulevard to U.S. 101. The extension of Geneva Avenue would connect to Harney Way to the east. The proposed roadway improvement would include a reconstruction of the existing U.S. 101/Harney/Alana interchange (see Section 4.3 above for a description of the proposed improvements). As a result of this roadway modification, the intersections of Alana/Beatty and Alana/Harney/Thomas Mellon would be reconstructed into a tight diamond freeway interchange. Based on the currently-proposed configuration of this roadway, the new intersections of Geneva/U.S. 101 southbound ramps and Harney/U.S. 101 northbound ramps would operate at LOS F during the weekday peak hours, and additional capacity would be needed on the off-ramp approaches to Geneva Extension and Harney Way.

> ***Project Mitigation Measure 3*****:** The City of Brisbane and Caltrans, as part of the Harney Interchange Project, shall account for existing traffic, background traffic growth, and the most recent forecasts of traffic expected to be associated with each of several adjacent development projects, including the Project. The San Francisco County Transportation Authority (SFCTA) shall coordinate with the City of Brisbane and Caltrans to ensure Project-generated vehicle trips are accounted for in the Harney Interchange analyses and design.

Mitigations and associated fair-share funding measures for cumulative regional roadway system impacts, including freeway segment impacts, shall be formulated through the current interjurisdictional Bi-County Transportation Study effort being led by the SFCTA. The Project Applicant shall contribute its fair share to the Harney Interchange Project.

Because the environmental review of the interchange project is not yet complete and the interchange would be approved by Caltrans, the implementation of **Project Mitigation Measure 3** is uncertain and is outside of the City/Agency jurisdiction. Therefore, Project-related contributions to cumulative traffic impacts at these two intersections would remain *significant and unavoidable*.

35. Amador/Cargo/Illinois – At the signalized intersection of Amador/Cargo/Illinois, the degradation in LOS at this intersection would primarily be due to increased traffic volumes and delays to the southbound approach on Illinois Street. As travel on Third Street becomes more congested, as expected in the future, Illinois Street would become a desirable alternate and parallel route. Because this intersection represents the southern terminus of Illinois Street, a relatively large volume of southbound traffic turns onto Cargo Way.

To mitigate the poor operating conditions at this intersection, the southbound approach of Illinois Street to Amador/Cargo would need to be reconfigured to provide a dedicated southbound left-turn lane and a dedicated right-turn lane. Sufficient right-of-way is available to implement this improvement, however, provision of two southbound lanes would require narrowing a portion of the island to the west of the southbound approach to Cargo Way.

Project Mitigation Measure 4: SFMTA shall conduct a feasibility study of the intersection of Amador/Cargo/Illinois with the Port of San Francisco to determine the feasibility of reconfiguring the southbound approach on Illinois Street to provide a dedicated southbound left turn lane and a dedicated right-turn lane. Sufficient right-of-way is available to implement this improvement, however, provision of two southbound lanes would require narrowing a portion of the island to the west of the southbound approach to Cargo Way. Implementation of the intersection improvements shall be the responsibility of SFMTA and the Port of San Francisco, and shall be implemented when traffic operating conditions with the existing intersection configuration worsens to unacceptable levels. If determined feasible, the Project Applicant shall contribute its fair share to the intersection improvements.

With implementation of **Project Mitigation Measure 4,** operations at this intersection would improve to acceptable LOS C conditions during the AM and PM peak hours. However, since a feasibility study would be required, implementation of Mitigation Measure 4 is uncertain, and therefore, Project-related impacts at this intersection would remain *significant and unavoidable.*

49. Bayshore/Geneva – The City of Brisbane, in consultation with the City of San Francisco, is currently evaluating a proposal to extend Geneva Avenue from its current terminus at Bayshore Boulevard to U.S. 101. The extension of Geneva Avenue would connect to Harney Way to the east. The proposed roadway improvement would include a reconstruction of the existing U.S. 101/Harney/Alana interchange. As a result of this roadway modification, the intersection of Bayshore/Geneva would include a fourth leg, east of Bayshore Boulevard. To mitigate the poor operating conditions at this intersection, the proposed intersection design would need to be modified to provide three westbound through lanes on Geneva Avenue through the Bayshore Boulevard intersection. To accommodate three "receiving" lanes on the west side of Bayshore Boulevard, eliminate on-street parking between Bayshore Boulevard and Talbert Street (approximately 550 feet).

> ***Project Mitigation Measure 5***: The City of Brisbane, as part of the Geneva Avenue Extension Project, shall account for existing traffic, background traffic growth, and the most recent forecasts of traffic expected to be associated with each of several adjacent development projects, including the Project. The San Francisco County Transportation Authority (SFCTA) and SFMTA shall coordinate with the City of Brisbane to ensure projected traffic volumes are accounted for in the design of the Geneva Avenue Extension.
>
> Mitigations and associated fair-share funding measures for cumulative regional roadway system impacts, including freeway segment impacts, shall be formulated through the current interjurisdictional Bi-County Transportation Study effort being led by the SFCTA. The Project Applicant shall contribute its fair share to the Geneva Avenue Extension Project.

Since implementation of Project Mitigation Measure 5 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Therefore, the Project-related impacts at this intersection would remain *significant and unavoidable.*

Of the 20 intersections where Project contributions were determined to be significant, feasible mitigation measures were not identified at 16 intersections, and therefore project-related impacts at these intersections would remain *significant and unavoidable*. The 16 study intersections where feasible mitigation measures have not been identified are:

1. Third/25th
2. Third/Cesar Chavez
3. Third/Cargo
4. Third/Evans
6. Third/Palou
9. Third/Paul

15. Cesar/Pennsylvania/I-280
21. Bayshore/Bacon
24. Bayshore/Visitacion
25. Bayshore/Sunnydale
38. Bayshore/Alemany/Industrial
41. Bayshore/Blanken
42. San Bruno/Paul
43. San Bruno/Silver
44. San Bruno/Mansell/U.S. 101 Southbound Off-ramp
58. Evans/Napoleon/Toland

1. Third/25th – At the signalized intersection of Third/25th, the degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Third Street. Due to the presence of the Third Street light rail, space for additional travel lanes could not be taken from the center median, and parking is not permitted on either side of the street. Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be sufficient to improve intersection operating conditions to acceptable levels.

To accommodate additional right-of-way needed for additional lanes, Third Street and 25th Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Third Street at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to the right-of-way constraints, the measure was not further considered.

Alternatively, the eastbound and westbound approaches on 25th Street could be re-striped to provide separate left-turn lanes. This may shorten the amount of green time needed for the 25th Street movement and allow more time for Third Street traffic. However, this would require a narrowing of the "receiving" lane on 25th Street. Given the relatively high portion of truck traffic using this road, the narrow receiving lane may not physically accommodate the required truck turning movements and this mitigation measure was not considered further. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

2. Third/Cesar Chavez - To mitigate the significant impacts at the signalized intersection of Third/Cesar, additional capacity would need to be provided on both Third Street and Cesar Chavez Street. Due to the presence of the Third Street light rail, space for additional travel lanes could not be taken from the center median on Third Street, and parking is not permitted on either side of the street. Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels of LOS D or better.

To accommodate additional right-of-way needed for additional lanes, Third Street and Cesar Chavez Street would need to be widened to the east, south, and north. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Third Street at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to right-of-way constraints, the measure was not further considered, and Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

3. Third/Cargo - At the signalized intersection of Third Street/Cargo Way, the degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Third Street. Due to the presence of the Third Street light rail, space for additional travel lanes could not be taken from the center median, and parking is not permitted on either side of the street. Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels of LOS D or better.

To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Third Street at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to the right-of-way constraints, the measure was not further considered. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

4. Third/Evans - Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels of LOS D or better.

To achieve acceptable operations, additional capacity would need to be provided on Third Street and/or Evans Avenue. To accommodate additional right-of-way needed for additional lanes on either Third Street or Evans Avenue, the roadways would need to be widened to the north, south, east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Third Street or Evans Avenue at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street or Evans Avenue would make the pedestrian crossings at the intersection longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to the right-of-way constraints, the measure was not further considered.

Another option to achieve acceptable operations at this intersection would be to provide grade separation, whereby Evans Avenue travels either above or below Third Street, and the existing signalized intersection would be eliminated. This option would have similar degradation to the pedestrian environment by reducing pedestrian connectivity between the two streets and creating new grades for pedestrians and cyclists to cross through the intersection. This measure was not further considered. Therefore, Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

6. Third/Palou - At the signalized intersection of Third/Palou, the degradation in level of service is primarily due to forecasted substantial traffic volume increases on Third Street. Due to the presence of the Third Street light rail, space for additional travel lanes could not be taken from the center median. Parking is generally permitted on either side of the street; however it is not permitted at the intersections. Instead, sidewalks are extended to increase the pedestrian waiting area at the intersection and reduce the pedestrian crossing distances.

Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels of LOS D or better.

To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition, or reduction in corner sidewalk width and prohibition of on-street parking along Third Street. Widening Third Street or reducing the corner sidewalk space at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to the right-of-way constraints, the measure was not further considered. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

9. Third/Gilman/Paul - At the signalized intersection of Third/Gilman/Paul, the degradation in level of service would primarily be due to substantial traffic volume increases on Third Street. In addition, Paul Avenue is one of a relatively few number of streets in the area that connects to the west side of U.S. 101. As a result, east-west travel in the area is concentrated to the few streets that provide connections across the freeway.

Due to the presence of the Third Street light rail, space for additional travel lanes on Third Street could not be taken from the center median, and parking is not permitted on either side of the street. Traffic signals on intersections along Third Street are timed to prioritize transit movements along Third Street. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Third Street that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels LOS D or better.

To accommodate additional right-of-way needed for additional lanes, Third Street would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Third Street at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Third Street would make the pedestrian crossing of Third Street longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to the right-of-way constraints, the measure was not further considered.

Widening Paul Avenue at this intersection would create the need for similar right-of-way acquisition and would cause similar inconsistencies with the desired pedestrian environment in the area. Further, widening Paul Avenue just at the Third Street intersection would not substantially address the problem created by limited vehicular capacity across U.S. 101. Widening Paul Avenue from Third Street to San Bruno Avenue, just west of US 101 would be required. However, this would require major right-of-way acquisition along the entire Paul Avenue corridor between Third Street and Bayshore Boulevard. Therefore, increased vehicular capacity along Paul Avenue was not considered further. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

15. Cesar Chavez/Pennsylvania/I-280 Northbound Off-Ramp - At the signalized intersection of Cesar Chavez/Pennsylvania/I-280 Northbound off-ramp, the degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Cesar Chavez Street, and increases in off-ramp traffic. The transportation and engineering analysis conducted by the San Francisco Department of Public Works for the *Bayview Transportation Improvements Project* (BTI Project) identified a potential mitigation measure at this intersection that would provide an additional dedicated eastbound left-turn lane. To accomplish this, the existing travel lanes would need to be narrowed to 10 and 11 feet, and the north sidewalk would be narrowed from eight to six feet.

The reduction in width of travel lanes and sidewalk narrowing would degrade conditions for westbound cyclists because the curbside travel lane would be too narrow to comfortably share with a motor vehicle. In addition, the mitigation measure would make it more difficult to add a bicycle lane on Cesar Chavez Street in the future, as is currently planned. For these reasons, consistent with the BTI Project analysis, this mitigation measure was not considered further. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

21. Bayshore/Bacon/Egbert/Phelps - At the signalized intersection of Bayshore/Bacon/ Egbert/Phelps, the degradation in level of service is primarily due to forecasted substantial traffic volume increases on Bayshore Boulevard and due to the fact that Bacon Street is one of a relatively few streets in the area that connects across U.S. 101. As a result, all approaches to the intersection would become congested and would require increased capacity.

Widening Bayshore Boulevard would require major right-of-way acquisition and demolition of existing structures. Widening Bacon Avenue would require similar right-of-way acquisition and reconstruction of the U.S. 101 overcrossing. Capacity constraints at Phelps Street and Egbert Avenue are primarily due to the relationship between the street grid east of Bayshore Boulevard and Bayshore Boulevard itself. Because these two streets meet at Bayshore Boulevard, widening either one of them would not alleviate congestion on this approach, which is primarily due to the awkward position of the streets relative to the intersection.

Because the potential mitigation measures would be infeasible to construct economically and without displacing existing homes, the measure was not further considered. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

24. Bayshore/Visitacion - At the signalized intersection of Bayshore/Visitacion, the degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Bayshore Boulevard. Due to the presence of the T-Third light rail, space for additional travel lanes could not be taken from the center median, and parking is permitted only intermittently on either side of the street. Traffic signals on intersections along Bayshore Boulevard are timed to prioritize transit movements along Bayshore Boulevard. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Bayshore Boulevard that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels of LOS D or better.

To accommodate additional right-of-way needed for additional lanes, Bayshore Boulevard would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Bayshore Boulevard at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Bayshore Boulevard would make the pedestrian crossing of Bayshore Boulevard longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to the right-of-way constraints, the measure was not further considered. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

25. Bayshore/Sunnydale - At the signalized intersection of Bayshore/Sunnydale, the degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Bayshore Boulevard. Due to the presence of the T-Third light rail, space for additional travel lanes could not be taken from the center median, and parking is permitted only intermittently on either side of the street. Traffic signals on intersections along Bayshore Boulevard are timed to prioritize transit movements along Bayshore Boulevard. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Bayshore Boulevard that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels of LOS D or better.

To accommodate additional right-of-way needed for additional lanes, Bayshore Boulevard would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Bayshore Boulevard at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Bayshore Boulevard would make the pedestrian crossing of Bayshore Boulevard longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to the right-of-way constraints, the measure was not further considered. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

38. Bayshore/Alemany/Industrial - At the signalized intersection of Bayshore/Alemany/ Industrial, the degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Bayshore Boulevard. Mitigation for this impact would involve increasing capacity on Bayshore Boulevard. There is not adequate right-of-way to provide additional lanes on Bayshore Boulevard without widening the roadway. Roadway widening would require major right-of-way acquisition along the entire Bayshore Boulevard corridor, at great cost and displacement of existing homes and businesses, and therefore, no feasible mitigation measures have been identified. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

41. Bayshore/Blanken - At the signalized intersection of Bayshore/Blanken, the degradation in level of service would primarily due to forecasted substantial traffic volume increases on Bayshore Boulevard. To mitigate the impact at this intersection, additional capacity would be needed on Bayshore Boulevard. Due to the presence of the T-Third light rail, space for additional travel lanes could not be taken from the center median. Although parking is permitted on the east side of the street, it is not permitted on the west side.

Traffic signals on intersections along Third Street and Bayshore Boulevard south of U.S. 101 are timed to prioritize transit movements along Bayshore Boulevard. The SFMTA has indicated that there may be slight adjustments to the traffic signal timing for intersections along Bayshore Boulevard that could be implemented that would reduce auto delay at signalized intersections without degrading transit travel times. However, those improvements would not be enough to improve intersection operating conditions to acceptable levels of LOS D or better.

To accommodate additional right-of-way needed for additional lanes, Bayshore Boulevard would need to be widened to the east and the west. This would require demolition of existing structures and substantial right-of-way acquisition. Widening Bayshore Boulevard at this location would be inconsistent with the pedestrian environment created by the Third Street Light Rail Project. Widening of Bayshore Boulevard would make the pedestrian crossing of Bayshore Boulevard longer, and would require more dedicated pedestrian crossing time as part of the signal phasing plan. Because the mitigation measure would worsen the pedestrian conditions and due to the right-of-way constraints, the measure was not further considered.

Previous studies have suggested restriping the westbound approach on Blanken Avenue to provide a dedicated right-turn lane and a dedicated left-turn lane approaching Bayshore Boulevard. However, SFMTA has indicated that this would not be advisable given the existing curve on Blanken Avenue. Therefore, this mitigation measure was not further considered. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

42. San Bruno/Paul - At the signalized intersection of San Bruno/Paul, the degradation in level of service would primarily due to forecasted substantial traffic volume increases on all approaches. Paul Avenue is one of a relatively few number of streets in the area that connects between the east and west side of U.S. 101. As a result, east-west travel in the area is concentrated to the few streets that provide connections across the freeway, including Paul Avenue.

Widening Paul Avenue at this intersection would create the need for major right-of-way acquisition and likely require reconstruction of the U.S. 101 overpass to accommodate a wider Paul Avenue cross section. Widening San Bruno Avenue would require roadway widening and major right-of-way acquisition, which would displace a large number of existing homes and businesses. Mitigation measures that would widen Paul Avenue or San Bruno Avenue at this intersection were not further considered. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

43. San Bruno/Silver - At the signalized intersection of San Bruno/Silver, the degradation in level of service would primarily be due to forecasted substantial traffic volume increases on all approaches. Silver Avenue is one of a relatively few number of streets in the area that connects between the east and west side of U.S. 101. As a result, east-west travel in the area is concentrated to the few streets that provide connections across the freeway, including Silver Avenue.

Widening Silver Avenue at this intersection would create the need for major right-of-way acquisition and likely require reconstruction of the existing bridge structure across U.S. 101 to accommodate a wider Silver Avenue cross section. Widening San Bruno Avenue would require roadway widening and major right-of-way acquisition, which would displace a large number of existing homes and businesses. Mitigation measures that would widen Silver Avenue or San Bruno Avenue at this intersection were not further considered. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

44. San Bruno/Mansell/U.S. 101 Southbound Off-ramp - At the all-way STOP sign controlled intersection of San Bruno/Mansell/U.S. 101 Southbound off-ramp, the degradation in level of service would primarily be due to forecasted substantial traffic volume increases on all approaches to the intersection. A new traffic signal at the intersection of San Bruno/Mansell/U.S. 101 Southbound off-ramp would increase the intersection's capacity. To ensure that queues from traffic using the off-ramp do not exceed 700 feet, which would extend onto the freeway mainline, the signal should be operated on a relatively short cycle length. However, due to the 50-foot wide median between eastbound and westbound Mansell Street, west of San Bruno Avenue, a new traffic signal would likely have to operate in a less-efficient "split phase" operation, such that westbound and eastbound movements could not happen simultaneously. Under this scenario, the intersection would improve to LOS E under 2030 No Project conditions, and queues on the off-ramp may occasionally extend to the freeway mainline during peak hours. Therefore, this improvement was deemed infeasible and was not considered further. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

58. Evans/Napoleon/Toland – At the signalized intersection of Evans/Napoleon/Toland, additional capacity would be required on Evans Street and Napoleon Street to achieve acceptable intersection LOS. Although the lanes on these streets are relatively wide, and additional lanes could possibly be striped within the existing right-of-way, particularly on Napoleon and Toland Streets, the resulting lane widths would not likely be appropriate for the relatively high portion of truck and industrial traffic in the area. Therefore, lane restriping at this intersection was not considered further as a mitigation measure.

Widening any of the approaches to this intersection would require right-of-way acquisition, and would require demolition of existing structures. This would require substantial amount of money and would result in the displacement of numerous businesses. Therefore, roadway widening at this intersection was not considered further as a mitigation measure. Project-related traffic impacts at this intersection would remain *significant and unavoidable*.

Less than Significant Traffic Impacts

Project-contributions to LOS E and LOS F operating conditions were determined to be less than significant at the following nine study intersections.

16. Cesar/Evans
19. Bayshore/Hester/U.S. 101 southbound off-ramp
20. Bayshore/Tunnel
22. Bayshore/Arleta
23. Bayshore/Leland
40. Bayshore/Silver
45. San Bruno/Silliman/U.S. 101 southbound ramps
52. Bayshore/Old County Road
53. Sierra Point/Lagoon Way

The degradation in level of service would primarily be due to forecasted traffic increases along Bayshore Boulevard, Cesar Chavez Street, Evans Avenue, and San Bruno Avenue. At the study intersections within San Bruno (i.e., Bayshore/Old County and Sierra Point/Lagoon) the primary cause of increased congestion development assumed to occur at the adjacent Brisbane Baylands site. Since the Project would not contribute significantly to the poor operating conditions at these nine intersections, Project-related impacts at these intersections would be *less than significant.*

Harney Way Widening – As part of the Project, the existing four-lane Harney Way would be widened to the north and south of its existing alignment, and would be rebuilt to contain between two and three travel lanes in each direction, turn pockets, two BRT-only lanes, Class I and Class II bicycle facilities, new sidewalks, as well as a landscaped area. Initially, the roadway would be rebuilt as a new five-lane roadway (with right-of-way reserved for additional lane(s) to be built in the future as needed for increased traffic levels). There would be two lanes in each direction, with eastbound left-turn lanes at Thomas Mellon Circle and Executive Park Boulevard East and a westbound right-turn lane at the Executive Park Boulevard East intersection. A Class II bicycle lane would be provided on the north side of the roadway, and a Class I bicycle path would be provided on the south side of the roadway. Two exclusive BRT lanes would be constructed adjacent to the roadway on its north side. After 49ers games at the new stadium, left turns would be prohibited at the two Harney Way intersections with Thomas Mellon Drive and Executive Park Boulevard for a period to allow for the configuration of the roadway to change to four westbound auto lanes and one eastbound auto lane. Under the final configuration, a portion of the landscaped area installed as part of the initial widening would be rebuilt to provide additional lane(s) from the proposed Harney Interchange east to Arelious Walker Drive, if necessary.

The initial phase of Harney Way widening would provide for additional landscaping area (i.e., in the area that would be converted to future travel lane(s)), which would make the pedestrian crossing of Harney Way shorter than with the final configuration. Under both the initial and final configurations, pedestrian crosswalks would be provided at the signalized intersections of Harney Way with Jamestown Avenue, Executive Park East and Thomas Mellon Drive, and pedestrian crossing times would be provided consistent with the requirements of the California Manual of Uniform Traffic Control Devices (MUTCD).

Since the need for the final lane configuration on Harney Way would depend on the rate of buildout of the Project, as well as the rate and extent of buildout of cumulative development in the area such as the Executive Park development, further studies would be needed to determine if and when additional travel lanes are needed to accommodate the traffic volume demand.

> ***Project Mitigation Measure 6:*** Prior to issuance of the grading permit for Phase 2 of the Project, the Project Applicant shall widen Harney Way as shown in **Figure 5** in the Transportation Study. Prior to the issuance of grading permits for Phases 2, 3 and 4, the Project Applicant shall fund a study to evaluate traffic conditions on Harney Way and determine whether additional traffic associated with the next phase of development would result in the need to modify Harney Way to its ultimate configuration, as shown in **Figure 6,** unless this ultimate configuration has already been built. This study shall be conducted in collaboration with the SFMTA, which would be responsible for making final determinations regarding the ultimate configuration. The ultimate configuration would be linked to intersection performance, and it would be required when study results indicate intersection LOS at one or more of the three signalized intersection on Harney Way at mid-LOS D (i.e., at an average delay per vehicle of more than 45 seconds per vehicle). If the study and SFMTA conclude that reconfiguration would be necessary to accommodate traffic demands associated with the next phase of development, the Project Applicant shall be responsible to fund and complete construction of the improvements prior to occupancy of the next phase.

With implementation of the Project Mitigation Measure 6, Harney Way would be widened and improved to its final configuration when traffic demand warrants additional capacity. Therefore, potential Project impacts and Project contribution to cumulative impacts on traffic capacity on Harney Way would be reduced to *less than significant*.

Traffic Spillover - As described above, the Project would result in traffic volumes on area roadways, and most substantially on key north/south and east/west streets, which would also experience cumulative traffic growth. A concern in the Bayview Hunters Point neighborhood is the likelihood that existing residential streets would be "cut-throughs," shortcuts, or bypasses used by non-neighborhood traffic. Substantial amounts of cut-through traffic can result in impacts such as noise, safety impacts to pedestrians, impaired driveway access, interference with emergency vehicle access, increased dust, exhaust, and litter, and similar annoyances that adversely affect neighborhood character.

Within the Candlestick Point area, the Project would include new arterials connecting the Project site to Harney Way and U.S. 101, as well as improvements to existing roadways such as Carroll Avenue, Gilman Avenue, and Jamestown Avenue. These improvements and new roadways would encourage residents and visitors to the Project to use the major arterials for access to and from the site, and would minimize the likelihood of cut-through traffic using residential streets in Bayview Hunters Point. Many of the residential streets in the neighborhood do not cross Third Street to connect with Bayshore Boulevard, and therefore are not attractive bypass routes. In addition, left turns from Third Street are permitted at limited locations, with Carroll Avenue, Gilman Avenue and Jamestown Avenue anticipated to serve as the key east/west routes for Project traffic.

SFMTA has recently completed the *Bayview Traffic Calming Project*[18] which was a community-based process to identify problem locations with a study area roughly bounded by Jamestown Avenue, Third Street and Evans Avenue, and traffic calming measures. The study resulted in a list of traffic calming measures (such as gateway islands, speed humps, speed cushions, and traffic circles) along specific roadways. Implementation of improvements will be phased, and most cost-efficient solutions will be implemented first. Implementation of SFMTA's traffic calming recommendations for the Bayview (e.g., gateway islands, speed humps, speed cushions, and traffic circles) would further discourage cut-through traffic. However, given that many intersections at or near the Project site would be congested, it is likely that spillover impacts would still occur.

The TDM Plan included as part of Project Mitigation Measure 1 would require annual monitoring of traffic conditions to review the effectiveness of the Project's transportation measures and other traffic calming measures implemented in the area to reduce congestion due to

[18] *Bayview Traffic Calming Project* report, SFMTA, December 2006.

Project vehicle trips and to minimize traffic spillover to neighboring residential streets. If warranted, the On-Site TDM Coordinator and SFMTA would consider implementation of additional traffic-calming and congestion-alleviating measures, such as adding additional lanes to the streets that approach Third Street, or other congested areas.

Implementation of the TDM Plan and the transit improvements would likely reduce spillover impacts. Nonetheless, cut-through traffic may occur during periods of congestion, and the impacts associated with spillover traffic would remain *significant and unavoidable.*

Project Variants

Project Variants 1 and 2 would be similar to the Project, except that instead of a new football stadium, which generates very few weekday peak hour vehicle trips, there would be additional research and development space under Variant 1, or a shift in residential units from Candlestick Point to Hunters Point Shipyard under Variant 2. The additional research and development space envisioned under Variant 1 would generate more weekday peak hour vehicular traffic than the Project. **Tables 29** and **30** in Chapter 4 present the peak hour vehicle trips for the Project Variants 1 and 2.

Since the final TDM Plan has not been formally approved yet, ***Project Variant 1 Mitigation Measure 1*** and ***Project Variant 2 Mitigation Measure 1*** would be to implement Project Mitigation Measure 1.

To ensure that Harney Way is widened and improved to its final configuration when traffic demand warrants additional capacity, ***Project Variant 1 Mitigation Measure 2*** and ***Project Variant 2 Mitigation Measure 2*** would be to implement Project Mitigation Measure 6.

Project Variant 1

Under Project Variant 1 conditions, 44 of the 60 study intersections would operate at LOS E or LOS F conditions during the weekday AM or PM, or Sunday PM peak hours. At 14 of the 44 intersections the Project would result in project-specific impacts (i.e., project trips would cause intersections expected to operate at LOS D or better under 2030 No Project conditions to operate at LOS E or F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions). At the remaining 30 of the 44 intersections that would operate at LOS E or LOS F, Project Variant 1 contributions were determined to be less than significant at 8 intersections, and significant at 22 intersections (as identified in **Table 48**). Development associated with Project Variant 1 would therefore result in impacts at 36 intersections (14 Project-specific and 22 with significant contributions to LOS E or LOS F conditions).

Mitigation measures have been identified for the following seven intersections:

26. Tunnel/Blanken
27. Geneva/U.S. 101 Southbound Ramps (existing Alana/Beatty)
28. Harney/U.S. 101 Northbound Ramps (existing Alana/Harney/Thomas Mellon)
30. Crisp/Palou/Griffith
35. Amador/Cargo
37. Bayshore/Oakdale
49. Bayshore/Geneva

26. Tunnel/Blanken – At the signalized intersection of Tunnel/Blanken (currently unsignalized and required to be signalized as part of the Visitacion Valley Redevelopment), the intersection operating conditions would worsen in the AM peak hour from LOS D under 2030 No Project conditions to LOS F with Project Variant 1. In the PM peak hour, the intersection would operate at LOS F under 2030 No Project and with the Project Variant 1 conditions.

> ***Project Variant 1 Mitigation Measure 3*****:** Implement Project Mitigation Measure 2 to reconfigure the northbound and southbound approaches to the intersection of Tunnel/Blanken to provide left turn lanes adjacent to shared through/right lanes. With implementation of Project Mitigation Measure 2, operations at this intersection would improve, but not to acceptable LOS D or better conditions in the AM and PM peak hours. Therefore, project-related impacts at this intersection would remain *significant and unavoidable*.

27. Geneva/U.S. 101 Southbound Ramps (existing Alana/Beatty)
28. Harney/U.S. 101 Northbound Ramps (existing Alana/Harney/Thomas Mellon)
Project Variant 1 would contribute significantly to cumulative impacts at these intersections.

> ***Project Variant 1 Mitigation Measure 4*****:** Implement Project Mitigation Measure 3. The SFCTA shall coordinate with the City of Brisbane and Caltrans to ensure that Project-generated vehicle trips are accounted for the Harney Interchange analyses and design. Since implementation of Project Mitigation Measure 5 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Therefore, the Variant 1-related impacts at these intersections would remain *significant and unavoidable.*

30. Crisp/Palou/Griffith – The intersection of Crisp/Palou is currently unsignalized, but would be signalized with implementation of Project Variant 1. With Project Variant 1, the intersection of Crisp/Palou would worsen in the AM and PM peak hours from LOS E under 2030 No Project conditions to LOS F with Project Variant 1.

> ***Project Variant 1 Mitigation Measure 5***: Restripe the southbound approach to provide a dedicated left-turn lane and a shared through/right-turn lane. On-street parking would be prohibited on Griffith Street between Palou Avenue and Oakdale Avenue.

Implementation of this improvement would be the responsibility of SFMTA and DPW, and shall be implemented as part of Hunters Point Shipyard Phase 3 roadway network improvements. The Project Applicant, in collaboration with the City, shall monitor traffic conditions at completion of Phase 2, Phase 3 and Phase 4 to determine whether the intersection operations would warrant reconfiguration and when it should be implemented. Based on the monitoring, if the City determines reconfiguration is warranted, the Project Applicant shall be required to fund the cost of reconfiguration. The SFMTA and DPW shall design and implement the measure as necessary. With implementation of Project Variant 1 Mitigation Measure 4, this intersection would operate at acceptable LOS D or better in the AM and PM peak hours, and therefore with its implementation, project-related impacts at this intersection would be *less than significant*.

35. Amador/Cargo/Illinois – Project Variant 1 would contribute significantly to cumulative impacts at this intersection.

***Project Variant 1 Mitigation Measure 6*:** Implement Project Mitigation Measure 4. SFMTA shall conduct a feasibility study of the intersection with the Port of San Francisco to determine the feasibility of reconfiguring the southbound approach on Illinois Street to provide a dedicated left turn lane and a dedicated right turn lane. With implementation of Project Mitigation Measure 4**,** operations at this intersection would improve to acceptable levels. However, since a feasibility study would be required, implementation of Mitigation Measure 4 is uncertain, and therefore, Variant 1-related impacts at this intersection would remain *significant and unavoidable.*

47. Innes/Earl - At the unsignalized intersection of Innes/Earl, operating conditions would worsen in the PM peak hour from LOS C under 2030 No Project conditions to LOS E with Project Variant 1, and traffic signal warrants would be met. The intersection is proposed as a side street STOP sign controlled intersection, with movements along Innes Avenue uncontrolled and movements on southbound Earl Street controlled by a STOP sign. The degradation in level of service is primarily due to large increases in traffic along Innes Avenue. The high traffic volumes on Innes Avenue cause additional delay for traffic attempting to exit Earl Street, which is assumed to provide a single lane to accommodate both southbound right-turns and southbound left-turns onto Innes. Project Variant 1 would result in higher volumes of traffic along Innes Avenue than the Project, therefore creating higher delays for southbound traffic on Earl Street.

Project Variant 1 Mitigation Measure 7: Install a traffic signal at the intersection of Innes/Earl. Installation of a traffic signal at the intersection of Innes/Earl would improve intersection operations to LOS D or better conditions. Traffic forecasts show that this intersection would be very close to meeting peak hour traffic signal warrants with buildout of the Project Variant 1. The Project Applicant, in collaboration with the City, shall monitor traffic volumes at completion of Phase 2, Phase 3 and Phase 4 to determine whether the intersection volumes would actually warrant a traffic signal and when it should be implemented. Based on the monitoring, if the City determines a traffic signal is warranted, the Project Applicant shall be required to fund installation of a traffic signal as part of later development phases. The SFMTA and DPW shall design and implement the measure as necessary. Implementation of Variant 1 Mitigation Measure 6 would reduce the impacts at this intersection to *less than significant* levels.

49. Bayshore/Geneva – Project Variant 1 would contribute significantly to cumulative impacts at this location.

***Project Variant 1 Mitigation Measure 8*:** Implement Project Mitigation Measure 5. The SFMTA and SFCTA shall coordinate with the City of Brisbane to ensure that projected traffic volumes are accounted for in the design of the Geneva Avenue Extension. Since implementation of Project Mitigation Measure 5 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Therefore, the Variant 1-related impacts at this intersection would remain *significant and unavoidable.*

The Project impact discussion above did not identify any feasible mitigation measures for 25 of the 36 intersections that would be impacted by Project Variant 1, which include the following:

1. Third/25th
2. Third/Cesar Chavez
3. Third/Cargo
4. Third/Evans
5. Third/Oakdale
6. Third/Palou
7. Third/Revere
8. Third/Carroll
9. Third/Paul
11. Third/Jamestown
15. Cesar/Pennsylvania/I-280
18. Bayshore/Paul
21. Bayshore/Bacon
24. Bayshore/Visitacion
25. Bayshore/Sunnydale
36. Bayshore/Cortland
38. Bayshore/Alemany/Industrial
39. Bayshore/U.S. 101 northbound off to Cesar
41. Bayshore/Blanken
42. San Bruno/Paul
43. San Bruno/Silver
44. San Bruno/Mansell/U.S. 101 Southbound Off-ramp

56. Third/Williams/Van Dyke
57. Third/Jerrold
58. Third/Napoleon/Toland

At these 25 intersections feasible mitigation measures have not been identified, and therefore Variant 1 impacts at these locations would remain *significant and unavoidable.*

Discussion is provided for four intersections not previously discussed under Project condition where mitigation measures have not been identified. The four intersections include:

15. Cesar/Evans
32. Ingalls/Carroll
37. Bayshore/Oakdale
48. Evans/Jennings

15. Cesar/Evans – Project Variant 1 would contribute significantly to cumulative impacts at the signalized intersection of Cesar/Evans. As indicated in the 2030 No Project discussion, feasible mitigation measures that do not involve reconstruction of the existing viaduct have not been identified. Project Variant 1 impacts would remain significant and unavoidable.

32. Ingalls/Carroll – The intersection of Ingalls/Carroll is currently unsignalized, but would be signalized with implementation of Project Variant 1. The intersection of Ingalls/Carroll would worsen in the PM peak hour from LOS C under year 2030 No Project conditions to LOS E with Project Variant 1. The degradation in level of service at this intersection would primarily be due to heavy increases in traffic on Ingalls Street, particularly in the southbound direction in the PM peak hour. Ingalls Street would serve as the most direct auto traffic route for traffic from the Hunters Point Shipyard site destined for Candlestick Point and US 101. Therefore, it would experience substantial traffic increases as part of the Project Variant 1.

To accommodate additional right-of-way needed for additional lanes on southbound Ingalls, Ingalls Street would need to be widened to the east and west. This would require prohibition of on-street parking, which is vital to the industrial businesses along this section of Ingalls Street that use street parking for loading and unloading, or substantial narrowing of the sidewalks. Narrowing of sidewalks would create longer pedestrian crossing distances, and would require more pedestrian crossing time as part of a signal phasing plan. Because widening Ingalls Street would worsen pedestrian conditions, this mitigation was not considered further.

Alternatively, a mitigation measure that reduced travel demand on Ingalls Street by providing an alternate route, such as the Yosemite Slough bridge, would improve operations at this intersection. The proposed new bridge across Yosemite Slough would accommodate four lanes of traffic on game days only plus two transit-only lanes, open at all times, under the Project scenario. Under Project Variant 1, the bridge would only provide the two transit-only lanes, and a bicycle/pedestrian path. If this bridge were to be constructed to the full width as proposed by the Project and if traffic were allowed to use it at all times (two lanes each direction), it would reduce traffic impacts at this intersection. However, allowing traffic on the Yosemite Slough bridge at all times would have potential secondary impacts to Yosemite Slough associated with noise, air quality, and visual impacts, and would be inconsistent with the overall character of the Yosemite Slough restoration. Therefore, opening the Yosemite Slough bridge to regular traffic was not considered further.

Since widening Ingalls Street would not be feasible and providing an alternate traffic route via the Yosemite Slough bridge may have secondary impacts, project-related impacts at this intersection would remain *significant and unavoidable*.

37. Bayshore/Oakdale – At the signalized intersection of Bayshore/Oakdale, the intersection operating conditions would worsen in the PM peak hour from LOS C under 2030 No Project conditions to LOS E with Project Variant 1. The degradation in level of service would primarily be due to forecasted substantial traffic volume increases on Bayshore Boulevard. Mitigation for this impact would involve increasing capacity on Bayshore Boulevard. There is not adequate right-of-way to provide additional lanes on Bayshore Boulevard without widening the roadway. Roadway widening would require major right-of-way acquisition along the entire Bayshore Boulevard corridor, at great cost and displacement of existing homes and businesses. Traffic impacts at this intersection under conditions with the Project Variant 1 would remain *significant and unavoidable*.

48. Evans/Jennings - The unsignalized intersection of Evans/Jennings would operate at LOS F in the AM and PM peak hours under 2030 No Project conditions. With the Project Variant 1, the intersection would be signalized and restriped to accommodate the future travel patterns. With Project Variant 1, the intersection would operate at LOS E in the AM peak hour, and Project Variant 1 would contribute significantly to the poor operating conditions. Additional capacity would be required in the eastbound and southbound directions to accommodate the additional vehicles generated by Project Variant 1. Additional lanes would require substantial right-of-way acquisition to the north or south of Evans Avenue, and on Jennings Street. Right-of-way acquisition would not be possible, and therefore, project-related impacts at Evans/Jennings would remain *significant and unavoidable*.

Project Variant 2

Under Project Variant 2 conditions, 40 of the 60 study intersections would operate at LOS E or LOS F conditions during the weekday AM or PM, or Sunday PM peak hours. At 11 of the 40 intersections the Project Variant 2 would result in project-specific impacts (i.e., project trips would cause intersections expected to operate at LOS D or better under 2030 No Project conditions to operate at LOS E or F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions). At the remaining 29 of the 40 intersections that would operate at LOS E or LOS F, Project Variant 2 contributions were determined to be less than significant at 8 intersections, and significant at 21 intersections (as identified in Table 48). Development associated with Project Variant 2 would therefore result in impacts at 32 intersections (11 project-specific and 21 with significant contributions to LOS E or LOS F conditions).

Mitigation measures were identified for the following five intersections:

26. Tunnel/Blanken
27. Geneva/U.S. 101 Southbound Ramps (Alana/Beatty)
28. Harney/U.S. 101 Northbound Ramps (Alana/Harney/Thomas Mellon)
35. Amador/Cargo
49. Bayshore//Geneva

26. Tunnel/Blanken – At the signalized intersection of Tunnel/Blanken (currently unsignalized and required to be signalized as part of the Visitacion Valley Redevelopment), the intersection operating conditions would worsen in the AM peak hour from LOS D under 2030 No Project conditions to LOS F with Project Variant 2. In the PM peak hour, the intersection would operate at LOS F under 2030 No Project and Project Variant 2 conditions.

> ***Project Variant 2 Mitigation Measure 3*:** Implement Project Mitigation Measure 2 to reconfigure the northbound and southbound approaches to the intersection of Tunnel/Blanken to provide left turn lanes adjacent to shared through/right lanes. With implementation of Project Mitigation Measure 2, operations at this intersection would improve, but not to acceptable LOS D or better conditions in the AM and PM peak hours. Therefore, project-related impacts at this intersection would remain *significant and unavoidable*.

27. Geneva/U.S. 101 Southbound Ramps (existing Alana/Beatty)
28. Harney/U.S. 101 Northbound Ramps (existing Alana/Harney/Thomas Mellon)
Project Variant 2 would contribute significantly to cumulative impacts at these intersections.

> ***Project Variant 2 Mitigation Measure 4*:** Implement Project Mitigation Measure 3. The SFCTA shall coordinate with the City of Brisbane and Caltrans to ensure that Project-generated vehicle trips are accounted for the Harney Interchange analyses and design. Since implementation of Project Mitigation Measure 5 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Therefore, the Variant 1-related impacts at these intersections would remain *significant and unavoidable.*

35. Amador/Cargo/Illinois – Project Variant 2 would contribute significantly to cumulative impacts at this intersection.

> ***Project Variant 2 Mitigation Measure 5*:** Implement Project Mitigation Measure 4. SFMTA shall conduct a feasibility study of the intersection with the Port of San Francisco to determine the feasibility of reconfiguring the southbound approach on Illinois Street to provide a dedicated left turn lane and a dedicated right turn lane. With implementation of Project Mitigation Measure 4**,** operations at this intersection would improve to acceptable levels. However, since a feasibility study would be required, implementation of Mitigation Measure 4 is uncertain, and therefore, Variant 2-related impacts at this intersection would remain *significant and unavoidable.*

49. Bayshore/Geneva – Project Variant 2 would contribute significantly to cumulative impacts at this location.

> ***Project Variant 2 Mitigation Measure 6*:** Implement Project Mitigation Measure 5. The SFMTA and SFCTA shall coordinate with the City of Brisbane to ensure that projected traffic volumes are accounted for in the design of the Geneva Avenue Extension. Since implementation of Project Mitigation Measure 5 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Therefore, the Project Variant 2-related impacts at this intersection would remain *significant and unavoidable.*

The Project and Project Variant 1 discussions did not identify any feasible mitigation measures for 27 of the 32 intersections that would be impacted by Project Variant 2, which include the following:

1. Third/25th
2. Third/Cesar Chavez
3. Third/Cargo
4. Third/Evans
5. Third/Oakdale
6. Third/Palou
7. Third/Revere
8. Third/Carroll
9. Third/Paul
11. Third/Jamestown
15. Cesar/Pennsylvania/I-280
16. Cesar/Evans
18. Bayshore/Paul
21. Bayshore/Bacon
24. Bayshore/Visitacion
25. Bayshore/Sunnydale
36. Bayshore/Cortland

37. Bayshore/Oakdale
38. Bayshore/Alemany/Industrial
39. Bayshore/U.S. 101 northbound off to Cesar
41. Bayshore/Blanken
42. San Bruno/Paul
43. San Bruno/Silver
44. San Bruno/Mansell/U.S. 101 Southbound Off-ramp
56. Third/Williams/Van Dyke
57. Third/Jerrold
58. Evans/Napoleon/Toland

At the 27 intersections where feasible mitigation measures have not been identified, Variant 2 impacts would remain *significant and unavoidable.*

Freeway Operations

Tables 49 through 51 present the results of the freeway mainline and weaving section analysis for conditions with the Project conditions for the AM and PM, and Sunday peak hours, respectively. **Table 52** presents a summary table of project impacts for Project, Project Variants, and Alternatives to the Project for the freeway mainline segments.

Tables 53 through 55 present the results of the freeway mainline and weaving section analysis for conditions with the Project conditions for the AM and PM, and Sunday peak hours, respectively. **Table 56** presents a summary table of project impacts for Project, Project Variants, and Alternatives to the Project for the ramp analysis locations. **Tables 57 through 59** present the results of the freeway diverge (off-ramp) queue storage analysis for conditions with the Project.

Mainline and Weaving Segments

The Project would not cause any freeway mainline segment to deteriorate from acceptable LOS D or better to LOS E or F conditions, nor would it cause any segment to deteriorate from LOS E to LOS F. However, the Project would contribute cumulatively considerable amounts of traffic to five freeway segments expected to operate at LOS E or F under 2030 No Project conditions:

- U.S. 101 northbound from Sierra Point to Alana/Geneva/Harney (AM and PM)
- U.S. 101 southbound from the I-80 Merge to Cesar Chavez (AM and PM)

Table 49
Mainline and Weaving Segment LOS
Project and Project Variant Conditions - Weekday AM Peak Hour

Mainline Segment	Existing		No Project (Alt 1)		Project		Project-Var. 1 (R&D)		Project-Var. 2 (Housing)	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB - Cesar Chavez to Vermont	**E**	**44.6**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Harney Way to Third/Bayshore	D	33.8	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Sierra Point to Harney Way	D	33.8	**E**	**40.5**	**E**	**44.0**	**F**	**>45**	**E**	**43.9**
SB – I-80 Merge to Cesar Chavez	D	33.4	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Third/Bayshore to Harney Way	**E**	**43.0**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Harney/Geneva to Sierra Point	**E**	**42.2**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB – Alemany Off to Alemany On	**E**	**39.1**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**>45**
SB – Alemany On to Alemany Off	C	23.9	D	34.6	D	34.6	D	34.6	D	34.6
Weaving Segment	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol.**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**
I-280										
NB – 25th Street to Mariposa Street	**E**	**1,680**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**
SB – Mariposa Street to 25th Street	B	810	**E**	**1,710**	**E**	**1,710**	**E**	**1,710**	**E**	**1,710**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
3. Segments operating at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 50
Mainline and Weaving Segment LOS
Project and Project Variant Conditions - Weekday PM Peak Hour

Mainline Segment	Existing		No Project (Alt 1)		Project		Project-Var. 1 (R&D)		Project-Var. 2 (Housing)	
	LOS [1]	Density [2] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB - Cesar Chavez to Vermont	D	26.8	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Harney Way to Third/Bayshore	**E**	**42.3**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Sierra Point to Harney Way	**E**	**42.9**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – I-80 Merge to Cesar Chavez	D	33.8	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Third/Bayshore to Harney Way	**E**	**36.0**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Harney/Geneva to Sierra Point	**E**	**36.8**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB – Alemany Off to Alemany On	C	23.9	D	33.3	D	33.3	D	33.3	D	33.3
SB – Alemany On to Alemany Off	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
Weaving Segment	**LOS**	**Service [3] Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**
I-280										
NB – 25th Street to Mariposa Street	C	1,350	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**
SB – Mariposa Street to 25th Street	**E**	**1,630**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**

Notes:
1. Segments operating at LOS E or LOS F conditions highlighted in **bold**
2. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
3. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
Source: Fehr and Peers.

Table 51
Mainline and Weaving Segment LOS
Project and Project Variant Conditions - Sunday PM Peak Hour

Mainline Segment	Existing		No Project (Alt 1)		Project		Project-Var. 1 (R&D)		Project-Var. 2 (Housing)	
	LOS [1]	Density [2] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB - Cesar Chavez to Vermont	C	20.6	D	32.3	D	33.7	D	33.7	D	34.0
NB – Harney Way to Third/Bayshore	C	22.0	D	30.4	D	32.3	D	32.3	D	32.4
NB – Sierra Point to Harney Way	C	21.9	D	27.3	D	31.4	D	31.0	D	31.0
SB – I-80 Merge to Cesar Chavez	D	28.8	D	33.3	D	34.1	D	34.0	D	34.0
SB – Third/Bayshore to Harney Way	C	21.4	D	32.0	D	34.3	D	34.5	D	34.4
SB – Harney/Geneva to Sierra Point	C	21.2	C	24.9	D	28.6	D	28.6	D	28.4
I-280										
NB – Alemany Off to Alemany On	B	15.6	C	21.6	C	21.6	C	21.6	C	21.6
SB – Alemany On to Alemany Off	D	27.0	D	29.5	D	29.5	D	29.5	D	29.5
Weaving Segment	**LOS**	**Service [3, 4] Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**
I-280										
NB – 25th Street to Mariposa Street	A	-	C	1,200	C	1,220	C	1,250	C	1,230
SB – Mariposa Street to 25th Street	A	-	C	1,310	C	1,300	C	1,340	C	1,320

Notes:
1. Segments operating at LOS E or LOS F conditions highlighted in **bold**
2. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
3. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
4. Weaving segments with speeds greater than 50 mph are outside of the realm of the weaving analysis, and thus are assumed to operate at LOS A.
Source: Fehr and Peers.

Table 52
Summary of Impacts at Mainline and Weaving Segments Operating at LOS E or LOS F

Mainline Segment	Project	P-Var 1 (R&D)	P-Var 2 (Housing)	Alt 1 No Project	Alt 2 No Bridge	Alt 3 49ers at Stick	Alt 4 Lesser Build	Alt 5 No Park Agree
U.S. 101								
NB - Cesar Chavez to Vermont	NSC	**SC/PI**	NSC	**NP Impact**	NSC	NSC	NSC	NSC
NB – Harney Way to Third/Bayshore	NSC	NSC	NSC	**NP Impact**	NSC	NSC	NSC	NSC
NB –Sierra Point to Harney Way	**SC/PI**	**SC/PI**	**PI**	**NP Impact**	**SC/PI**	NSC	**SC/PI**	**PI**
SB – I-80 Merge to Cesar Chavez	**SC/PI**	**SC/PI**	NSC	**NP Impact**	**SC/PI**	NSC	NSC	NSC
SB – Third/Bayshore to Harney Way	**SC/PI**	**SC/PI**	**SC/PI**	**NP Impact**	**SC/PI**	NSC	**SC/PI**	**SC/PI**
SB – Harney/Geneva to Sierra Point	**SC/PI**	**SC/PI**	**SC/PI**	**NP Impact**	**SC/PI**	**SC/PI**	**SC/PI**	**SC/PI**
I-280								
NB – Alemany Off to Alemany On	NSC	NSC	NSC	**NP Impact**	NSC	NSC	NSC	NSC
SB – Alemany On to Alemany Off	NSC	NSC	NSC	**NP Impact**	NSC	NSC	NSC	NSC
NB – 25th Street to Mariposa Street	NSC	NSC	NSC	**NP Impact**	NSC	NSC	NSC	NSC
SB – Mariposa Street to 25th Street	NSC	NSC	NSC	**NP Impact**	NSC	NSC	NSC	NSC

Notes:
1. PI – Project Impact. Project results in a change in mainline segments from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives.
2. NSC – No Significant Contribution. Project would not contribute significantly to mainline segments operating at LOS E or LOS F under 2030 No Project conditions. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to mainline segment operating at LOS E or LOS F under 2030 No Project conditions, resulting in a Project Impact.

Table 53
Ramp Junction LOS
Project and Project Variants Conditions - Weekday AM Peak Hour

Ramp Location	Existing		2030 No Project		Project		Project-Var. 1 (R&D)		Project-Var. 2 (Housing)	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB on from Sierra Point Parkway	C	27.0	C	27.5	D	30.4	D	31.8	D	30.3
NB on from Harney Way[2]	C	20.2	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore	D	31.2	C	22.5	C	23.6	C	24.4	C	23.5
NB on from Alemany/Industrial	**E**	**36.4**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore/Cesar	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Bayshore/Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	C	24.1	D	28.8	C	24.1	C	24.5	C	24.1
SB on from Third/Bayshore	D	30.0	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Harney/Geneva[2]	D	29.7	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Sierra Point/Lagoon	C	27.7	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB off to Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Indiana/25th	D	33.4	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Pennsylvania/25th	C	23.6	**E**	**37.0**	**E**	**36.9**	**E**	**37.5**	**E**	**36.9**
SB on from Pennsylvania/25th	C	22.9	**E**	**36.3**	**E**	**36.1**	**E**	**36.3**	**E**	**36.3**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 54
Ramp Junction LOS
Project and Project Variants Conditions - Weekday PM Peak Hour

Ramp Location	Existing		2030 No Project		Project		Project-Var. 1 (R&D)		Project-Var. 2 (Housing)	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB on from Sierra Point Parkway	D	29.7	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Harney Way[2]	D	30.0	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore	D	28.6	D	27.9	D	30.0	D	30.0	D	30.0
NB on from Alemany/Industrial	D	30.2	**E**	**35.9**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore/Cesar	B	19.6	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Bayshore/Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	C	24.5	D	29.6	D	32.6	D	32.7	D	32.7
SB on from Third/Bayshore	C	26.5	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Harney/Geneva[2]	C	24.2	D	31.9	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Sierra Point/Lagoon	C	26.5	C	22.7	D	28.5	D	30.0	D	28.5
I-280										
NB off to Cesar Chavez	D	28.4	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Indiana/25th	C	27.4	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Pennsylvania/25th	**E**	**36.7**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Pennsylvania/25th	**E**	**38.5**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 55
Ramp Junction LOS
Project and Project Variants Conditions - Sunday PM Peak Hour

Ramp Location	Existing		2030 No Project		Project		Project-Var. 1 (R&D)		Project-Var. 2 (Housing)	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB on from Sierra Point Parkway	B	19.3	A	9.1	A	9.8	A	9.8	A	9.8
NB on from Harney Way[2]	B	19.5	D	33.0	**E**	**35.1**	**E**	**35.2**	**E**	**35.3**
NB on from Bayshore	B	16.8	C	21.9	C	22.4	C	22.4	C	21.9
NB on from Alemany/Industrial	C	23.5	C	24.6	C	25.6	C	25.7	C	24.6
NB on from Bayshore/Cesar	C	26.1	D	31.7	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Bayshore/Cesar Chavez	**E**	**37.5**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	D	30.6	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	B	17.3	C	21.2	C	22.5	B	22.5	C	22.5
SB on from Third/Bayshore	B	16.5	C	23.9	D	26.1	C	26.1	C	25.9
SB on from Harney/Geneva[2]	B	18.7	C	24.8	D	29.8	C	29.8	D	29.5
SB on from Sierra Point/Lagoon	B	18.3	C	21.6	C	22.6	C	22.6	C	22.4
I-280										
NB off to Cesar Chavez	B	19.2	C	26.0	D	26.0	C	26.0	C	26.0
NB on from Indiana/25th	B	18.4	C	25.6	D	25.8	C	26.2	C	26.0
SB off to Pennsylvania/25th	C	27.0	D	30.7	D	30.9	D	31.1	D	31.1
SB on from Pennsylvania/25th	C	26.4	D	29.5	D	29.5	D	29.2	D	29.5

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 56
Summary of Impacts at Ramp Junctions Operating at LOS E or LOS F

Ramp Location	Project	P-Var 1 (R&D)	P-Var 2 (Housing)	Alt 1 No Project	Alt 2 No Bridge	Alt 3 49ers at Stick	Alt 4 Lesser Build	Alt 5 No Park Agree
U.S. 101								
NB on from Sierra Point Parkway	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
NB on from Harney Way[2]	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	NSC	SC/PI	SC/PI
NB on from Bayshore	--	--	--	--	--	--	--	--
NB on from Alemany/Industrial	PI	PI	PI	NP Impact	PI	NSC	NSC	PI
NB on from Bayshore/Cesar	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
SB off to Bayshore/Cesar Chavez	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
SB on from Cesar Chavez/Potrero	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
SB on from Alemany/San Bruno	--	--	--	--	--	--	--	--
SB on from Third/Bayshore	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
SB on from Harney/Geneva[2]	PI	PI	PI	NP Impact	PI	SC/PI	SC/PI	PI
SB on from Sierra Point/Lagoon	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC
I-280								
NB off to Cesar Chavez	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
NB on from Indiana/25th	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
SB off to Pennsylvania/25th	SC/PI	SC/PI	SC/PI	NP Impact	SC/PI	SC/PI	SC/PI	SC/PI
SB on from Pennsylvania/25th	NSC	NSC	NSC	NP Impact	NSC	NSC	NSC	NSC

Notes:
1. PI – Project Impact. Project results in a change in ramp merge/diverge from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives**.**
2. NSC – No Significant Contribution. Project would not contribute significantly to ramp merge/diverges operating at LOS E or LOS F under 2030 No Project conditions. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to ramp merge/diverges operating at LOS E or LOS F under 2030 No Project conditions, resulting in a Project Impact.

Table 57
Freeway Diverge Queue Storage
Project and Project Variant Conditions - Weekday AM Peak Hour

Ramp Location	Ramp Storage	Existing	2030 No Project	Project	Project – Variant 1 (R&D)	Project – Variant 2 (Housing)
		95th % Queue[1]	95th % Queue	95th % Queue	95th % Queue	95th % Queue
U.S. 101						
NB off to Harney Way[2]	2,800	< 100	1,725	2,350	2,500	2,350
NB off to Bayshore/Cesar Chavez	750	400	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to San Bruno/Silliman	600	225	225	225	225	225
SB off to San Bruno/Mansell	650	< 100	< 100	<100	< 100	< 100
SB off to Bayshore/Hester	1,700	225	275	275	275	275
SB off to Harney/Geneva[2]	1,000	< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon	1,250	< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
I-280						
NB off to Cesar Chavez	2,500	1,500	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB on from Pennsylvania/25th	900	< 100	< 100	< 100	100.0	< 100

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.
Source: Fehr & Peers.

Table 58
Freeway Diverge Queue Storage
Project and Project Variant Conditions - Weekday PM Peak Hour

Ramp Location	Ramp Storage	Existing	2030 No Project	Project	Project – Variant 1 (R&D)	Project – Variant 2 (Housing)
		95^{th} % Queue[1]	95^{th} % Queue	95^{th} % Queue	95^{th} % Queue	95^{th} % Queue
U.S. 101						
NB off to Harney Way[2]	2,800	< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
NB off to Bayshore/Cesar Chavez	750	375	525	525	525	525
SB off to San Bruno/Silliman	600	325	425	425	425	425
SB off to San Bruno/Mansell	650	150	350	350	350	350
SB off to Bayshore/Hester	1,700	225	125	125	125	125
SB off to Harney/Geneva[2]	1,000	< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon	1,250	< 100	1,000	1,000	1,000	1,000
I-280						
NB off to Cesar Chavez	2,500	650	900	900	900	900
SB on from Pennsylvania/25th	900	< 100	875	875	875	875

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.

Source: Fehr & Peers.

Table 59
Freeway Diverge Queue Storage
Project and Project Variant Conditions - Sunday PM Peak Hour

Ramp Location	Ramp Storage	Existing	2030 No Project	Project	Project – Variant 1 (R&D)	Project – Variant 2 (Housing)
		95th % Queue[1]	95th % Queue	95th % Queue	95th % Queue	95th % Queue
U.S. 101						
NB off to Harney Way[2]	2,800	< 100	1,450	**Spillback**	**Spillback**	2,575
NB off to Bayshore/Cesar Chavez	750	275	350	350	350	350
SB off to San Bruno/Silliman	600	175	250	250	250	250
SB off to San Bruno/Mansell	650	< 100	< 100	100	100	100
SB off to Bayshore/Hester	1,700	300	300	325	350	325
SB off to Harney/Geneva[2]	1,000	< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon	1,250	< 100	125	125	125	125
I-280						
NB off to Cesar Chavez	2,500	300	825	825	825	825
SB on from Pennsylvania/25th	900	< 100	150	175	200	200

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.

Source: Fehr & Peers.

- U.S. 101 southbound from Third/Bayshore to Alana/Geneva/Harney (AM and PM)
- U.S. 101 southbound from Alana/Geneva/Harney to Sierra Point (AM and PM)

All freeway mainline segments would operate at LOS D or better during the Sunday PM peak hour with the Project.

The Project's contributions to LOS E or LOS F conditions at the four freeway segments would be considered significant impacts. The projected poor operating conditions on the affected freeway segments could only be improved by creating additional mainline capacity, which would require substantial additional right-of-way acquisition, substantial freeway reconstruction, and associated substantial costs, and would require an associated jurisdictional transportation improvement planning, prioritization and fair share funding formulation effort, that exceed the reasonable scope of the Project and reasonable control of the lead agency. More specifically,

- Freeway mainline widening to provide acceptable operational conditions would require acquisition of substantial right-of-way, and substantial and infeasible reconstruction of the affected freeway segments and associated over- and under-crossings, the cost of which far exceed the reasonable capability and responsibility of the Project, and for which no interjurisdictional fair share funding mechanism has been established;
- The co-lead agencies (Planning Department and the Redevelopment Agency) do not have jurisdiction over the affected freeway right-of-way; the necessary right-of-way acquisition would necessarily involve Caltrans use of its eminent domain powers;
- Expansion of portions of the affected freeway segments rights-of-way is constrained by existing topography;
- Acquisition of portions of the necessary additional freeway mainline and associated under- and over-crossing right-of-way, and subsequent construction of the necessary freeway mainline widening and associated under- and over-crossings, could not be achieved without the displacement of existing businesses and households and demolition of existing residential and commercial establishments

Therefore, mitigation of this Project-related contribution to 2030 cumulative freeway congestion impacts to a less-than-significant level is considered to be infeasible. The Project-related contribution to this cumulative freeway segment congestion would be *significant and unavoidable*.

Ramp Junctions

Tables 53 through 55 present the results of the ramp junction merge (on-ramp) and diverge (off-ramp) analysis for Project conditions for the AM, PM, and Sunday peak hours, respectively. **Table 56** presents a summary table of project impacts for Project, Project Variants, and Alternatives to the Project for the ramp analysis locations.

The Project would cause four ramp junctions to deteriorate from acceptable LOS D or better to LOS E or F conditions or from LOS E to LOS F conditions:

- U.S. 101 northbound on-ramp from Alemany/Industrial (PM)
- U.S. 101 northbound on-ramp from Harney Way (Sunday)
- U.S. 101 northbound on-ramp from Bayshore/Cesar Chavez (Sunday)
- U.S. 101 southbound on-ramp from Harney/Geneva (PM)

The Project would result in significant traffic impacts at these locations. Providing additional on-ramp lanes would increase the volume of traffic entering the freeway mainline segment, and may exacerbate the poor merging conditions. As described above, widening of U.S. 101 to provide additional capacity would not be feasible. Thus, mitigation of these impacts has been determined to be infeasible. Project impacts at these locations would be *significant and unavoidable*.

The Project would also contribute cumulatively significant traffic increases at ramp junctions projected to operate at LOS E or LOS F under 2030 No Project conditions:

- U.S. 101 northbound on-ramp from Sierra Point (PM)
- U.S. 101 northbound on-ramp from Harney Way (AM and PM)
- U.S. 101 northbound on-ramp from Alemany/Industrial (AM)
- U.S. 101 northbound on-ramp from Bayshore/Cesar Chavez (AM and PM)
- U.S. 101 southbound off-ramp to Bayshore/Cesar Chavez (AM, PM, and Sunday)
- U.S. 101 southbound on-ramp from Third Street/Bayshore Boulevard (AM and PM)
- U.S. 101 southbound on-ramp from Harney/Geneva (AM)
- U.S. 101 southbound on-ramp from Sierra Point (AM)
- I-280 northbound off-ramp to Cesar Chavez (AM and PM)
- I-280 northbound on-ramp from Indiana/25th Street (AM and PM)
- I-280 southbound off-ramp to Pennsylvania/25th Street (AM and PM)
- I-280 southbound on-ramp from Pennsylvania/25th Street (AM and PM)

The Project would contribute significantly to cumulative impacts at these locations. As described above, no feasible mitigation measures have been identified for the ramp junction locations. Therefore, the Project's contributions to cumulative impacts at the ramp locations would be *significant and unavoidable*.

Tables 57 through 59 present the results of the freeway diverge (off-ramp) queue storage analysis for conditions with the Project. The Project would result in increases in traffic volumes that would cause the U.S. 101 northbound off-ramp to Harney Way to experience queues that may extend back to the upstream freeway mainline segment which could result in unsafe conditions on the freeway mainline. The Project would therefore result in significant traffic impacts at this location.

Project Mitigation Measure 3 provides for the Project Applicant to pay a fair share toward the construction of the Harney Way Interchange Project, which could mitigate for the Project's contributions to this impact. Because the environmental review of the interchange project is not yet complete and the interchange project would be undertaken and approved by Caltrans, the implementation of Project Mitigation Measure 3 is uncertain and is outside the City/Agency jurisdiction. Therefore, Project-related impacts related to freeway diverge queue storage would be *significant and unavoidable*.

The Project would also contribute cumulatively significant traffic increases at off-ramps where queues may extend onto freeway mainline segments under year 2030 No Project Conditions:

- U.S. 101 northbound off-ramp to Harney Way (PM)
- U.S. 101 northbound off-ramp to Bayshore/Cesar Chavez (AM)
- U.S. 101 southbound off-ramp to Harney/Geneva (AM, PM, and Sunday)
- U.S. 101 southbound off-ramp to Sierra Point/Lagoon (AM)
- I-280 northbound off-ramp to Cesar Chavez (AM)

As noted above, Project Mitigation Measure 3 provides for the Project Applicant to pay a fair share toward the construction of the Harney Way Interchange Project, which could mitigate for the Project's contributions to this impact. Because the environmental review of the interchange project is not yet complete and the interchange would be undertaken and approved by Caltrans, the implementation of Project Mitigation Measure 3 is uncertain and is outside the City/Agency jurisdiction. Therefore, Project's contribution to impacts related to freeway diverge queue storage would remain *significant and unavoidable*.

Project Variants

Mainline and Weaving Segments

The Project Variants would create impacts at similar freeway mainline sections to the Project, although the magnitude of impacts may be greater with Project Variants 1 and 2, due to increased traffic generation compared to the Project.

Project Variant 1

Project Variant 1 would result in significant impacts at the same freeway mainline sections as the Project. However, as described in Chapter 5 for 2030 No Project conditions, no feasible mitigation measures have been identified for the freeway segments expected to experience significant impacts under 2030 No Project conditions. Therefore, the Project Variant 1 contributions to LOS E or LOS F freeway operating conditions would be considered *significant and unavoidable*.

Project Variant 2

Project Variant 2 would result in similar significant traffic impacts at freeway mainline segments as the Project. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway segments expected to experience significant impacts under Project conditions. Therefore, the Project Variant 2 contributions to LOS E and LOS F freeway operating conditions would be considered *significant and unavoidable*.

Ramp Junctions

The Project Variants would create impacts at similar freeway ramp junctions to the Project, although the magnitude of impacts may be greater with Project Variants 1 and 2, due to increased traffic generation compared to the Project.

Project Variant 1

Project Variant 1 would create similar significant traffic impacts to freeway ramp junctions as the Project. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway ramp junctions expected to experience significant impacts under Project conditions. Therefore, the Project Variant 1 contributions to deficient freeway operating conditions are considered *significant and unavoidable*.

Project Variant 2

Project Variant 2 would create similar significant traffic impacts to freeway ramp junctions as the Project. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway ramp junctions expected to experience significant impacts under Project conditions. Therefore, the Project Variant 1 contributions to deficient freeway operating conditions are considered *significant and unavoidable*.

The analysis of ramp queuing for Variants 1 and 2 is similar to the analysis of ramp merge and diverge junctions.

Project Variant 1

Project Variant 1 would result in significant impacts with respect to ramp queuing at the same off-ramp locations as the Project. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway off-ramps expected to experience significant impacts under Project conditions. Therefore, the Project Variant 1 contributions to freeway segments operating at LOS E or LOS F conditions would be considered *significant and unavoidable*.

Project Variant 2

Project Variant 2 would result in significant impacts with respect to ramp queuing at the same off-ramp locations as the Project, with one exception. Under Project Variant 2, the U.S. 101 northbound off-ramp to Harney Way would not be likely to experience queues extending back to the mainline in the Sunday peak hour. However, the Project Variant 2 contributions to all other off-ramps expected to experience significant traffic impacts associated with queuing under Project conditions would be the same as the Project. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway off-ramps expected to experience significant impacts under Project conditions. Therefore, the Project Variant 2 contributions to freeway segments operating at LOS E or LOS F would be considered *significant and unavoidable*.

6.1.2 Alternatives to the Project

Transportation Study Appendix E contains the intersection turning movement volumes at the study intersections for existing and future conditions in table format, while Transportation Study Appendix F contains the intersection LOS analysis calculation sheets.

Intersection Operations

Tables 60 and 61 presents a comparison of the intersection LOS analysis for the Alternatives to the Project for the weekday AM and PM peak hours, respectively. **Table 62** presents this comparison for Sunday PM peak hour conditions. **Table 48** on page 175 presented the summary table of project impacts for the Alternatives to the Project.

Alternative 1 – No Project: Alternative 1 assumes that development within Hunters Point Shipyard would occur per the approved plans for Phase I. No development within Candlestick Point was assumed. Under the 2030 No Project conditions, 38 of the 60 intersections would operate at LOS E or LOS F (as compared with three intersections under existing conditions). The intersections include:

- Third/25th
- Third/Cargo
- Third/Evans
- Third/Palou
- Third/Gilman/Paul
- 25th/Pennsylvania
- Cesar Chavez/Pennsylvania/I-280 northbound off-ramp
- Cesar Chavez/Evans
- Bayshore/Paul
- Bayshore/Hester/U.S. 101 southbound off-ramp
- Bayshore/Tunnel
- Bayshore/Bacon/Egbert/Phelps
- Bayshore/Arleta
- Bayshore/Leland
- Bayshore/Visitacion
- Bayshore/Sunnydale

- Tunnel Blanken
- Geneva/U.S. 101 southbound ramps (existing Alana/Beatty)
- Harney/U.S. 101 northbound ramps (existing Alana/Harney/Thomas Mellon)
- Harney/Jamestown
- Crisp/Palou/Griffith
- Arelious Walker/Gilman
- Amador/Cargo/Illinois
- Bayshore/Cortland
- Bayshore/Alemany/Industrial
- Bayshore/U.S. 101 northbound off-ramp/Jerrold
- Bayshore/Silver
- Bayshore/Blanken
- San Bruno/Paul
- San Bruno/Silver
- San Bruno/Mansell/U.S. 101 southbound off-ramp
- San Bruno/Silliman/U.S. 101 southbound ramps
- Evans/Jennings
- Bayshore/Geneva
- Bayshore/Old County
- Sierra Point Parkway/U.S. 101 southbound ramps/Lagoon Way
- Third/Jerrold
- Evans/Napoleon/Toland

As indicated in section 4.3, a number of intersection improvements would be implemented as part of conditions of approval placed on development projects by the Planning Department and the Redevelopment Agency. For the intersections of Cesar Chavez/Evans and Third/Evans, the Hunters Point Shipyard Development Plan's Mitigation Monitoring and Reporting Program included an improvement at the intersection of Cesar Chavez/Evans, which have not been assumed for the 2030 No Project condition due to its infeasibility.

Cesar Chavez/Evans – The Hunters Point Shipyard Redevelopment Plan's mitigation measure identified reconfiguration of the northbound approach of Evans Avenue to Cesar Chavez Street to provide exclusive northbound left and right turn lanes, and changing the signal timing plan to include the exclusive left turn and right turn movements. The measure identified that the southeast corner curb return would require structural modifications to the existing viaduct. DPW, as part of the BTI Project analysis, identified widening of the existing structure supporting the Evans Avenue and Cesar Chavez Street intersection as infeasible.

Table 60
Intersection LOS
Alternatives to the Project – Weekday AM Peak Hour – 2030 Conditions

	Intersection	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Third/25th	**>80/1.43**	**F**	**>80/1.54**	**F**	**>80/1.39**	**F**	**>80/1.41**	**F**	**>80/1.53**	**F**
2	Third/Cesar Chavez	**>80/1.61**	**F**	**>80/1.63**	**F**	**>80/1.58**	**F**	**>80/1.61**	**F**	**>80/1.63**	**F**
3	Third/Cargo Way	**>80/1.36**	**F**	**>80/1.90**	**F**	**>80/1.33**	**F**	**>80/1.84**	**F**	**>80/1.90**	**F**
4	Third/Evans	**>80/1.41**	**F**	**>80/1.43**	**F**	**>80/1.36**	**F**	**>80/1.38**	**F**	**>80/1.44**	**F**
5	Third/Oakdale	21	C	25	C	20	C	23	C	24	C
6	Third/Palou	**>80/1.77**	**F**	**>80/1.91**	**F**	**>80/1.81**	**F**	**>80/1.75**	**F**	**>80/1.97**	**F**
7	Third/Revere	35	C	51	D	36	D	41	D	46	D
8	Third/Carroll	12	B	23	C	12	B	18	B	19	B
9	Third/Paul	**>80/1.23**	**F**	**>80/2.00**	**F**	**>80/1.30**	**F**	**>80/1.82**	**F**	**>80/1.89**	**F**
10	Third/Ingerson	5	A	6	A	5	A	6	A	6	A
11	Third/Jamestown	29	C	**>80/1.03**	**F**	30	C	49	D	**77/0.99**	**E**
12	Third/Le Conte/101 nb off	50	D	50	D	51	D	50	D	50	D
13	25th/Illinois	14	B	13	B	13	B	13	B	13	B
14	25th/Pennsylvania	26	D	29	C	29	C	29	C	29	C
15	Cesar Chavez/Penns/I-280	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**
16	Cesar Chavez St/Evans	**>80/1.92**	**F**	**>80/1.91**	**F**	**>80/1.92**	**F**	**>80/1.90**	**F**	**>80/1.92**	**F**
17	Cesar Chavez St/Illinois	25	C	34	C	24	C	23	C	24	C
18	Bayshore/Paul	**61/1.56**	**E**	**>80/2.64**	**F**	**70/1.68**	**E**	**>80/2.45**	**F**	**>80/2.63**	**F**
19	Bayshore/Hester/101 sb off	**>80/1.34**	**F**	**>80/1.36**	**F**	**>80/1.34**	**F**	**>80/1.35**	**F**	**>80/1.36**	**F**
20	Bayshore/Tunnel	**>80/2.00**	**F**	**>80/2.05**	**F**	**>80/2.00**	**E**	**>80/2.05**	**E**	**>80/2.05**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
Source: Fehr & Peers.

Table 60 (continued)
Intersection LOS
Alternatives to the Project – Weekday AM Peak Hour – 2030 Conditions

	Intersection	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
21	Bayshore/Bacon	**>80/4.05**	**F**	**>80/4.08**	**F**	**>80/4.15**	**F**	**>80/4.01**	**F**	**>80/4.18**	**F**
22	Bayshore/Arleta	**>80/1.21**	**F**	**>80/1.23**	**F**	**>80/1.21**	**F**	**>80/1.22**	**F**	**>80/1.23**	**F**
23	Bayshore/Leland	**>80/1.24**	**F**	**>80/1.26**	**F**	**>80/1.24**	**F**	**>80/1.25**	**F**	**>80/1.26**	**F**
24	Bayshore/Visitacion	**>80/1.55**	**F**	**>80/1.56**	**F**	**>80/1.55**	**F**	**>80/1.56**	**F**	**>80/1.56**	**F**
25	Bayshore/Sunnydale	**>80/1.32**	**F**	**>80/1.34**	**F**	**>80/1.32**	**F**	**>80/1.33**	**F**	**>80/1.34**	**F**
26	Tunnel/Blanken	43	D	**>80/1.06**	**F**	44	D	**>80/1.06**	**F**	**>80/1.06**	**F**
27	Geneva/U.S. 101 SB Ramps [3]	**>80/2.17**	**F**	**>80/2.31**	**F**	**>80/2.17**	**F**	**>80/2.31**	**F**	**>80/2.31**	**F**
28	Harney/U.S. 101 NB Ramps [3]	**>80/1.20**	**F**	**>80/1.35**	**F**	**>80/1.20**	**F**	**>80/1.35**	**F**	**>80/1.35**	**F**
29	Harney/Jamestown [4]	12	B	20	B	11	B	23	C	22	B
30	Crisp/Palou [4]	**57/0.99**	**E**	44	D	39	D	39	D	42	D
31	Ingalls/Thomas [4]	19.0 (wb)	C	22	C	21.7 (wb)	C	20	B	22	C
32	Ingalls/Carroll [4]	15	B	28	C	16	C	27	C	28	C
33	Ingalls/Egbert	8	A	9	A	8	A	9	A	9	A
34	A.Walker/Gilman [4]	**>60 (eb)**	**F**	30	C	**>60 (eb)**	**F**	31	C	31	C
35	Amador/Cargo	**65/1.06**	**E**	54	D	**56/1.01**	**E**	48	D	**56/1.02**	**E**
36	Bayshore/Cortland	37	D	**>80/1.18**	**F**	37	D	**>80/1.18**	**F**	**>80/1.18**	**F**
37	Bayshore/Oakdale	43	D	51	D	43	D	49	D	50	D
38	Bayshore/Alemany/Industrial	**>80/1.00**	**F**	**>80/1.05**	**F**	**>80/1.01**	**F**	**>80/1.03**	**F**	**>80/1.04**	**F**
39	Bayshore/101 nb off to Cesar	**74/0.91**	**E**	**>80/0.94**	**F**	**77/0.91**	**E**	**>80/0.93**	**F**	**>80/0.93**	**F**
40	Bayshore/Silver	**>80/1.58**	**F**	**>80/1.70**	**F**	**>80/1.61**	**F**	**>80/1.63**	**F**	**>80/1.75**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 60 (continued)
Intersection LOS
Alternatives to the Project – Weekday AM Peak Hour – 2030 Conditions

Intersection		Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore/Blanken	**>80/1.48**	**F**	**>80/1.51**	**F**	**>80/1.48**	**F**	**>80/1.51**	**F**	**>80/1.51**	**F**
42	San Bruno/Paul	**>80/1.21**	**F**	**>80/1.23**	**F**	**>80/1.19**	**F**	**>80/1.22**	**F**	**>80/1.23**	**F**
43	San Bruno/Silver	**>80/1.43**	**F**	**>80/1.41**	**F**	**>80/1.41**	**F**	**>80/1.40**	**F**	**>80/1.41**	**F**
44	S. Bruno/Mansell/101 sb off	**>80/1.08**	**F**	**>80/1.11**	**F**	**64/1.09**	**F**	**68/1.11**	**F**	**>80/1.11**	**F**
45	S. Bruno/Silliman/101 sb off	**>80/1.08**	**F**	**>80/1.08**	**F**	**>80/1.07**	**F**	**>80/1.08**	**F**	**>80/1.07**	**F**
46	Innes/A.Walker [4]	5	A	6	A	5	A	6	A	5	A
47	Innes/Earl	17.3 (sb)	C	13.3 (sb)	B	17.1 (sb)	C	12.5 (sb)	B	15.0 (sb)	B
48	Evans/Jennings	**>80/1.96**	**F**	28	C	28	C	24	C	30	C
49	Bayshore/Geneva	**>80/1.39**	**F**	**>80/1.40**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.40**	**F**
50	Bayshore/Guadalupe	21	C	21	C	21	C	21	C	21	C
51	Bayshore/Valley	20	C	20	C	20	C	20	C	20	C
52	Bayshore/Old County	40	D	39	D	39	D	39	D	39	D
53	Sierra Pt/Lagoon/101 sb off	**>80/1.85**	**F**	**>80/1.85**	**F**	**>80/1.85**	**F**	**>80/1.85**	**F**	**>80/1.85**	**F**
54	Ingalls/Palou [4]	16	B	18	B	16	B	18	B	18	B
55	Keith/Palou [4]	10	A	9	A	10	A	10	A	10	A
56	Third/Williams/Van Dyke	18	B	30	C	18	B	27	C	29	C
57	Third/Jerrold	49	D	**>80/0.74**	**F**	**56/0.64**	**E**	**>80/0.71**	**F**	**>80/0.73**	**F**
58	Evans/Napoleon/Toland	**>80/1.45**	**F**	**>80/1.50**	**F**	**>80/1.43**	**F**	**>80/1.48**	**F**	**>80/1.50**	**F**
59	Harney/Executive Park East	25	C	25	C	25	C	25	C	25	C
60	Harney/Thomas Mellon	30	C	34	C	32	C	34	C	34	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 61
Intersection LOS
Alternatives to the Project – Weekday PM Peak Hour – 2030 Conditions

	Intersection	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Third/25th	**>80/2.45**	**F**	**>80/2.92**	**F**	**>80/2.51**	**F**	**>80/2.77**	**F**	**>80/2.93**	**F**
2	Third/Cesar Chavez	**>80/1.56**	**F**	**>80/1.76**	**F**	**>80/1.60**	**F**	**>80/1.70**	**F**	**>80/1.75**	**F**
3	Third/Cargo Way	**>80/1.44**	**F**	**>80/1.74**	**F**	**>80/1.49**	**F**	**>80/1.68**	**F**	**>80/1.74**	**F**
4	Third/Evans	**>80/1.36**	**F**	**>80/1.53**	**F**	**>80/1.44**	**F**	**>80/1.47**	**F**	**>80/1.56**	**F**
5	Third/Oakdale	30	C	**60/1.12**	**E**	33	C	53	D	**60/1.12**	**E**
6	Third/Palou	**>80/4.71**	**F**	**>80/5.99**	**F**	**>80/5.08**	**F**	**>80/5.37**	**F**	**>80/6.07**	**F**
7	Third/Revere	37	D	**>80/1.14**	**F**	39	D	**80/1.10**	**F**	**>80/1.14**	**F**
8	Third/Carroll	14	B	**75/0.93**	**E**	15	B	**56/0.86**	**E**	**67/0.92**	**E**
9	Third/Paul	**>80/1.37**	**F**	**>80/3.36**	**F**	**>80/1.49**	**F**	**>80/2.87**	**F**	**>80/3.32**	**F**
10	Third/Ingerson	7	A	43	D	7	A	40	D	52	D
11	Third/Jamestown	30	C	**>80/6.64**	**F**	32	C	**>80/1.21**	**F**	**>80/6.15**	**F**
12	Third/Le Conte/101 nb off	24	C	23	C	23	C	23	C	23	C
13	25th/Illinois	14	B	14	B	14	B	13	B	14	B
14	25th/Pennsylvania	**>80/1.42**	**F**	40	D	40	D	40	D	40	D
15	Cesar Chavez/Penns/I-280	**>80/1.36**	**F**	**>80/1.37**	**F**	**>80/1.37**	**F**	**>80/1.36**	**F**	**>80/1.37**	**F**
16	Cesar Chavez St/Evans	**>80/1.83**	**F**	**>80/1.84**	**F**	**>80/1.84**	**F**	**>80/1.83**	**F**	**>80/1.84**	**F**
17	Cesar Chavez St/Illinois	22	C	23	C	23	C	22	C	23	C
18	Bayshore/Paul	**>80/2.00**	**F**	**>80/2.90**	**F**	**>80/2.03**	**F**	**>80/2.70**	**F**	**>80/2.93**	**F**
19	Bayshore/Hester/101 sb off	**>80/1.25**	**F**	**>80/1.28**	**F**	**>80/1.25**	**F**	**>80/1.28**	**F**	**>80/1.28**	**F**
20	Bayshore/Tunnel	**>80/2.30**	**F**	**>80/2.51**	**F**	**>80/2.34**	**F**	**>80/2.47**	**F**	**>80/2.51**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 61 (continued)
Intersection LOS
Alternatives to the Project – Weekday PM Peak Hour – 2030 Conditions

	Intersection	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
21	Bayshore/Bacon	**>80/1.87**	**F**	**>80/1.91**	**F**	**>80/1.92**	**F**	**>80/1.91**	**F**	**>80/1.95**	**F**
22	Bayshore/Arleta	**>80/1.36**	**F**	**>80/1.39**	**F**	**>80/1.36**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**
23	Bayshore/Leland	**>80/1.58**	**F**	**>80/1.67**	**F**	**>80/1.58**	**F**	**>80/1.66**	**F**	**>80/1.67**	**F**
24	Bayshore/Visitacion	**>80/1.43**	**F**	**>80/1.47**	**F**	**>80/1.43**	**F**	**>80/1.47**	**F**	**>80/1.47**	**F**
25	Bayshore/Sunnydale	**>80/1.15**	**F**	**>80/1.19**	**F**	**>80/1.15**	**F**	**>80/1.19**	**F**	**>80/1.19**	**F**
26	Tunnel/Blanken	**>80/1.46**	**F**	**>80/1.45**	**F**	**>80/1.46**	**F**	**>80/1.45**	**F**	**>80/1.45**	**F**
27	Geneva/U.S. 101 SB Ramps [3]	**>80/2.94**	**F**	**>80/3.25**	**F**	**>80/2.97**	**F**	**>80/3.19**	**F**	**>80/3.25**	**F**
28	Harney/U.S. 101 NB Ramps [3]	**>80/1.43**	**F**	**>80/1.74**	**F**	**>80/1.46**	**F**	**>80/1.69**	**F**	**>80/1.74**	**F**
29	Harney/Jamestown [4]	**40/1.03**	**E**	41	D	**61/1.18**	**F**	31	C	41	D
30	Crisp/Palou [4]	**58/0.97**	**E**	54	D	48	D	46	D	55	D
31	Ingalls/Thomas [4]	27.9 (wb)	C	33	C	**40.7 (wb)**	**E**	28	C	33	C
32	Ingalls/Carroll [4]	17	C	38	D	28	D	33	C	38	D
33	Ingalls/Egbert	9	A	9	A	9	A	9	A	9	A
34	A.Walker/Gilman [4]	**>60 (eb)**	**F**	36	D	**>60 (eb)**	**F**	34	C	36	D
35	Amador/Cargo	**60/1.05**	**E**	**59/1.04**	**E**	**62/1.05**	**E**	50	D	**60/1.05**	**E**
36	Bayshore/Cortland	**>80/1.48**	**F**	**>80/1.87**	**F**	**>80/1.49**	**F**	**>80/1.85**	**F**	**>80/1.87**	**F**
37	Bayshore/Oakdale	33	C	55	D	34	C	52	D	**55/1.05**	**E**
38	Bayshore/Alemany/Industrial	**>80/1.23**	**F**	**>80/1.18**	**F**	**>80/1.24**	**F**	**>80/1.15**	**F**	**>80/1.18**	**F**
39	Bayshore/101 nb off to Cesar	**>80/0.88**	**F**	**>80/0.91**	**F**	**>80/0.89**	**F**	**>80/0.91**	**F**	**>80/0.91**	**F**
40	Bayshore/Silver	**>80/2.64**	**F**	**>80/2.91**	**F**	**>80/2.89**	**F**	**>80/2.91**	**F**	**>80/2.91**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 61 (continued)
Intersection LOS
Alternatives to the Project – Weekday PM Peak Hour – 2030 Conditions

	Intersection	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore/Blanken	**>80/1.33**	**F**	**>80/1.40**	**F**	**>80/1.34**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**
42	San Bruno/Paul	**>80/2.10**	**F**	**>80/2.71**	**F**	**>80/2.17**	**F**	**>80/2.56**	**F**	**>80/2.75**	**F**
43	San Bruno/Silver	**>80/1.46**	**F**	**>80/1.56**	**F**	**>80/1.56**	**F**	**>80/1.55**	**F**	**>80/1.57**	**F**
44	S. Bruno/Mansell/101 sb off	**64/1.15**	**F**	**>80/1.22**	**F**	**64/1.15**	**F**	**78/1.20**	**F**	**>80/1.20**	**F**
45	S. Bruno/Silliman/101 sb off	38	D	38	D	38	D	38	D	38	D
46	Innes/A.Walker [4]	5	A	6	A	5	A	6	A	6	A
47	Innes/Earl	23.1 (sb)	C	19.4 (sb)	C	24.8 (sb)	C	16.5 (sb)	C	19.7 (sb)	C
48	Evans/Jennings	**>80/2.41**	**F**	31	C	33	C	27	C	33	C
49	Bayshore/Geneva	**>80/1.73**	**F**	**>80/1.76**	**F**	**>80/1.74**	**F**	**>80/1.75**	**F**	**>80/1.76**	**F**
50	Bayshore/Guadalupe	50	D	49	D	50	D	49	D	49	D
51	Bayshore/Valley	40	D	40	D	40	D	40	D	40	D
52	Bayshore/Old County	**>80/1.10**	**F**	**>80/1.13**	**F**	**>80/1.10**	**F**	**>80/1.13**	**F**	**>80/1.13**	**F**
53	Sierra Pt/Lagoon/101 sb off	**>80/4.38**	**F**	**>80/4.38**	**F**	**>80/4.38**	**F**	**>80/4.38**	**F**	**>80/4.38**	**F**
54	Ingalls/Palou [4]	16	B	22	C	17	B	20	C	22	C
55	Keith/Palou [4]	8	A	8	A	8	A	8	A	8	A
56	Third/Williams/Van Dyke	17	B	**>80/0.98**	**F**	17	B	**>80/0.95**	**F**	**>80/0.98**	**F**
57	Third/Jerrold	**>80/0.72**	**F**	**>80/0.88**	**F**	**>80/0.75**	**F**	**>80/0.87**	**F**	**>80/0.89**	**F**
58	Evans/Napoleon/Toland	**>80/1.53**	**F**	**>80/1.61**	**F**	**>80/1.53**	**F**	**>80/1.60**	**F**	**>80/1.62**	**F**
59	Harney/Executive Park East	25	C	26	C	26	C	26	C	27	C
60	Harney/Thomas Mellon	19	B	26	C	20	B	24	C	26	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 62
Intersection LOS
Alternatives to the Project – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Third/25th	**63/0.57**	**E**	**58/0.70**	**E**	**68/0.63**	**E**	**56/0.67**	**E**	**61/0.74**	**E**
2	Third/Cesar Chavez	31	C	**66/0.73**	**E**	36	D	53	D	**>80/0.78**	**F**
3	Third/Cargo Way	30	C	30	C	31	C	28	C	33	C
4	Third/Evans	**57/0.65**	**E**	**59/0.87**	**E**	**74/0.80**	**E**	**51/0.80**	**D**	**67/0.91**	**E**
5	Third/Oakdale	14	C	15	B	14	B	14	B	15	B
6	Third/Palou	**>80/0.92**	**F**	**>80/4.03**	**F**	**>80/1.73**	**F**	**>80/2.70**	**F**	**>80/2.51**	**F**
7	Third/Revere	20	B	24	C	20	B	22	C	24	C
8	Third/Carroll	10	B	**55/0.66**	**E**	11	B	40	D	**60/0.65**	**E**
9	Third/Paul	**64/0.73**	**E**	**>80/1.89**	**F**	**>80/0.82**	**F**	**>80/1.67**	**F**	**>80/1.82**	**F**
10	Third/Ingerson	3	A	27	C	3	A	24	C	27	C
11	Third/Jamestown	24	C	**>80/1.24**	**F**	24	C	**>80/1.06**	**F**	**>80/1.14**	**F**
12	Third/Le Conte/101 nb off	14	B	13	B	14	B	14	B	14	B
13	25th/Illinois	10	A	10	A	10	A	10	A	10	A
14	25th/Pennsylvania	**45/1.01**	**E**	34	C	34	C	34	C	34	C
15	Cesar Chavez/Penns/I-280	**61/0.65**	**E**	**60/0.65**	**E**	**60/0.65**	**E**	**61/0.65**	**E**	**60/0.65**	**E**
16	Cesar Chavez St/Evans	18	B	19	B	19	B	19	B	19	B
17	Cesar Chavez St/Illinois	18	B	18	B	18	B	18	B	18	B
18	Bayshore/Paul	14	B	54	D	15	B	42	D	55	D
19	Bayshore/Hester/101 sb off	14	B	14	B	14	B	14	B	14	B
20	Bayshore/Tunnel	53	D	**60/1.59**	**E**	53	D	**59/1.56**	**E**	**60/1.59**	**E**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
Source: Fehr & Peers.

Table 62 (continued)
Intersection LOS
Alternatives to the Project – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
21	Bayshore/Bacon	17	B	30	C	18	B	29	C	30	C
22	Bayshore/Arleta	54	D	49	D	55	D	49	D	49	D
23	Bayshore/Leland	41	D	38	D	42	D	38	D	38	D
24	Bayshore/Visitacion	**64/0.98**	**E**	**70/1.03**	**E**	**64/0.98**	**E**	**69/1.02**	**E**	**69/1.02**	**E**
25	Bayshore/Sunnydale	55	D	55	D	**56/0.79**	**E**	55	D	55	D
26	Tunnel/Blanken	30	C	51	D	30	C	51	D	51	D
27	Geneva/U.S. 101 SB Ramps [3]	**>80/2.04**	**F**	**>80/2.34**	**F**	**>80/2.09**	**F**	**>80/2.32**	**F**	**>80/2.36**	**F**
28	Harney/U.S. 101 NB Ramps [3]	54	D	**>80/1.36**	**F**	**61/1.08**	**E**	**>80/1.27**	**F**	**>80/1.28**	**F**
29	Harney/Jamestown [4]	22	C	24	C	**37/0.99**	**E**	21	C	24	C
30	Crisp/Palou [4]	37	D	46	D	**73/1.08**	**E**	44	D	44	D
31	Ingalls/Thomas [4]	11.8 (wb)	B	26	C	13.9 (wb)	B	24	C	25	C
32	Ingalls/Carroll [4]	9	A	28	C	12	B	27	C	27	C
33	Ingalls/Egbert	8	A	8	A	8	A	8	A	8	A
34	A.Walker/Gilman [4]	**72.5 (eb)**	**F**	36	D	**>80 (eb)**	**F**	35	D	36	D
35	Amador/Cargo	21	C	20	B	23	C	20	B	20	C
36	Bayshore/Cortland	23	C	25	C	23	C	25	C	25	C
37	Bayshore/Oakdale	21	C	21	C	21	C	21	C	21	C
38	Bayshore/Alemany/Industrial	40	D	52	D	41	D	49	D	51	D
39	Bayshore/101 nb off to Cesar	25	C	26	C	25	C	26	C	26	C
40	Bayshore/Silver	19	B	26	C	21	C	24	C	26	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 62 (continued)
Intersection LOS
Alternatives to the Project – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore/Blanken	51	D	**68/1.16**	**E**	51	D	**66/1.16**	**E**	**68/1.16**	**E**
42	San Bruno/Paul	39	D	**>80/1.46**	**F**	**56/0.98**	**E**	**>80/1.39**	**F**	**>80/1.36**	**F**
43	San Bruno/Silver	**>80/1.29**	**F**	**>80/1.40**	**F**	**>80/1.37**	**F**	**>80/1.37**	**F**	**>80/1.37**	**F**
44	S. Bruno/Mansell/101 sb off	27	D	**38/1.00**	**E**	27	D	**38/1.00**	**E**	**36/0.98**	**E**
45	S. Bruno/Silliman/101 sb off	**78/0.36**	**E**	**70/0.37**	**E**	**77/0.36**	**E**	**77/0.36**	**E**	**77/0.36**	**E**
46	Innes/A.Walker [4]	4	A	6	A	4	A	6	A	5	A
47	Innes/Earl	9.9 (sb)	A	10 (sb)	B	10.4 (sb)	B	10.0 (sb)	A	10.5 (sb)	B
48	Evans/Jennings	33	D	20	C	20	C	20	B	20	C
49	Bayshore/Geneva	44	D	43	D	44	D	43	D	43	D
50	Bayshore/Guadalupe	9	A	9	A	9	A	9	A	9	A
51	Bayshore/Valley	10	A	10	A	10	A	10	A	10	B
52	Bayshore/Old County	43	D	42	D	44	D	42	D	42	D
53	Sierra Pt/Lagoon/101 sb off	43	D	**44/1.01**	**E**	**44/1.01**	**E**	**44/1.01**	**E**	**44/1.01**	**E**
54	Ingalls/Palou [4]	16	B	22	C	16	B	22	C	20	C
55	Keith/Palou [4]	10	B	7	A	8	A	8	A	8	A
56	Third/Williams/Van Dyke	14	B	23	C	13	B	21	C	23	C
57	Third/Jerrold	23	C	31	C	24	C	29	C	34	C
58	Evans/Napoleon/Toland	**57/0.50**	**E**	**60/0.57**	**E**	**56/0.54**	**E**	**60/0.56**	**E**	**60/0.58**	**E**
59	Harney/Executive Park East	18	B	22	C	18	B	16	B	15	B
60	Harney/Thomas Mellon	15	B	19	B	15	B	15	B	15	B

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

With the planned construction of a Class II bicycle lane on Cesar Chavez Street, which would remove an eastbound travel lane on Cesar Chavez Street, the operations at this intersection are expected to deteriorate even further. As a result, widening the Evans Avenue viaduct to provide an additional lane on Evans Avenue may not offer a substantial benefit, since the primary constraint would be on Cesar Chavez Street.

Third/Evans – The Hunters Point Shipyard Redevelopment Plan included a mitigation measure at the intersection of Third/Evans which proposed that the southbound left turn lane be eliminated and left turns be rerouted via Phelps Street to Evans Avenue. The mitigation measure also called for signalization of the intersection of Phelps/Evans and removal of on-street parking on Phelps Street and Evans Avenue. The intersection of Phelps Street and Evans Avenue has recently been signalized and on-street parking has been removed along Phelps Street and Evans Avenue, although the removal of the southbound left-turn movement from Third Street to Evans Avenue has not been implemented. Evaluation of intersection operating conditions with the rerouting of southbound left turns indicated that the elimination of the southbound left turn lane and rerouting of traffic to Phelps Street would not substantially improve intersection operating conditions and overall intersection operations would remain at LOS F

Alternative 2 – No Bridge: Alternative 2 would be the same as the Project, except that the bridge across Yosemite Slough would not be constructed. Because the Yosemite Slough bridge would not accommodate auto travel on non-game days, the traffic circulation patterns are expected to be the same under Alternative 2 as the Project.

Without the bridge across Yosemite Slough, the proposed new BRT route traveling between Balboa Park BART Station and the Hunters Point Shipyard Transit Center would be follow a different alignment than under the Project. Instead of a direct route across Yosemite Slough, the BRT route would travel west along Carroll Avenue, north along Hawes Street, and then west on Armstrong Avenue, where it would join the Navy railroad right-of-way. The BRT route would travel in the railroad right-of-way around Yosemite Slough, rejoining the existing roadway network at Shafter Avenue. The route would continue east on Shafter Avenue to Arelious Walker, where it would reassume the same alignment as the Project. Operation of the BRT within the rail right-of-way would not affect study intersection operations. Therefore, the traffic impacts associated with Alternative 2 would be the same as the Project.

Under Alternative 2 conditions, 39 of the 60 study intersections would operate at LOS E or LOS F conditions during the weekday AM or PM, or Sunday PM peak hours. At 10 of the 39 intersections the Alternative 2 would result in project-specific impacts (i.e., project trips would cause intersections expected to operate at LOS D or better under 2030 No Project conditions to operate at LOS E or F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions). At the remaining 29 of the 39 intersections that would operate at LOS E or LOS F, Alternative 2 contributions were determined to be less than significant at 9 intersections, and significant at 20 intersections (as identified in Table 48). Therefore, development associated with Alternative 2 would result in significant impacts at 30 intersections (10 project-specific and 20 due to significant contributions to LOS E or LOS F conditions).

No feasible mitigation measures have been identified for 25 of the 30 impacted intersections. The 25 intersections include:

1. Third/25th
2. Third/Cesar Chavez
3. Third/Cargo
4. Third/Evans
5. Third/Oakdale
3. Third/Palou
7. Third/Revere
8. Third/Carroll
9. Third/Paul
11. Third/Jamestown
15. Cesar/Pennsylvania/I-280
18. Bayshore/Paul
21. Bayshore/Bacon
24. Bayshore/Visitacion
25. Bayshore/Sunnydale
36. Bayshore/Cortland
38. Bayshore/Alemany/Industrial
39. Bayshore/U.S. 101 off to Cesar
41. Bayshore/Blanken
42. San Bruno/Paul
43. San Bruno/Silver
44. San Bruno/Mansell/U.S. 101 Southbound Off-ramp
56. Third/Williams/Van Dyke
57. Third/Jerrold
58. Evans/Napoleon/Toland

At the 25 intersections where feasible mitigation measures have not been identified, Alternative 2 impacts would remain *significant and unavoidable.*

At the following five intersections feasible mitigation measures were identified:

26. Tunnel/Blanken
27. Geneva/U.S. 101 southbound ramps (existing Alana/Beatty)
28. Harney/U.S. 101 northbound ramps (existing Alana/Harney/Thomas Mellon)
35.Amador/Cargo/Illinois
49. Bayshore/Geneva

At these intersections, Project Mitigation Measures 2 through 5 would be applicable for Alternative 2. At the intersection of Tunnel/Blanken, with implementation of Project Mitigation Measure 2, operations would improve, but not to acceptable LOS D or better conditions in the AM and PM peak hours. Therefore, project-related impacts at Tunnel/Blanken would be *significant and unavoidable*.

Since implementation of Project Mitigation Measures 3 though 5 are uncertain, Project-related impacts at the four intersections of Geneva/U.S. 101 southbound ramps, Harney/U.S. 101 northbound ramps, Amador/Cargo/Illinois, and Bayshore/Geneva, traffic impacts would remain *significant and unavoidable*.

Alternative 3 – 49ers at Candlestick: Compared to the Project, Alternative 3 would involve less overall development, with slightly more development at the Hunters Point Shipyard and virtually no change to the existing uses at Candlestick Point. Overall, Alternative 3 would result in fewer impacts than those identified for the Project.

Under Alternative 3 conditions, 36 of the 60 study intersections would operate at LOS E or LOS F conditions during the weekday AM or PM, or Sunday PM peak hours. At 3 of the 36 intersections, Alternative 3 would result in project-specific impacts (i.e., project trips would cause intersections expected to operate at LOS D or better under 2030 No Project conditions to operate at LOS E or F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions). At the remaining 33 of the 36 intersections that would operate at LOS E or LOS F, Alternative 3 contributions were determined to be less than significant at 24 intersections, and significant at 9 intersections (as identified in Table 48). Therefore, development associated with Alternative 3 would therefore result in impacts at 20 intersections (3 project-specific and 17 with significant contributions to LOS E or LOS F conditions).

No feasible mitigation measures have been identified for 14 of the 20 impacted intersections. The 14 intersections include:

1. Third/25th
2. Third/Cesar Chavez
3. Third/Cargo
4. Third/Evans
6. Third/Palou
9. Third/Paul
15. Cesar/Pennsylvania/I-280
16. Cesar/Evans
18. Bayshore/Paul
21. Bayshore/Bacon
38. Bayshore/Alemany/Industrial
43. San Bruno/Silver

57. Third/Jerrold
58. Evans/Napoleon/Toland

At the 14 intersections where feasible mitigation measures have not been identified, Alternative 3 impacts would remain *significant and unavoidable.*

Project Mitigation Measures 3 through 5 were identified for the following three intersections where Alternative 3 would have significant contributions to cumulative impacts:

27. Geneva/U.S. 101 Southbound Ramps (existing Alana/Beatty)
35. Amador/Cargo
49. Bayshore/Geneva

At these intersections, Project Mitigation Measures 3 through 5 would be applicable for Alternative 3. Since implementation of Project Mitigation Measures 3 though 5 are uncertain, Project-related traffic impacts at the three intersections would remain *significant and unavoidable*.

In addition, Alternative 3 would have project-specific impacts at the following intersections, and mitigation measures were identified:

29. Harney/Jamestown
31. Ingalls/Thomas
34. Arelious Walker/Gilman

29. Harney/Jamestown – At the unsignalized intersection of Harney/Jamestown, the intersection operations would deteriorate in the PM peak hour from LOS E under year 2030 No Project conditions to LOS F with Alternative 3.

> ***Alternative 3 Mitigation Measure 5:*** Install a traffic signal at the intersection of Harney/Jamestown. Implementation of this measure would be the responsibility of SFMTA, and should be implemented when traffic signal warrants are met. Prior to completion of Phase 1 of development, the Project Applicant shall fully fund the cost of signalization improvements.

Implementation of this mitigation measure would reduce Alternative 3 traffic impacts at this intersection to *less than significant* levels.

31. Ingalls/Thomas - At the unsignalized intersection of Ingalls/Thomas, the intersection operating conditions would worsen in the PM peak hour from LOS C under 2030 No Project conditions to LOS E with Alternative 3. (The intersection would operate at LOS C in the AM and PM peak hours with the Project. This intersection would be signalized with the Project, but not under Alternative 3.) Traffic forecasts show that this intersection would meet peak hour traffic signal warrants with buildout of Alternative 3.

The intersection is a side street STOP sign controlled intersection, with movements along Ingalls Street uncontrolled and movements on eastbound and westbound Thomas Avenue controlled by a STOP sign. The degradation in level of service would primarily be due to large increases in traffic along Thomas Avenue attempting to turn left onto southbound Ingalls Street.

> ***Alternative 3 Mitigation Measure 6:*** Install traffic signal at the intersection of Ingalls/Thomas. Implementation of this measure would be the responsibility of SFMTA, and should be implemented when traffic signal warrants are met. Prior to completion of Phase 1 of development, the Project Applicant shall fully fund the cost of signalization improvements. Installation of a traffic signal at the intersection of Ingalls/Thomas intersection would improve intersection operations to LOS D or better conditions.

Implementation of Alternative 3 Mitigation Measure 6 would reduce the impacts at this intersection to *less than significant* levels.

34. Arelious Walker/Gilman – At the unsignalized intersection of Arelious Walker/Gilman, under Alternative 3 the LOS F operating conditions would worsen in the AM and PM peak hours. Peak hour traffic volumes at this intersection would meet signal warrants.

> ***Alternative 3 Mitigation Measure 7***: Install a traffic signal at the intersection of Arelious Walker/Gilman. Implementation of the new signal would be the responsibility of SFMTA, and should be implemented when traffic signal warrants are met. Since signalization was determined to be required even without the Project under 2030 No Project conditions, the Project Applicant shall contribute its fair-share toward the cost of improvements. Prior to payment of the contribution, the City shall create a mechanism to determine and receive fair share contributions from the Project Applicant. The SFMTA and DPW shall design and implement the measure as necessary. Since implementation of this mitigation measure is uncertain, traffic impacts would remain significant and unavoidable.

Alternative 4 – Lesser Build: Alternative 4 would be similar to the Project, but with less overall development in the project area. Impacts associated with Alternative 4 would be similar to or less than those identified for the Project.

Under Alternative 4 conditions, 37 of the 60 study intersections would operate at LOS E or LOS F conditions during the weekday AM or PM, or Sunday PM peak hours. At 8 of the 37 intersections Alternative 4 would result in project-specific impacts (i.e., project trips would cause intersections expected to operate at LOS D or better under 2030 No Project conditions to operate at LOS E or F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions). At the remaining 29 of the 37 intersections that would operate at LOS E or LOS F, Alternative 4 contributions were determined to be less than significant at 16 intersections, and significant at 13 intersections (as identified in Table 48). Development associated with Alternative 4 would therefore result in impacts at 21 intersections (8 project-specific and 13 with significant contributions to LOS E or LOS F conditions).

No feasible mitigation measures have been identified for 21 of the 25 impacted intersections. The 21 intersections include:

1. Third/25th
2. Third/Cesar Chavez
3. Third/Cargo
4. Third/Evans
6. Third/Palou
7. Third/Revere
8. Third/Carroll
9. Third/Paul
11. Third/Jamestown
15. Cesar/Pennsylvania/I-280
18. Bayshore/Paul
21. Bayshore/Bacon
36. Bayshore/Cortland
38. Bayshore/Alemany/Industrial
39. Bayshore/U.S. 101 northbound off to Cesar
42. San Bruno/Paul
43.San Bruno/Silver
44.San Bruno/Mansell/U.S. 101 Southbound Off-ramp
56. Third/Williams/Van Dyke
59. Evans/Napoleon/Toland
57. Third/Jerrold

At the 21 intersections where feasible mitigation measures have not been identified, Alternative 4 impacts would remain *significant and unavoidable.*

Project Mitigation Measures 2, 3 and 5 would be applicable for the following four intersections:

26. Tunnel/Blanken
27. Geneva/U.S. 101 southbound ramps (existing Alana/Beatty)
28. Harney/U.S. 101 northbound ramps (existing Alana/Harney/Thomas Mellon)
49. Bayshore/Geneva

At the intersection of Tunnel/Blanken, with implementation of Project Mitigation Measure 2, operations would improve, but not to acceptable LOS D or better conditions in the AM and PM peak hours. Therefore, project-related impacts at Tunnel/Blanken would be *significant and unavoidable*.

Since implementation of Project Mitigation Measures 3 and 5 are uncertain, Project-related impacts at the four intersections of Geneva/U.S. 101 southbound ramps, Harney/U.S. 101

northbound ramps, and Bayshore/Geneva, traffic impacts would remain *significant and unavoidable*.

Alternative 5 – No Park Agreement: Alternative 5 would be the same as Project Variant 2, but with no bridge over Yosemite Slough. As discussed under Alternative 2, eliminating the bridge over Yosemite Slough may have a minor effect on mode choice, resulting in slightly higher auto trips compared to the same scenario with the bridge. However, the difference in the number of vehicle trips is expected to be negligible. The travel patterns would be the same with and without the bridge, since it would not be open to auto travel on non-game days. Therefore, impacts associated with Alternative 5 would be similar to those identified for Project Variant 2.

Under Alternative 5 conditions, 40 of the 60 study intersections would operate at LOS E or LOS F conditions during the weekday AM or PM, or Sunday PM peak hours. At 11 of the 40 intersections the Alternative 5 would result in project-specific impacts (i.e., project trips would cause intersections expected to operate at LOS D or better under 2030 No Project conditions to operate at LOS E or F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions). At the remaining 29 of the 40 intersections that would operate at LOS E or LOS F, Alternative 5 contributions were determined to be less than significant at 8 intersections, and significant at 21 intersections (as identified in Table 48). Development associated with Alternative 5 would therefore result in impacts at 32 intersections (11 project-specific and 21 with significant contributions to LOS E or LOS F conditions).

Feasible mitigation measures were not identified for the following 27 of the 32 intersections that would be impacted by Alternative 5:

1. Third/25th
2. Third/Cesar Chavez
3. Third/Cargo
4. Third/Evans
5. Third/Oakdale
6. Third/Palou
7. Third/Revere
8. Third/Carroll
9. Third/Paul
11. Third/Jamestown
15. Cesar/Pennsylvania/I-280
16. Cesar/Evans
18. Bayshore/Paul
21. Bayshore/Bacon
24. Bayshore/Visitacion
25. Bayshore/Sunnydale
36. Bayshore/Cortland

37. Bayshore/Oakdale
38. Bayshore/Alemany/Industrial
39. Bayshore/U.S. 101 northbound off to Cesar
41. Bayshore/Blanken
42. San Bruno/Paul
43.San Bruno/Silver
44.San Bruno/Mansell/U.S. 101 Southbound Off-ramp
56. Third/Williams/Van Dyke
57. Third/Jerrold
58. Evans/Napoleon/Toland

At the 27 intersections where feasible mitigation measures have not been identified, Variant 2 impacts would remain *significant and unavoidable.*

Mitigation measures were identified for the following five intersections:

26. Tunnel/Blanken
27. Geneva/U.S. 101 Southbound Ramps (existing Alana/Beatty)
28. Harney/U.S. 101 Northbound Ramps (existing Alana/Harney/Thomas Mellon)
35. Amador/Cargo
49. Bayshore//Geneva

At these intersections, Project Mitigation Measures 2 through 5 would be applicable for Alternative 5. At the intersection of Tunnel/Blanken, with implementation of Project Mitigation Measure 2, operations would improve, but not to acceptable LOS D or better conditions in the AM and PM peak hours. Therefore, project-related impacts at Tunnel/Blanken would be *significant and unavoidable*.

Since implementation of Project Mitigation Measures 3 though 5 are uncertain, Project-related impacts at the four intersections of Geneva/U.S. 101 southbound ramps, Harney/U.S. 101 northbound ramps, Amador/Cargo/Illinois, and Bayshore/Geneva, traffic impacts would remain *significant and unavoidable*.

Freeway Operations

Tables 63 through 65 present the comparison of the mainline and weaving section LOS for Project Alternatives for the AM, PM, and Sunday peak hours, respectively. **Tables 66 through 68** present the comparison of the ramp junction analysis. **Tables 69 through 71** present a comparison of the ramp queuing analysis. Transportation Study Appendix G contains the freeway LOS analysis calculation sheets.

Table 63
Mainline and Weaving Segment LOS
Project Alternative Conditions - Weekday AM Peak Hour

Mainline Segment	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49es at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB - Cesar Chavez to Vermont	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Harney Way to Third/Bayshore	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB –Sierra Point to Harney Way	**E**	**40.5**	**E**	**44.0**	**E**	**40.4**	**E**	**43.6**	**E**	**43.9**
SB – I-80 Merge to Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Third/Bayshore to Alana Way	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Alana Way to Sierra Point	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB – Alemany Off to Alemany On	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Alemany On to Alemany Off	D	34.6	D	34.6	D	34.6	D	34.6	D	34.6
Weaving Segment	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**
I-280										
NB – 25th Street to Mariposa Street	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**
SB – Mariposa Street to 25th Street	**E**	**1,710**	**E**	**1,710**	**E**	**1,710**	**E**	**1,690**	**E**	**1,710**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
3. Segments operating at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 64
Mainline and Weaving Segment LOS
Project Alternative Conditions - Weekday PM Peak Hour

Mainline Segment	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49es at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB - Cesar Chavez to Vermont	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Harney Way to Third/Bayshore	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB –Sierra Point to Harney Way	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – I-80 Merge to Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Third/Bayshore to Alana Way	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Alana Way to Sierra Point	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB – Alemany Off to Alemany On	D	33.3	D	33.3	D	33.3	D	33.3	D	33.3
SB – Alemany On to Alemany Off	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
Weaving Segment	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**
I-280										
NB – 25th Street to Mariposa Street	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**
SB – Mariposa Street to 25th Street	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
3. Segments operating at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 65
Mainline and Weaving Segment LOS
Project Alternative Conditions - Sunday PM Peak Hour

Mainline Segment	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49es at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB - Cesar Chavez to Vermont	D	32.3	D	33.7	D	32.5	D	32.8	D	33.0
NB – Harney Way to Third/Bayshore	D	30.4	D	32.3	D	30.8	D	31.1	D	31.2
NB –Sierra Point to Harney Way	D	27.3	D	31.4	D	28.3	D	30.9	D	31.0
SB – I-80 Merge to Cesar Chavez	D	33.3	D	34.1	D	33.3	D	34.1	D	34.0
SB – Third/Bayshore to Alana Way	D	32.0	D	34.3	D	32.4	D	34.1	D	34.4
SB – Alana Way to Sierra Point	C	24.9	D	28.6	C	25.7	D	28.3	D	28.4
I-280										
NB – Alemany Off to Alemany On	C	21.6	C	21.6	C	21.6	C	21.6	C	21.6
SB – Alemany On to Alemany Off	D	29.5	D	29.5	D	29.5	D	29.5	D	29.5
Weaving Segment	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**	**LOS**	**Service Vol (pc/h)**
I-280										
NB – 25th Street to Mariposa Street	C	1,200	C	1,220	C	1,230	C	1,210	C	1,230
SB – Mariposa Street to 25th Street	C	1,310	C	1,300	C	1,300	C	1,280	C	1,320

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
3. Segments operating at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 66
Ramp Junction LOS
Project Alternative Conditions - Weekday AM Peak Hour

Ramp Location	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49es at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln	LOS	Density (pc/mi/ln)
U.S. 101										
NB on from Sierra Point Parkway	C	27.5	D	30.4	C	27.4	D	30.1	C	30.3
NB on from Harney Way[2]	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore	C	22.5	C	23.6	C	22.7	C	23.5	C	23.5
NB on from Alemany/Industrial	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore/Cesar	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Bayshore/Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	D	28.8	D	24.1	D	28.8	D	24.1	D	24.1
SB on from Third/Bayshore	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Harney/Geneva[2]	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Sierra Point/Lagoon	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB off to Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Indiana/25th	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Pennsylvania/25th	**E**	**37.0**	**E**	**36.9**	**E**	**36.8**	**E**	**36.8**	**E**	**36.9**
SB on from Pennsylvania/25th	**E**	**36.3**	**E**	**36.3**	**E**	**36.3**	**E**	**36.3**	**E**	**36.3**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 67
Ramp Junction LOS
Project Alternative Conditions - Weekday PM Peak Hour

Ramp Location	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49es at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln	LOS	Density (pc/mi/ln)
U.S. 101										
NB on from Sierra Point Parkway	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Harney Way[2]	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore	C	27.9	D	30.0	D	28.1	C	29.8	D	30.0
NB on from Alemany/Industrial	**E**	**35.9**	**F**	**>45**	**E**	**36.0**	**F**	**>45**	**F**	**>45**
NB on from Bayshore/Cesar	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Bayshore/Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	D	29.6	D	32.6	D	29.9	D	32.3	D	32.7
SB on from Third/Bayshore	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Harney/Geneva[2]	D	31.9	**F**	**>45**	C	23.4	**F**	**>45**	**F**	**>45**
SB on from Sierra Point/Lagoon	C	22.7	D	28.5	C	23.4	C	27.3	D	28.5
I-280										
NB off to Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Indiana/25th	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Pennsylvania/25th	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Pennsylvania/25th	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 68
Ramp Junction LOS
Project Alternative Conditions - Sunday PM Peak Hour

Ramp Location	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49es at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln	LOS	Density (pc/mi/ln)
U.S. 101										
NB on from Sierra Point Parkway	A	9.1	A	9.8	A	9.3	A	9.7	A	9.8
NB on from Harney Way[2]	D	33.0	**E**	**35.1**	D	33.2	D	33.5	D	33.5
NB on from Bayshore	C	21.9	C	22.4	C	21.9	C	21.9	C	21.9
NB on from Alemany/Industrial	C	24.6	C	25.6	C	24.6	C	24.6	C	24.6
NB on from Bayshore/Cesar	D	31.7	**F**	**>45**	D	32.1	D	32.7	D	33.2
SB off to Bayshore/Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	C	21.2	C	22.4	C	21.4	C	22.4	C	22.5
SB on from Third/Bayshore	C	23.9	C	26.0	C	24.4	C	25.7	C	25.9
SB on from Harney/Geneva[2]	C	24.8	D	29.8	C	25.7	D	29.4	C	29.5
SB on from Sierra Point/Lagoon	C	21.6	C	22.6	D	20.5	C	22.3	C	22.4
I-280										
NB off to Cesar Chavez	C	26.0	C	26.0	C	26.0	C	26.0	C	26.0
NB on from Indiana/25th	C	25.6	C	25.8	C	25.6	C	25.7	C	26.0
SB off to Pennsylvania/25th	D	30.7	D	30.9	D	31.1	D	30.9	D	31.1
SB on from Pennsylvania/25th	D	29.5	D	29.5	D	29.5	D	29.5	D	29.5

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 69
Freeway Diverge Queue Storage
Project Alternative Conditions - Weekday AM Peak Hour

Ramp Location	Ramp Storage	Alternative 1 No Project	Alternative 2 No Bridge	Alternative 3 49es at Candlestick	Alternative 4 Lesser Build	Alternative 5 No Park Agreement
		95th % Queue[1]	95th % Queue	95th % Queue	95th % Queue	95th % Queue
U.S. 101						
NB off to Harney Way[2]	2,800	1,725	2,350	1,725	600	2,350
NB off to Bayshore/Cesar Chavez	750	**Spillback**	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to San Bruno/Silliman	600	175	175	175	175	175
SB off to San Bruno/Mansell	650	< 100	100	< 100	< 100	< 100
SB off to Bayshore/Hester	1,700	275	275	275	275	275
SB on from Harney/Geneva[2]	1,000	**Spillback**	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon	1,250	**Spillback**	**Spillback**	**Spillback**	**Spillback**	**Spillback**
I-280						
NB off to Cesar Chavez	2,500	**Spillback**	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB on from Pennsylvania/25th	900	< 100	< 100	< 100	< 100	< 100

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.
Source: Fehr & Peers.

Table 70
Freeway Diverge Queue Storage
Project Alternative Conditions - Weekday PM Peak Hour

Ramp Location	Ramp Storage (feet)	Alternative 1 No Project	Alternative 2 No Bridge	Alternative 3 49es at Candlestick	Alternative 4 Lesser Build	Alternative 5 No Park Agreement
		95th % Queue[1]	95th % Queue	95th % Queue	95th % Queue	95th % Queue
U.S. 101						
NB off to Harney Way[2]	2,800	**Spillback**	**Spillback**	**Spillback**	**Spillback**	**Spillback**
NB off to Bayshore/Cesar Chavez	750	525	525	525	525	525
SB off to San Bruno/Silliman	600	425	425	425	425	425
SB off to San Bruno/Mansell	650	350	350	325	350	350
SB off to Bayshore/Hester	1,700	125	125	125	125	125
SB on from Harney/Geneva[2]	1,000	**Spillback**	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon	1,250	1,000	1,000	1,000	1,000	1,000
I-280						
NB off to Cesar Chavez	2,500	900	900	900	900	900
SB off to Pennsylvania/25th	900	875	875	875	875	875

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.
Source: Fehr & Peers.

Table 71
Freeway Diverge Queue Storage
Project Alternative Conditions - Sunday PM Peak Hour

Ramp Location	Ramp Storage (feet)	Alternative 1 No Project	Alternative 2 No Bridge	Alternative 3 49es at Candlestick	Alternative 4 Lesser Build	Alternative 5 No Park Agreement
		95th % Queue[1]	95th % Queue	95th % Queue	95th % Queue	95th % Queue
U.S. 101						
NB off to Harney Way[2]	2,800	1,450	**Spillback**	1,600	2,550	2,575
NB off to Bayshore/Cesar Chavez	750	350	350	350	350	350
SB off to San Bruno/Silliman	600	250	250	200	200	250
SB off to San Bruno/Mansell	650	< 100	100	< 100	100	100
SB off to Bayshore/Hester	1,700	300.0	325	300	325	325
SB on from Harney/Geneva[2]	1,000	**Spillback**	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon	1,250	125	125	125	125	125
I-280						
NB off to Cesar Chavez	2,500	825	825	825	825	825
SB on from Pennsylvania/25th	900	150	175	200	150	200

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.
Source: Fehr & Peers.

Project Alternative 1 is the 2030 No Project scenario, and was discussed in Chapter 5. Project Alternative 2 has the same travel demand and distribution characteristics as the Project and Project Alternative 5 has the same travel demand and distribution characteristics as Project Variant 2. Thus, discussion of these three Alternatives is not repeated in this section.

Project Alternatives 3 and 4 would generate fewer peak hour vehicle trips than the Project, and thus their contributions to study mainline and weaving segments and ramps would be less than for the Project.

Mainline and Weaving Segments

Project Alternatives 3 and 4 would generally contribute less traffic to the roadway system than the Project. A discussion of Project Alternatives 3 and 4 is included below.

Alternative 3 – 49ers at Candlestick: Traffic generated by Alternative 3 would create significant traffic impacts at the same locations as those identified for the Project. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway mainline segments expected to experience significant impacts under Project conditions. Therefore, the impacts associated with Alternative 3 are considered *significant and unavoidable*.

Alternative 4 – Lesser Build: Traffic generated by Alternative 4 would create significant traffic impacts at the same locations as those identified for the Project. However, Alternative 4 would also cause the freeway mainline segment on I-280 southbound between Mariposa Street and 25th Street to deteriorate from LOS E to LOS F in the AM peak hour, compared to the No Project. This would be an additional significant impact associated with Alternative 4, compared to the Project. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway mainline segments expected to experience significant impacts under Project conditions. Therefore, the impacts associated with Alternative 4 are considered *significant and unavoidable*.

Ramp Junctions

The freeway impacts analysis also examined merge/diverge levels of service and the potential for queues to extend from off-ramps onto freeway mainline segments for Alternatives 3 and 4.

Alternative 3 – 49ers at Candlestick: Traffic generated by Alternative 3 would create significant traffic impacts at the same locations as those identified for the Project, with four exceptions:

- The U.S. 101 northbound on-ramp from Alemany/Industrial was projected to deteriorate from LOS E in the PM peak hour under 2030 No Project conditions to LOS F with the Project. Under Alternative 3, the ramp merge section would continue to operate at LOS E in the PM peak hour.
- The U.S. 101 southbound on-ramp from Geneva Extension was projected to deteriorate from LOS D in the PM peak hour under 2030 No Project conditions to LOS F with the

Project. Under Alternative 3, the ramp merge section would operate at acceptable LOS C in the PM peak hour.

- The U.S. 101 northbound on-ramp from Harney Way was projected to deteriorate from LOS D in the Sunday peak hour under 2030 No Project conditions to LOS E with the Project. Under Alternative 3, this segment would remain at acceptable LOS D.
- The U.S. 101 northbound on-ramp from Bayshore/Cesar Chavez was projected to deteriorate from LOS D in the Sunday peak hour under 2030 No Project conditions to LOS F with the Project. Under Alternative 3, this segment would remain at acceptable LOS D.

Otherwise, significant traffic impacts associated with Alternative 3 would occur at the same locations as the Project, although the magnitude may be less due to less overall traffic generation associated with Alternative 3. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway mainline segments expected to experience significant impacts under Project conditions. Therefore, the impacts associated with Alternative 3 are considered *significant and unavoidable*.

Alternative 4 – Lesser Build: Traffic generated by Alternative 4 would create significant traffic impacts at the same locations as those identified for the Project, with two exceptions:

- The U.S. 101 northbound on-ramp from Harney Way was projected to deteriorate from LOS D in the Sunday peak hour under 2030 No Project conditions to LOS E with the Project. Under Alternative 3, this segment would remain at acceptable LOS D.
- The U.S. 101 northbound on-ramp from Bayshore/Cesar Chavez was projected to deteriorate from LOS D in the Sunday peak hour under 2030 No Project conditions to LOS F with the Project. Under Alternative 3, this segment would remain at acceptable LOS D.

Otherwise, significant traffic impacts associated with Alternative 4 would occur at the same locations as the Project, although the magnitude may be less due to less overall traffic generation associated with Alternative 4. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway mainline segments expected to experience significant impacts under Project conditions. Therefore, the impacts associated with Alternative 3 are considered *significant and unavoidable*.

The ramp analysis also examined the potential for queues at study off-ramps to extend back onto study freeway segments under conditions with Alternatives 3 and 4.

Alternative 3 – 49ers at Candlestick: Traffic generated by Alternative 3 would create significant traffic impacts associated with off-ramp queuing at the same locations as those identified for the Project, with one exception:

- Queues on the U.S. 101 northbound off-ramp to Harney Way were projected to extend back onto the adjacent freeway mainline segment during the Sunday peak hour under conditions with the Project. This would not occur under conditions with Alternative 3.

Otherwise, significant traffic impacts associated with Alternative 3 associated with off-ramp queuing would occur at the same locations as the Project, although the magnitude may be less due to less overall traffic generation associated with Alternative 3. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway off-ramps expected to experience significant queuing impacts under Project conditions. Therefore, the impacts associated with Alternative 3 are considered *significant and unavoidable*.

Alternative 4 – Lesser Build: Conditions under Alternative 4 would be similar to Alternative 3. Traffic generated by Alternative 4 would create significant traffic impacts associated with off-ramp queuing at the same locations as those identified for the Project, with one exception:

- Queues on the U.S. 101 northbound off-ramp to Harney Way were projected to extend back onto the adjacent freeway mainline segment during the Sunday peak hour under conditions with the Project. This would not occur under conditions with Alternative 4.

Otherwise, significant traffic impacts associated with Alternative 4 associated with off-ramp queuing would occur at the same locations as the Project, although the magnitude may be less due to less overall traffic generation associated with Alternative 4. As described in the discussion of Project impacts, no feasible mitigation measures have been identified for the freeway off-ramps expected to experience significant queuing impacts under Project conditions. Therefore, the impacts associated with Alternative 4 would be considered *significant and unavoidable*.

6.2 TRANSIT IMPACTS

The changes to the transit network that would be made as part of the ongoing TEP effort were described in section 4.3.2. The TEP operating improvements do not consider the needs of potential future development associated with the Project. As a result, the Project includes a series of transit service improvements in addition to those proposed by the TEP. Three routes would be extended into the proposed Hunters Point Transit Center: the 24-Divisadero, the 44-O'Shaughnessy, and the 48-Quintara-24th Street. Frequencies on the 24-Divisadero would increase from 7.5 minutes under the TEP operating scenario to 6 minutes in the AM and PM peak hours. Frequencies on the 44-O'Shaughnessey would remain at 6 minutes and frequencies on the 48-Quintara-24th Street would increase from 15 minutes to 10 minutes in the AM and PM peak hours. The Project would also extend the 29-Sunset from its current terminus near the Alice Griffith housing development, near Gilman Avenue and Giants Drive into the proposed Candlestick Point retail area, and increase its frequency by reducing headways between buses from 10 minutes to 5 minutes during the AM and PM peak hours. The T-Third service between Bayview and Chinatown via the Central Subway would convert from one-car to two-car trains, but headways would remain unchanged.

In addition, the 28L-19th Avenue Limited would be extended from its TEP-proposed terminus on Geneva Avenue, just east of Mission Street, into the Hunters Point Shipyard transit center. The 28L-19th Avenue Limited would travel along Geneva Avenue across U.S. 101 via the proposed Geneva Avenue extension and new interchange with U.S. 101, to Harney Way. East of Bayshore Boulevard, the 28L-19th Avenue Limited would operate as BRT, traveling in exclusive bus lanes into the Candlestick Point area. The BRT route would travel through the Candlestick Point retail corridor, and cross over Yosemite Slough into the Hunters Point Shipyard transit center. Frequencies on the 28L-19th Avenue Limited would be increased, and headways between buses would be reduced from 10 minutes to 5 minutes.

Funding for implementing the proposed TEP improvements is expected to be negligible because the TEP is designed to be budget-neutral. For the additional service proposed as part of the Project, the City and the Project Applicant have agreed to a Muni service plan that includes service hours, miles and vehicles associated, and have also agreed to execute an agreement which would determine a funding plan to provide the SFMTA the revenues necessary to support the Project. See Transportation Study Appendix K.

Table 72 compares the overall cordon capacity for Muni service for existing conditions, 2030 No Project (with TEP changes assumed to be in place), and the Project conditions for the three study area cordons (**see Figure 19**). Specifically, the Project would more than double overall east-west transit capacity at the cordon just east of Third Street (primarily due to the extension of the 28L-19th Avenue/Geneva Limited BRT route into Hunters Point Shipyard). North-south transit capacity to the north of the project site would double and capacity to the south of the project site would increase by over 80 percent over the transit service proposed by the TEP. Therefore, even though the Project would increase transit ridership on local transit service, the additional capacity provided by the project results in lower overall capacity utilization at the cordons with the Project compared to the 2030 No Project condition.

Table 72
Comparison of Capacity at Study Area Cordons [1, 2]
Existing, 2030 No Project and Project Conditions – Weekday AM and PM Peak Hours

Cordon	Existing Capacity	2030 No Project TEP Capacity [3]	Project Capacity [4]
East of Third Cordon	1,715	1,715	3,988
North Cordon	2,085	1,769	3,546
West Cordon	2,033	2,224	4,002

Notes:
1. Capacity presented in riders per hour. Inbound and Outbound Capacity the same – one direction of capacity presented.
2. Study Area Cordons presented on Figure 19.
3. Year 2030 No Project reflects implementation of TEP recommendations for lines serving the study area. 19-Polk will no longer serve the study area, but will be replaced by the 48-Quintara-24th Street, and the 56-Rutland will be eliminated.
4. Project conditions reflect TEP, plus the following improvements (see Figure 7):
a. 24-Divisadero would be extended from its terminus at Third/Palou, along Palou Avenue and Crisp Avenue into the Hunters Point Shipyard Transit Center. Peak period headways would be reduced from 7.5 minutes under the TEP to 6 minutes
b. The 28L would be extended from its proposed TEP terminus on Geneva Avenue, just east of Mission Street, along Geneva Avenue and Harney Way, across the proposed Yosemite Slough bridge, and into the Hunters Point Shipyard Transit Center. Peak period headways would be reduced from 10 minutes under the TEP to 5 minutes
c. 29-Sunset would be extended from its current terminus at Gilman Avenue/Giants Drive into the Candlestick Point retail center. Headways would be reduced from 10 minutes under the TEP to 5 minutes.
d. 44-O'Shaughnessey would be rerouted from its current route terminating at Evans/Mendell into the Hunters Point Transit Center. Headways would remain at 6 minutes, similar to the TEP scenario.
e. 48-Quintara-24th Street would be rerouted from its current terminus near 22nd/Third to serve the project study area as part of the TEP (replacing the 19-Polk, which would no longer serve the Shipyard site). With the Project, this route would be extended to the Hunters Point Transit Center and headways would decrease from 15 minutes under the TEP to 10 minutes.
f. CPX-Candlestick Express to downtown would be a new express bus route serving the Candlestick Point site, traveling along Harney Way (with potential stops at Executive Park), before traveling on U.S. 101 toward downtown, terminating at the Transbay Terminal.
g. HPX- Hunters Point Shipyard Express to downtown would be a new express bus route serving the Hunters Point Shipyard site, traveling from the Hunters Point Shipyard Transit Center, along Innes Street, with stops at the India Basin and Hunters View areas, before continuing along Evans Avenue to Third Street, eventually entering I-280 northbound at 25th/Indiana. The HPX would continue non-stop to the Transbay Terminal in Downtown San Francisco.
h. T-Third service between Bayview and Chinatown via the Central Subway would convert from one-car to two-car trains, but headways would remain unchanged. The two-car short-line operating between Chinatown and Mariposa Street would remain unchanged.
Source: SFMTA, Fehr & Peers.

6.2.1 Project and Project Variants

This section describes the impacts to transit associated with the Project and Project Variants. For project impacts, two transit analyses were conducted: the impact of the additional transit travel demand generated by the Project on the capacity utilization of the study area cordons, the downtown Muni screenlines, and the regional screenlines; and the impact of the additional vehicle and transit travel demand on transit travel times for the Muni routes traveling within the study area.

Overview

The Project would include substantial improvements to transit service in the Hunters Point Shipyard, Candlestick Point, and Bayview neighborhoods, in addition to improvements currently proposed as part of SFMTA's Transit Effectiveness Program. As discussed below, the Project improvements to transit service, combined with existing service and proposed TEP improvements, would provide transit capacity to accommodate the new transit riders generated by the Project and by cumulative development.

Although the Project Description includes a plan for increased transit service to the study area (described in the Project Description), because the final Transit Plan has not been formally approved by SFMTA, **Project Mitigation Measure 7** is required to ensure the final Transit Plan will be prepared and implemented. Thus, mitigation measure **Project Mitigation Measure 7** below requires preparation, approval, and implementation of the final transit-operating plan.

> ***Project Mitigation Measure 7***: The Project Applicant shall work with SFMTA to develop and implement the Project's Transit Operating Plan. Elements of the Project Transit Operating Plan shall include:
>
> - Extension of the 24-Divisadero, the 44-O'Shaughnessy, and the 48-Quintara-24th Street into Hunters Point Shipyard.
> - Increased frequency on the 24-Divisadero to 6 minutes in the AM and PM peak periods. Extension of the 29-Sunset from its current terminus near the Alice Griffith housing development, near Gilman Avenue and Giants Drive, into the proposed Candlestick Point retail area. The 29-Sunset would operate a short line between Candlestick Point and the Balboa Park BART station. This would increase frequencies on the 29-Sunset by reducing headways between buses from 10 minutes to 5 minutes during the AM and PM peak periods between Candlestick Point and the Balboa BART station. Every other bus would continue to serve the Sunset District (to the proposed terminus at Lincoln Drive and Pershing Drive in the Presidio) at 10-minute headways.
> - Convert T-Third service between Bayview and Chinatown via the Central Subway from one-car to two-car trains or comparable service improvement.

- Extension of the 28L-19th Avenue Limited from its TEP-proposed terminus on Geneva Avenue, just east of Mission Street, into the Hunters Point Shipyard transit center. The 28L-19th Avenue Limited would travel along Geneva Avenue across U.S. 101 via the proposed Geneva Avenue extension and new interchange with U.S. 101, to Harney Way. East of Bayshore Boulevard, the 28L-19th Avenue Limited would operate as BRT, traveling in exclusive bus lanes into the Candlestick Point area. The BRT route would travel through the Candlestick Point retail corridor, and cross over Yosemite Slough into the Hunters Point Shipyard transit center.
- The 28L-19th Avenue Limited would operate a short line to the Balboa Park BART station. This would increase frequencies on the 28L-19th Avenue Limited by reducing headways between buses from 10 minutes to 5 minutes for the segment between Hunters Point Shipyard and the Balboa Park BART station. Every other bus would continue to the Sunset District (to the proposed terminus at North Point Street and Van Ness Avenue) at 10-minute headways. If the TEP-proposed extension of the 28L has not been implemented by the SFMTA by the Phase 2 of Project development, the Project Applicant shall fund the extension of that line between its existing terminus and Bayshore Boulevard.
- New CPX-Candlestick Express to downtown serving the Candlestick Point site, traveling along Harney Way (with potential stops at Executive Park), before traveling on U.S. 101 toward downtown, terminating at the Transbay Terminal.
- New HPX-Hunters Point Shipyard Express to downtown serving the Hunters Point Shipyard site, traveling from the Hunters Point Shipyard Transit Center, along Innes Avenue, with stops at the India Basin and Hunters View areas, before continuing along Evans Avenue to Third Street, eventually entering I-280 northbound at 25th/Indiana. The HPX would continue non-stop to the Transbay Terminal in Downtown San Francisco.

Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources. With implementation of the Transit Plan, Project-generated transit trips would be accommodated within the existing and proposed transit capacity, and therefore Project impacts on transit capacity would be *less than significant.*

Transit Capacity Utilization

Table 73 summarizes the capacity utilization for each of the three cordons for the AM and PM peak hours for the Project conditions, and for Project Variants 1 and 2. With the transit capacity increases proposed by the Project, the total transit travel demand on Muni under Project conditions could be accommodated for each of the three cordons during the AM and PM peak hours. All three cordons would operate at less than Muni's 85 percent capacity utilization standards.

Table 73
Ridership and Capacity Utilization at Study Area Cordons
Project and Project Variants – Weekday AM and PM Peak Hours

Peak Hour/Cordon	Project		Variant 1 (R&D)		Variant 2 (Housing)	
	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.
AM Peak Hour						
East of Third Cordon						
Inbound	2,548	64%	2,585	65%	2,512	63%
Outbound	1,541	39%	1,841	46%	1,511	38%
North Cordon						
Inbound	2,458	69%	2,490	70%	2,457	69%
Outbound	2,151	61%	2,257	64%	2,145	60%
West Cordon						
Inbound	3,164	79%	3,108	78%	3,057	76%
Outbound	1,870	47%	2,073	52%	1,863	47%
PM Peak Hour						
East of Third Cordon						
Inbound	2,002	50%	2,280	57%	2,014	50%
Outbound	2,092	52%	2,214	56%	2,151	54%
North Cordon						
Inbound	2,675	75%	2,889	81%	2,664	75%
Outbound	2,231	63%	2,299	65%	2,237	63%
West Cordon						
Inbound	1,938	48%	2,076	52%	1,922	48%
Outbound	2,374	59%	2,442	61%	2,403	60%

Source: Fehr & Peers.

If Project-related transit capacity improvements are not provided, then only the capacity presented in **Table 72** for the 2030 No Project conditions would be available to accommodate Project and cumulative transit ridership. As indicated in **Table 42**, under 2030 No Project conditions, the capacity utilization at the study area cordons is projected to exceed Muni's 85 percent capacity utilization standard. With the addition of Project-generated transit trips, the severity of the standard exceedance would increase, and would result in significant impacts. Because the final transit plan has not been formally approved by SFMTA, Project Mitigation Measure 7 is required to ensure the final Transit Plan will be prepared and implemented.

With implementation of Project Mitigation Measure 7, the Project's impacts and the Project's contribution to cumulative impacts on transit capacity at the study area cordons would be *less than significant*.

Table 74 summarizes the capacity utilization for the downtown screenlines for the AM and PM peak hours for the Project conditions, and for Project Variants 1 and 2. As summarized in Table 72, the project would only add peak-direction riders through the southeast downtown screenline. Ridership on other screenlines would remain unchanged. With the addition of project trips, all downtown screenlines would continue to operate with Muni's 85 percent utilization standard. Therefore, Project impact on transit capacity at the Downtown Screenlines would be *less than significant.*

Table 74
Ridership and Capacity Utilization at Downtown Screenlines
Project and Project Variants – Weekday AM and PM Peak Hours

Peak Hour/Screenline	Project		Variant 1 (R&D)		Variant 2 (Housing)	
	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.
AM Peak Hour						
Northeast	3,008	78%	3,008	78%	3,008	78%
Northwest	8,949	75%	8,949	75%	8,949	75%
Southeast	7,536	74%	7,573	74%	7,553	74%
Southwest	7,674	76%	7,674	76%	7,674	76%
Total All Screenlines	27,167	75%	27,167	75%	27,167	75%
PM Peak Hour						
Northeast	3,140	78%	3,140	78%	3,140	78%
Northwest	8,155	75%	8,155	75%	8,155	75%
Southeast	8,223	83%	8,306	84%	8,263	83%
Southwest	8,829	82%	8,829	82%	8,829	82%
Total All Screenlines	28,347	80%	28,347	80%	28,347	80%

Source: Fehr & Peers.

Table 75 summarizes the capacity utilization for the regional transit provider screenlines for the AM and PM peak hours for the Project conditions, and for Project Variants 1 and 2. The Project and Project Variants 1 and 2 would each contribute relatively small ridership increases to regional transit compared to 2030 No Project conditions. Regional cordons would operate at the same percentage of capacity utilization with the Project and Project Variants 1 and 2 as under 2030 No Project conditions, with one exception. The capacity utilization for the South Bay would increase from 69 to 70 percent during the PM peak hour with the Project and Variants 1 and 2, compared to the 2030 No Project scenario. The Project and Variants 1 and 2 would contribute slightly fewer trips to the South Bay cordon in the off-peak directions (southbound in the AM peak hour and northbound in the PM peak hour) than in the peak directions. Off-peak direction ridership would remain within available capacity in the AM and PM peak hours.

Overall, the Project would not increase the capacity utilization by more than one percentage point on any cordon or screenline expected to exceed available capacity without the Project. Further, the increase in Project transit trips would not result in any cordon or screenline expected to operate within available capacity without the Project to exceed its capacity. Project contributions to regional transit providers operating at more than 100 percent capacity utilization (e.g., BART to East Bay, Golden Gate Transit to North Bay) would be minimal, about 0.1 percent. Therefore, the Project and Project Variant's impacts on transit capacity would be *less than significant*.

Table 75
Project Transit Trips and Capacity Utilization at Regional Screenlines
Project and Project Variants – Weekday AM and PM Peak Hours

Peak Hour/Screenline	Project		Variant 1 (R&D)		Variant 2 (Housing)	
	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.
AM Peak Hour						
East Bay						
BART	36,202	185%	36,221	185%	36,200	185%
AC Transit	3,347	61%	3,347	61%	3,347	61%
Ferries	1,971	83%	1,971	83%	1,971	83%
subtotal	*41,520*	*151%*	*41,539*	*151%*	*41,518*	*151%*
North Bay						
Golden Gate Transit	2,621	106%	2,621	106%	2,621	106%
Ferries	1,647	97%	1,647	97%	1,647	97%
subtotal	*4,268*	*102%*	*4,268*	*102%*	*4,268*	*102%*
South Bay						
BART	12,416	89%	12,456	90%	12,413	89%
Caltrain	4,451	70%	4,474	70%	4,449	69%
SamTrans	799	75%	812	76%	798	75%
Ferries	152	51%	152	51%	152	51%
subtotal	*17,818*	*82%*	*17,893*	*82%*	*17,812*	*82%*
Total All Screenlines	***63,606***	***119%***	***63,700***	***119%***	***63,598***	***119%***
PM Peak Hour						
East Bay						
BART	30,268	154%	30,275	154%	30,268	154%
AC Transit	4,485	68%	4,485	68%	4,485	68%
Ferries	2,147	79%	2,147	79%	2,147	79%
subtotal	*36,900*	*128%*	*36,907*	*128%*	*36,900*	*128%*
North Bay						
Golden Gate Transit	2,513	114%	2,513	114%	2,513	114%
Ferries	1,630	96%	1,630	96%	1,630	96%
subtotal	*4,143*	*106%*	*4,143*	*106%*	*4,143*	*106%*
South Bay						
BART	10,707	76%	10,720	77%	10,708	76%
Caltrain	4,008	63%	4,017	63%	4,013	63%
SamTrans	404	43%	408	43%	408	43%
Ferries	75	25%	75	25%	75	25%
subtotal	*15,194*	***70%***	*15,219*	***70%***	*15,204*	***70%***
Total All Screenlines	***56,237***	***103%***	***56,269***	***103%***	***56,247***	***103%***

Source: Fehr & Peers.

Project Transit Delay

Impacts to transit were also measured in terms of increases to transit travel times. The analysis evaluated the increases to transit travel times associated with the following three influencing factors[19]:

- **Traffic congestion delay** – Traffic congestion associated with increases in area traffic slows down transit vehicles and results in increased transit travel times. Traffic congestion delays are calculated by summing the average vehicular delay at each intersection along the transit line's route within the study area. The increase in total route segment delay is equal to the increase in travel time associated with the project.
- **Transit re-entry delay** – Transit vehicles typically experience delays after stopping to pick up and drop off passengers while waiting for gaps in adjacent street traffic in order to pull out of bus stops. As traffic volumes on the adjacent street increase, re-entering the flow of traffic becomes more difficult and transit vehicles experience increased delay. Transit re-entry delay was calculated using empirical data presented in the 2000 Highway Capacity Manual (HCM). Total transit re-entry delay for each route was calculated as the sum of transit re-entry delay at each stop within the study area.
- **Passenger boarding delay** – Although increases in transit ridership are generally viewed positively, the amount of time a transit vehicle has to stop to pick up and drop off passengers (i.e., the transit vehicle dwell time) is directly correlated to the number of passengers boarding the vehicle. If, as proposed, the project includes substantial improvements to transit service in the future (and as general transit ridership grows), vehicles would have to spend more time at stops, which may increase overall transit travel times. Passenger boarding delay was calculated assuming two seconds per passenger boarding for buses, and 0.5 seconds per passenger boarding for light rail vehicles. Passenger boardings within the study area were estimated by examining the increases in ridership across the study area cordons.

Although the transit routes in the study area would not be extended into the study area under existing conditions or under 2030 No Project conditions, transit delay for those scenarios was calculated as if the transit routes were extended only for purposes of comparing project impacts. Generally, the increases in travel times associated with the project are somewhat smaller than those associated with the increases expected between existing and 2030 No Project conditions.

[19] The methodology used is similar to that used in the *San Francisco Bicycle Plan Draft EIR*, City of San Francisco Planning Department, November 2008, except that methodology included the additional transit delay associated with substantial increases in bicycle volumes, which was appropriate for a project contemplating large-scale changes to the City's bicycle network. Bicycle volumes are not expected to substantially change as part of this project, so the "bicycle delay" was not included. However, instead, this evaluation includes the added delay associated with increases in passenger boardings, which is more appropriate for this project since the project includes major improvements to area transit service. A more detailed discussion of the methodology is included in Appendix H.

A detailed discussion of how each of these three delay components was calculated is included in Transportation Study Appendix H. **Table 76** summarizes the increases in transit travel times associated with the Project and the Project Variants for each route within the study area, compared to 2030 No Project conditions. A detailed breakdown of the calculations of increased delay associated with the Project is provided in Transportation Study Appendix H. **Table 77** identifies the number of additional vehicles that would be required to meet the proposed headways.

The Project would have a significant impact if it would increase travel times such that additional vehicles would be required to maintain the proposed headways. This was assumed to be the case if either the project's travel time increases to a particular route would be greater than ½ its proposed headway or if the number of required vehicles estimated using SFMTA's cost/scheduling model, which takes into account scheduled breaks and extra time built into schedules, increases by one or more vehicles with the addition of the project characteristics.

Table 78 presents the summary table of project transit impacts for Project, Project Variants, and Alternatives to the Project. On **Table 78**, Project impacts (PI) were identified where the Project would result in an increase in ridership that would result in an exceedance of the capacity utilization standard, or an increase in transit delay such that additional transit vehicles would be required to maintain proposed headways**.** In addition, Project impacts were identified where the Project would contribute significantly to poor intersection operations that, therefore, would contribute to significantly to transit delays that would result in the need for additional transit vehicles to maintain proposed headways, and noted as Significant Contribution/Project Impact (SC/PI). Where the Project would *not* contribute significantly to transit ridership at locations where capacity utilization under 2030 No Project condition exceeds capacity utilization standards, or if the Project would not contribute significantly to poor intersection operations that would affect transit operations, this was noted as No Significant Contribution (NSC).

Where projected ridership under the 2030 No Project condition would result in an exceedance of the capacity utilization standard, or where traffic congestion associated with background traffic growth would result in a need for additional transit vehicles to maintain existing or TEP-proposed headways, this was identified as a No Project Impact (NP Impact).

Table 76
Project Increases to Transit Travel Time (minutes:seconds)[1, 2]
Project and Project Variants – Weekday AM and PM Peak Hours

Route	Proposed Headway (min.)	Northbound/Eastbound			Southbound/Westbound		
		Project	Variant 1 (R&D)	Variant 2 (Housing)	Project	Variant 1 (R&D)	Variant 2 (Housing)
AM Peak Hour							
9-San Bruno	10	**1:09**	**1:07**	**1:19**	**8:04**	**8:42**	**8:09**
23-Monterey	15	0:41	0:41	0:38	3:51	3:51	3:51
24-Divisadero	6	**5:34**	**11:48**	**9:50**	**2:44**	**-0:13**	**-0:49**
28L-19th Ave Ltd	5	**3:36**	**3:36**	**3:36**	**1:01**	**0:39**	**0:39**
29-Sunset	10	**4:39**	**7:06**	**6:15**	**9:55**	**9:27**	**8:28**
44-O'Shaughnessy	6	**5:53**	**8:24**	**5:54**	**6:16**	**7:53**	**6:14**
48-Quintara-24th St	15	**2:00**	**7:40**	**3:06**	**2:20**	**7:11**	**6:39**
54-Felton [3]	20	0:56	3:23	1:39	-0:17	-3:10	-3:00
T-Third	8	1:34	1:42	1:35	1:39	1:39	1:39
PM Peak Hour							
9-San Bruno	10	**4:03**	**4:19**	**3:55**	**6:49**	**6:56**	**6:49**
23-Monterey	15	0:56	0:58	0:58	1:57	2:01	1:57
24-Divisadero	6	**6:45**	**6:10**	**5:32**	**9:49**	**10:00**	**8:24**
28L-19th Ave Ltd	5	**2:59**	**2:59**	**2:59**	0:03	0:03	0:03
29-Sunset	10	**16:00**	**15:10**	**15:35**	**16:32**	**17:05**	**16:18**
44-O'Shaughnessy	6	**6:05**	**12:30**	**6:56**	**7:18**	**10:06**	**8:02**
48-Quintara-24th St	15	2:51	**9:08**	**7:21**	3:00	**9:03**	**5:26**
54-Felton [3]	20	**3:48**	**5:44**	**4:09**	**5:32**	**3:45**	**3:13**
T-Third	8	**2:57**	**3:35**	**2:50**	**2:33**	**2:45**	**2:32**

Notes:
1. Delays measured for each route between project site and key destination/transfer point away from the project. The study segment for each route is as follows:
- 9-San Bruno: Bayshore Boulevard between Sunnydale Avenue and Jerrold Avenue
- 23-Monterey: between Ingalls Street/Oakdale Avenue and the Glen Park BART Station
- 24-Divisadero: between Hunters Point Shipyard and Mission Street
- 28L-19th Avenue Limited: between Hunters Point Shipyard and Mission Street
- 29-Sunset: between Candlestick Point and Mission Street
- 44-O'Shaughnessy: between Hunters Point Shipyard and the Glen Park BART Station
- 48-Quintara-24th St: between Hunters Point Shipyard and the 24th Street BART Station
- 54-Felton: between Jerrold Avenue/Earl Street and Mission Street
- T-Third: Third Street between Thomas Avenue and Jerrold Avenue (This segment represents the section of the T-Third route that does not provide exclusive right-of-way for transit and would be most affected by increased traffic congestion.)

2. Routes where the Project would increase travel times such that additional vehicles would be required highlighted in **bold**.
3. Due to roadway improvements proposed by the Project and differences between the No Project and Project land use assumptions at the Hunters Point Shipyard, there would be less traffic congestion along 54-Felton route in study area with the Project, than under 2030 No Project conditions.
Source: Fehr & Peers.

Table 77
Additional Muni Transit Vehicle Requirements
Project and Project Variants – Weekday AM and PM Peak Hours

Route	Project	Variant 1 (R&D)	Variant 2 (Housing)
AM Peak Hour			
9-San Bruno	**1**	**1**	**1**
23-Monterey	0	0	0
24-Divisadero	**1**	**2**	**2**
28L-19th Ave Ltd	**1**	**1**	**1**
29-Sunset	**1**	**2**	**1**
44-O'Shaughnessy	**2**	**3**	**2**
48-Quintara-24th Street	**1**	**1**	**1**
54-Felton [2]	0	0	0
T-Third	0	0	0
Total	*7*	***10***	***8***
PM Peak Hour			
9-San Bruno	**1**	**1**	**1**
23-Monterey	0	0	0
24-Divisadero	**3**	**3**	**2**
28L-19th Ave Ltd	**1**	**1**	**1**
29-Sunset	**3**	**3**	**3**
44-O'Shaughnessy	**2**	**4**	**2**
48-Quintara-24th Street	0	**1**	**1**
54-Felton	**1**	**1**	**1**
T-Third	**1**	**1**	**1**
Total	***12***	***15***	***12***

Note:
Transit vehicle requirements for Project and Project Variants are in addition to those required for the 2030 No Project condition (Alternative 1) identified in Table 80.
Source: Fehr & Peers.

Table 78
Summary of Transit Impacts – Capacity Utilization and Transit Operations

Intersection	Project	P-Var 1 (R&D)	P-Var 2 (Housing)	Alt 1 No Project	Alt 2 No Bridge	Alt. 3 49ers at Stick	Alt 4 Lesser Build	Alt 5 No Park Agree
Capacity Utilization Analyses								
Cordons								
North	--	--	--	NPI	--	--	--	--
West	--	--	--	NPI	--	--	--	--
East of Third	--	--	--	NPI	--	--	--	--
Downtown Screenlines								
Northeast	NSC	NSC	NSC	--	NSC	NSC	NSC	NSC
Northwest	NSC	NSC	NSC	--	NSC	NSC	NSC	NSC
Southeast	NSC	NSC	NSC	--	NSC	NSC	NSC	NSC
Southwest	NSC	NSC	NSC	--	NSC	NSC	NSC	NSC
Regional Screenlines								
East Bay	NSC	NSC	NSC	--	NSC	NSC	NSC	NSC
North Bay	NSC	NSC	NSC	--	NSC	NSC	NSC	NSC
South Bay	NSC	NSC	NSC	--	NSC	NSC	NSC	NSC

Notes:
1. PI – Project Impact. Project results in an increase in ridership that would result in an exceedance of the capacity utilization standard, or an increase in transit delay such that additional transit vehicles would be required to maintain proposed headways**.**
2. NSC – No Significant Contribution. Project would not contribute significantly to transit ridership at locations where capacity utilization under 2030 No Project condition exceeds capacity utilization standards. Or if Project would not contribute significantly to poor intersection operations that would affect transit operations. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to poor intersection operations that, therefore, would contribute to significantly to transit delays that would result in the need for additional transit vehicles to maintain proposed headways.
4. NPI – No Project Impact. Projected ridership under 2030 No Project conditions would result in an exceedance of the capacity utilization standard. Or traffic congestion associated with background traffic growth would result in a need for additional transit vehicles to maintain existing or TEP-proposed headways.
Source: Fehr & Peers.

Table 78 (continued)
Summary of Transit Impacts – Capacity Utilization and Transit Operations

Intersection	Project	P-Var 1 (R&D)	P-Var 2 (Housing)	Alt 1 No Project	Alt 2 No Bridge	Alt. 3 49ers at Stick	Alt 4 Lesser Build	Alt 5 No Park Agree
Transit Operations Analyses								
9-San Bruno	PI	PI	PI	NPI	PI	SC/PI	PI	PI
23-Monterey	SC/PI	SC/PI	SC/PI	NPI	SC/PI	SC/PI	SC/PI	SC/PI
24-Divisadero	PI	PI	PI	NPI	PI	PI	PI	PI
28L-Geneva Limited	PI	PI	PI	NPI	PI	PI	SC/PI	PI
29-Sunset	PI	PI	PI	NPI	PI	--	PI	PI
44-O'Shaughnessy	PI	PI	PI	NPI	PI	PI	PI	PI
48-Quintara-24th Street	PI	PI	PI	NPI	PI	PI	PI	PI
54-Felton	PI	PI	PI	NPI	PI	PI	PI	PI
T-Third	PI	PI	PI	NPI	PI	PI	PI	PI

Notes:
1. PI – Project Impact. Project results in an increase in ridership that would result in an exceedance of the capacity utilization standard, or an increase in transit delay such that additional transit vehicles would be required to maintain proposed headways.
2. NSC – No Significant Contribution. Project would not contribute significantly to transit ridership at locations where capacity utilization under 2030 No Project condition exceeds capacity utilization standards. Or if Project would not contribute significantly to poor intersection operations that would affect transit operations. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to poor intersection operations that, therefore, would contribute to significantly to transit delays that would result in the need for additional transit vehicles to maintain proposed headways.
4. NPI – No Project Impact. Projected ridership under 2030 No Project conditions would result in an exceedance of the capacity utilization standard. Or traffic congestion associated with background traffic growth would result in a need for additional transit vehicles to maintain existing or TEP-proposed headways.

Source: Fehr & Peers.

As shown on **Table 77**, the addition of Project traffic and ridership demands would create the need for additional vehicles on five routes in the AM peak hour and six routes in the PM peak hour.

- In the AM peak hour, the Project travel demand would require 7 additional transit vehicles for the 9-San Bruno (1 vehicle), 24-Divisadero (1 vehicle), 28L-19th Avenue Limited (1 vehicle), 29-Sunset (1 vehicle), 44-O'Shaughnessy (2 vehicles), and the 48-Quintara-24th Street (1 vehicle) routes. These would be in addition to the 16 vehicles required to maintain 2030 No Project headways (see Table 83).

- In the PM peak hour, the Project would result in the need for 12 additional transit vehicles for the 9-San Bruno (1 vehicle), 24-Divisadero (3 vehicles), 28L-19th Avenue Limited (1 vehicle), 29-Sunset (3 vehicles), 44-O'Shaughnessy (2 vehicles), the 54-Felton (1 vehicle), and the T-Third (1 train car) routes. These would be in addition to the 16 required to maintain 2030 No Project headways.

This would be a significant impact. Although the Project would increase congestion in the overall study area, the traffic analysis indicates that the impacts to transit would be greatest at key bottleneck locations where there is substantial cross-traffic, specifically routes that cross Third Street. Discussion of impacts is presented by line and corridor.

9-San Bruno - Project-related transit delays due to congestion on study area roadways and passenger loading delays associated with increased ridership would result in significant impacts on the operation of the 9-San Bruno. Within the study area, the 9-San Bruno would experience substantial delays at key intersections along San Bruno Avenue, including at Silver Avenue, Silliman Avenue, Paul Avenue/Dwight Street, and at Mansell Street. Overall, the Project-related congestion would add up to 8 minutes of delay per bus during peak hours. The provision of transit-only lanes on San Bruno Avenue, and other transit-priority treatments would reduce travel time delays and impacts on this line.

> **Project Mitigation Measure 8.1:** To address Project impacts to the 9-San Bruno, prior to issuance of a grading permit for Phase 1, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvements which could reduce Project impacts on transit operations along the San Bruno Avenue corridor, generally between Campbell Avenue and Silver Avenue. The study shall create a monitoring program to determine the implementation extent and schedule (as identified below) to maintain the proposed headways of the 9-San Bruno.
>
> - Install a transit-only lane on northbound San Bruno Avenue for the one-block section (400 feet) between Silliman Street and Silver Avenue. This would involve removal of five metered spaces on the east side of San Bruno Avenue, just south of Silver Avenue. Treatment for transit-only lanes can range from

striping to physical elevation changes or barriers to protect transit right-of-way from mixed-flow traffic.

- Install a transit-only lane on southbound San Bruno Avenue at the approach to Dwight Street/Paul Avenue. This lane would function as a so-called "queue-jump" lane, allowing buses to bypass queues on southbound San Bruno Avenue at the intersection. The lane should begin approximately 200 feet north of Dwight Street and extend one block (about 300 feet) south of Paul Avenue to Olmstead Street. This would involve the removal of up to 20 on-street parking spaces on the west side of San Bruno Avenue. This treatment could be limited to peak hours only, which would minimize the impact of the parking loss. The segment of San Bruno Avenue between Dwight Street and Olmstead Street is designated as Bicycle Routes #705 and 5 (Class III signed routes).

- At the intersection of San Bruno/Silver install signal priority treatments on westbound Silver Avenue, where buses waiting to turn left from Silver Avenue onto southbound San Bruno Avenue must currently wait through almost an entire signal cycle due to the heavy oncoming traffic on eastbound Silver Avenue. Installation of a transit signal pre-emption at this location that provides a "green" signal for westbound vehicles but holds eastbound vehicles when buses are present would allow transit vehicles to turn left onto San Bruno Avenue without having to wait for opposing eastbound through traffic to clear.

The Project Applicant shall fully fund the costs of implementing the transit priority improvements (either the improvements identified above, or alternative improvements of equal or greater effectiveness and comparable cost) as determined by the study and the monitoring program. Other options to be evaluated in the study could include comprehensive replacement of stop-controlled intersections with interconnected traffic signals equipped with transit priority elements.

Project Mitigation Measure 8.2 - Should Project Mitigation Measure 8.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 9-San Bruno. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

The three treatments contained in Project Mitigation Measure 8.1 combined could reduce AM peak hour travel times by 4 minutes and 6 seconds in the northbound direction, and 6 minutes 18 seconds in the southbound direction. During the PM peak hour, these treatments could reduce PM peak hour travel times by 4 minutes 6 seconds in the northbound direction and by 8 minutes in the southbound direction. With the combination of mitigation measures, transit travel times in each direction and during each peak period would be no greater than for 2030 No Project conditions. However, because 2030 No Project conditions constitute adverse delays to transit service, cumulative adverse delays to transit service would occur even with these Project transit mitigation measures. Because adverse transit delays affecting this line are generated by adverse traffic congestion to which the Project has a considerable contribution, the Project also has a cumulatively considerable contribution to adverse transit delays.

Implementation of Project Mitigation Measure 8.2, on the other hand, would allow operation of headways as described in Project Mitigation Measure 7. However, given the congestion along the San Bruno Avenue corridor, implementation of Project Mitigation Measure 8.2 alone, without Project Mitigation Measure 8.1, might not be sufficient to reduce the impact to less than significant levels.

Implementation of **Project Mitigation Measure 8.1** would exacerbate LOS F conditions at the intersections of San Bruno/Silver, San Bruno/Silliman/U.S. 101 Southbound off-ramp, and San Bruno/Paul that were identified as having significant and unavoidable impacts. Additional impacts of these mitigation measures would be similar to Project impacts addressed in this section regarding traffic circulation, parking supply, loading supply and operations, and bicycle circulation.

Because a feasibility study of the improvements contemplated in mitigation measure **Project Mitigation Measure 8.1** would be required, implementation of **Project Mitigation Measure 8.1** is uncertain. Because implementation of **Project Mitigation Measure 8.2** alone, without **Project Mitigation Measure 8.1**, might not be sufficient to reduce the impacts on the 9-San Bruno to a less than significant level, the Project impacts on the 9-San Bruno would remain *significant and unavoidable.*

23-Monterey, 24-Divisadero and 44-O'Shaughnessy - Project-related transit delays due to congestion on study area roadways and passenger boarding delays associated with increased ridership would result in significant impacts on the operation of the 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy. Along Palou Avenue these lines would be affected by the substantial congestion projected at the intersection of Third/Palou and the queues that would extend to the east and west of Third Street. Overall, the Project-related congestion would add up to 7 minutes of delay per bus during peak hours. The provision of transit-only lanes on Palou Avenue would reduce travel time delays and impacts on these lines.

Project Mitigation Measure 9.1: To address Project impacts to the 23-Monterey, 24-Divisidero and the 44-O'Shaughnessy, prior to issuance of a grading permit for Phase 1, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvements which could reduce Project impacts on transit operations along the Palou Avenue corridor, generally between Griffith Street and Newhall Street. The study shall create a monitoring program to determine the implementation extent and schedule (as identified below) to maintain the proposed headways of the 23-Monterey, 24-Divisidero and the 44-O'Shaughnessy.

- Convert one of the two westbound travel lanes on Palou Avenue between Keith Street and Newhall Street (three blocks) to a transit-only lane at all times. Treatment for transit-only lanes can range from striping to physical elevation changes to protect right-of-way from mixed-flow traffic. Because the westbound lanes between Third Street and Newhall Street are relatively narrow, parking would likely need to be prohibited on the north side of Palou Avenue between Third Street and Newhall Street (approximately 600 feet) during peak periods to maximize the effectiveness of the transit-only lane.

- Convert one of the two eastbound travel lanes on Palou Avenue between Newhall Street and Third Street (one block) to a transit-only lane at all times. Because the eastbound travel lanes between Newhall Street are relatively narrow, parking would likely need to be prohibited on the south side of Palou Avenue between Newhall Street and Third Street (approximately 600 feet) during peak periods to maximize the effectiveness of the transit-only lane. In the eastbound direction, east of Third Street, buses would re-enter the single mixed-flow traffic lane at the bus stop on the far (east) side of Third Street.

- There are currently pedestrian corner bulbs on the northwest and southwest corners of the intersection of Palou Avenue and Third Street. In order to accommodate the transit-only lanes west of Third Street, these bulbouts would be reconfigured or removed. Although removing pedestrian bulb-outs may increase pedestrian crossing distances and is generally inconsistent with the City's desire to prioritize pedestrian activity, in this case, the improvement would offer substantial benefits to transit travel times by allowing a transit-only lane through a congested intersection. This would be consistent with the City's transit-first policy.

- During the PM peak period only, prohibit parking on westbound Palou Avenue for the four-block segment between Griffith Street/Crisp Avenue and Keith Street, to provide for a PM peak period curb transit-only lane along this segment. This would create a continuous westbound transit-only lane on Palou

Avenue between Griffith Street/Crisp Avenue and Newhall Street during the PM peak period.

- As an alternative to the bulleted measures above, narrow the existing sidewalks on Palou Avenue from Third Street to Crisp Avenue (seven blocks) from 15 feet to 12 feet in width. The pedestrian bulb-outs on the west side of Third Street would be removed. The resulting 12-foot-wide sidewalks would be consistent with the Better Streets Plan guidelines. The reduction in sidewalk width would allow for the provision of a 7-foot-wide on-street parking lane, an 11-foot-wide transit-only lane, and a 10-foot-wide mixed-flow lane in each direction on Palou Avenue. This would preserve on-street parking along the corridor and provide a seven-block transit-only lane on Palou Avenue between Griffith Street/Crisp Avenue and Newhall Street. Treatment for transit-only lanes can range from striping to physical elevation changes to protect right-of-way from mixed-flow traffic.

The Project Applicant shall fully fund the costs of implementing the transit priority improvements (either the improvements identified above, or alternative improvements of equal or greater effectiveness and comparable cost) as determined by the study and the monitoring program. Other options to be evaluated in the study could include signal priority treatments at other signalized intersections including at Bayshore/Cortland, Bayshore/Industrial, and Bayshore/Oakdale.

Project Mitigation Measure 9.2: Should Project Mitigation Measure 9.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 23-Monterey, the 24-Divisadero and the 44-O’Shaughnessy. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA’s associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Implementation of the transit-only lanes would reduce travel times on the three routes:

<u>23-Monterey</u> – The Project would not result in Project-specific impacts to the 23-Monterey because increases in Project-generated vehicles would not increase intersection delay and transit travel times such that additional transit vehicles would be required to maintain the proposed headways. However, it would contribute to cumulatively significant impacts identified for the 2030 No Project condition. The mitigation measures identified for Palou Avenue would improve

service on the 23-Monterey, but the route would continue to experience cumulatively significant impacts.

24-Divisadero – Combined, these measures (either the first three bullets combined or the fourth alone) could reduce AM peak hour travel times by 4 minutes and 45 seconds in the westbound direction and by 4 minutes in the eastbound direction. During the PM peak hour travel times could be reduced by 8 minutes and 15 seconds in the westbound direction and by 4 minutes in the eastbound direction. In each direction and peak hour, the transit travel times with the Project might not be greater than the 2030 No Project travel times by more than ½ headway, and therefore additional transit vehicles would not be required.

44-O'Shaughnessy – The improvements along Palou Avenue between Keith Street and Newhall Street would improve the travel times on the 44-O'Shaughnessy such that in each direction and peak hour, the transit travel times with the Project would not be greater than the 2030 No Project travel times by more than ½ headway, and therefore additional vehicles would not be required to maintain the proposed headways.

With the combination of treatments identified in Project Mitigation Measure 9.1, transit travel times in each direction and during each peak period would be no greater than for 2030 No Project conditions. However, because 2030 No Project conditions constitute adverse delays to transit service, cumulative adverse delays to transit service would occur even with these Project transit mitigation measures. Because adverse transit delays affecting this line are generated by adverse traffic congestion to which the Project has a considerable contribution, the Project also has a cumulatively considerable contribution to adverse transit delays.

Implementation of Project Mitigation Measure 9.2, on the other hand, would allow operation of headways as described under Project Mitigation Measure 9.1. However, given the congestion along the Palou Avenue corridor, implementation of Project Mitigation Measure 9.2 alone, without Project Mitigation Measure 9.1, might not be sufficient to reduce the impact to less than significant levels.

Implementation of Project Mitigation Measure 9.1 would also exacerbate automobile LOS F conditions at the intersection of Third/Palou that would have significant and unavoidable impacts under Project conditions. In addition, these measures may result in new significant and unavoidable impacts at intersections along Palou Avenue (i.e., at Griffith/Crisp, Ingalls, Jennings, Lane, Keith Streets). Additional impacts of these mitigation measures would be similar to other Project impacts regarding traffic circulation, parking supply, loading supply and operations, and bicycle circulation.

Because a feasibility study of the improvements contemplated in Project Mitigation Measure 9.1 would be required, implementation of this measure is uncertain. Because implementation of

Project Mitigation Measure 9.2 alone, without Project Mitigation Measure 9.1, might not be sufficient to reduce the impacts on the 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy to a less than significant level, the Project impacts on the 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy would remain *significant and unavoidable.*

29-Sunset - Project-related transit delays due to congestion on study area roadways and passenger loading delays associated with increased ridership would result in significant impacts on the operation of the 29-Sunset. Within the study area, the 29-Sunset would experience substantial delays at key intersections along Gilman Avenue and Paul Avenue, particularly at Third Street and Bayshore Boulevard. Overall, the Project-related congestion would add up to 17 minutes of delay per bus during peak hours. The provision of transit-only lanes on Gilman Avenue and Paul Avenue would reduce travel time delays and impacts on this line.

> **Project Mitigation Measure 10.1:** To address Project impacts to the 29-Sunset, prior to issuance of a grading permit for Phase I, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvements which could reduce Project impacts on transit operations along the Gilman Avenue and Paul Avenue corridor, generally between Arelious Walker Drive and Bayshore Boulevard. The study shall create a monitoring program to determine the implementation extent and schedule (as identified below) to maintain the proposed headways of the 29-Sunset.
>
> - For the five-block segment of Gilman Avenue between Arelious Walker Drive and Third Street, prohibit on-street parking on westbound Gilman Avenue during the AM and PM peak periods to provide for three westbound travel lanes. During the peak periods convert one of the three westbound travel lanes to transit-only. During off-peak periods, parking would be allowed, and buses would travel in one of the two mixed-flow lanes. The peak period transit lanes would impact 90 parking spaces.
>
> - For the same five-block segment of Gilman Avenue between Arelious Walker Drive and Third Street, restripe the eastbound direction to provide two travel lanes, one of which would accommodate on-street parking and one of which would be a mixed-flow travel lane. During the AM and PM peak periods, prohibit on-street parking in the eastbound direction, and operate one of the two eastbound lanes as transit-only lanes. The peak period transit lanes would impact 80 parking spaces.
>
> - As an alternative to the two bulleted measures above, narrow the existing sidewalks on Gilman Avenue from Third Street to Griffith Street (four blocks) from 15 feet to 12 feet in width. The resulting 12-foot-wide sidewalks would

be consistent with the Better Streets Plan guidelines. The reduction in sidewalk width would allow for the provision of a 7-foot-wide on-street parking lane, an 11-foot-wide transit-only lane, and a 10-foot-wide mixed-flow lane in each direction on Gilman Avenue. This would preserve on-street parking along the corridor and provide four-block transit-only lanes on Gilman Avenue between Griffith Street and Third Street. Treatment for transit-only lanes can range from striping to physical elevation changes to protect right-of-way from mixed-flow traffic.

- Prohibit on-street parking on the north side of Paul Avenue, between Third Street and Bayshore Boulevard to create two westbound through lanes. Convert one westbound through lane to transit-only in the AM and PM peak periods. The peak period transit-only lane would impact 40 parking spaces. At the intersection of Paul Avenue and Bayshore Avenue, provide transit signal priority treatment (i.e., queue jump) to allow transit vehicles to maneuver into the mixed flow left-hand lane, facilitating a left-turn movement immediately west of Bayshore Boulevard from westbound Paul Avenue to southbound San Bruno.

The Project Applicant shall fully fund the costs of implementing the transit priority improvements (either the improvements identified above, or alternative improvements of equal or greater effectiveness and comparable cost) as determined by the study and the monitoring program. Other options to be evaluated in the study could include transit priority treatments on San Bruno Avenue, on the portions where the 29-Sunset travels.

Project Mitigation Measure 10.2: Should Project Mitigation Measure 10.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 29-Sunset. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Implementation of transit-only lanes identified in mitigation measure Project Mitigation Measure 10.1 could reduce AM peak hour transit travel times by 4 minutes and 48 seconds in the westbound direction and 5 minutes and 10 seconds in the eastbound direction. During the PM peak, these measures would reduce transit travel times by 5 minutes and 20 seconds in the westbound direction and by 2 minutes in the eastbound direction. With the combination of mitigation measures, transit travel times in each direction and during each peak period would be no greater than for 2030 No Project conditions. However, because 2030 No Project conditions constitute adverse delays to transit service, cumulative adverse delays to transit service would occur even with these Project transit mitigation measures. Because adverse transit delays affecting this line are generated by adverse traffic congestion to which the Project has a considerable contribution, the Project also has a cumulatively considerable contribution to adverse transit delays.

Implementation of Project Mitigation Measure 10.1, on the other hand, would allow operation of headways as described under Project Mitigation Measure 7. However, given the congestion along the Gilman Avenue corridor, implementation of Project Mitigation Measure 10.2 alone, without Project Mitigation Measure 10.1, might not be sufficient to reduce the impact to less than significant levels.

Implementation of Project Mitigation Measure 10.1 would also exacerbate automobile LOS F conditions at the intersection of Third/Paul and Paul/Bayshore that was identified as having significant and unavoidable impacts. Additional impacts of these mitigation measures would be similar to Project impacts regarding traffic circulation, parking supply, loading supply and operations, and bicycle circulation.

Because a feasibility study of the improvements contemplated in mitigation measure Project Mitigation Measure 10.1 would be required, implementation of Project Mitigation Measure 10.1 is uncertain. Because implementation of Project Mitigation Measure 10.2 alone, without Project Mitigation Measure 10.1, might not be sufficient to reduce the impacts on the 29-Sunset to a less than significant level, the Project impacts on the 29-Sunset would remain *significant and unavoidable.*

48-Quintara-24th Street – Project-related transit delays due to congestion on study area roadways and passenger loading delays associated with increased ridership would result in significant impacts on the operation of the 48-Quintara-24th Street. Within the study area, the 48-Quintara-24th Street would experience substantial delays at key intersections along Evans Avenue, particularly at the key intersections with Third Street, Napoleon/Toland Streets and at Cesar Chavez Street. Overall, the Project-related congestion would add up to 3 minutes of delay per bus during peak hours. The provision of transit-only lanes on Evans Avenue and other transit-priority treatments would reduce travel time delays and impacts on this line.

> **Project Mitigation Measure 11.1:** To address Project impacts to the 48-Quintara-24th Street, prior to issuance of a grading permit for Phase I, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvements which could reduce Project impacts on transit operations along the Evans Avenue corridor, generally between Hunters Point Boulevard and Napoleon Street. The study shall create a monitoring program to determine the

implementation extent and schedule (as identified below) to maintain the proposed headways of the 48-Quintara-24th Street.

- On Evans Avenue, between Jennings Street and Napoleon Street (a nine-block segment—about 6,000 feet), convert one of the two travel lanes in each direction to a transit-only lane at all times. Treatment for transit-only lanes can range from striping to physical elevation changes or barriers to protect transit right-of-way from mixed-flow traffic.

The Project Applicant shall fully fund the costs of implementing the transit priority improvements (either the improvements identified above, or alternative improvements of equal or greater effectiveness and comparable cost) as determined by the study and the monitoring program. Other options to be evaluated in the study could include extension of transit only lanes in one or both directions between Napoleon Street and Cesar Chavez Street or onto Hunters Point Boulevard and Innes Avenue.

Project Mitigation Measure 11.2: Should Project Mitigation Measure 11.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 48-Quintara-24th Street. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Provision of the transit-only lane on Evans Avenue, as identified in mitigation measure Project Mitigation Measure 11.1 would reduce AM peak hour transit travel times by 80 seconds in the westbound direction, and by 2 minutes and 33 seconds in the eastbound direction. During the PM peak hour transit travel times would be reduced by 1 minute and 40 seconds in the westbound direction, and by 2 minutes and 15 seconds in the eastbound direction. With the combination of mitigation measures, transit travel times in each direction and during each peak period would be no greater than for 2030 No Project conditions. However, because 2030 No Project conditions constitute adverse delays to transit service, cumulative adverse delays to transit service would occur even with these Project transit mitigation measures. Because adverse transit delays affecting this line are generated by adverse traffic congestion to which the Project has a considerable contribution, the Project also has a cumulatively considerable contribution to adverse transit delays.

Implementation of Project Mitigation Measure 11.2, on the other hand, would allow operation of headways as described under Project Mitigation Measure 7. However, given the congestion along Evans Avenue, implementation of Project Mitigation Measure 11.2 alone, without Project Mitigation Measure 11.1, might not be sufficient to reduce the impact to less than significant levels.

Implementation of Project Mitigation Measure 11.1 would also exacerbate automobile LOS F conditions at some intersections that were identified as significant and unavoidable impacts. In addition, it would ultimately be at SFMTA's discretion whether the transit-only lane would be implemented in the center lanes or in the lanes adjacent to the curb. Implementation of center-running lanes may have some operational benefit (depending on the results of feasibility study to be conducted if conditions warrant implementation of this measure), center-running lanes may result in loss of some additional on-street parking near stop platforms. Additional impacts of these mitigation measures would be similar to Project impacts regarding traffic circulation, parking supply, loading supply and operations, and bicycle circulation.

Because a feasibility study of the improvements contemplated in Project Mitigation Measure 11.1 would be required, implementation of Project Mitigation Measure 11.1 is uncertain. Because implementation of Project Mitigation Measure 11.2 alone, without Project Mitigation Measure 11.1, might not be sufficient to reduce the impacts on the 48-Quintara-24th Street to a less than significant level, the Project impacts on the 48-Quintara-24th Street would remain *significant and unavoidable.*

54-Felton – Additional traffic congestion associated with Project vehicle trips would result in significant impacts to the operations of the 54-Felton, particularly during the PM peak hour. Overall, the Project-related congestion would add up to 6 minutes of delay per bus during peak hours. However, unlike many of the other transit routes within the study area, the 54-Felton provides a relatively circuitous neighborhood collector service, which typically includes a number of turns and short distances on individual streets. As a result, mitigation measures that provide transit-only lanes are not practical due to the difficulty of accommodating turning movements at intersections. Further, although the 54-Felton would travel along Third Street between Palou Avenue and Hudson Street, relocating the 54-Felton to the dedicated light rail transit right of way in the center of Third Street would not be feasible because the train platforms are high-floor and on the left-hand side and buses load and unload from the right-hand side at low-floor stops. There is not adequate space in the existing right-of-way to provide new platforms to load and unload passengers from a bus in this area.

> **Project Mitigation Measure 12:** SFMTA shall purchase additional transit vehicles and contribute to operating costs and facility improvements to mitigate the Project impacts and Project contribution to cumulative impacts to headways on 54-Felton. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated

ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

While the provision of additional transit vehicles for the 54-Felton would reduce impacts associated with increased travel times, the transit vehicles would still be subject to delays resulting from increased congestion, and therefore Project impacts on the 54-Felton would remain *significant and unavoidable.*

T-Third – Project-related transit delays due to congestion on Third Street and passenger loading delays associated with increased ridership would result in significant impacts on the operation of the T-Third. Within the study area, the T-Third would primarily experience delays related to increased traffic volumes within the segment between Thomas Avenue and Kirkwood Avenue where the light rail operates within a mixed-flow travel lane. Along the remainder of Third Street and Bayshore Boulevard, the T-Third operates within an exclusive right-of-way. Overall, the Project-related congestion would add up to 3 minutes of delay per bus during peak hours. Providing exclusive right-of-way for the T-Third in the segment between Thomas Avenue and Kirkwood Avenue would reduce travel time delays for the T-Third.

Project Mitigation Measure 13.1: To address Project impacts to the T-Third, prior to issuance of a grading permit for Phase I, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvement that could reduce Project impacts on transit operations along Third Street between Thomas Avenue and Kirkwood Avenue. The study shall create a monitoring program to determine the implementation extent and schedule (as identified below) to maintain the proposed headways of the T-Third.

- Reconfigure the section of Third Street between Thomas Avenue and Kirkwood Avenue (9 blocks) where the light rail vehicles currently share the travel lane with auto traffic to provide a dedicated transit right-of-way, consistent with the rest of the route. This would require either removal of one travel lane in each direction on Third Street, or removal of on-street parking and some sidewalk bulbouts. In addition, left-turns from Third Street in this segment would be restricted in both directions. Treatment for transit-only lanes can range from striping to physical elevation or barriers to protect transit right-of-way from mixed-flow traffic.

Implementation of the intersection reconfiguration shall be the responsibility of SFMTA, and shall be implemented when the results of the study described above indicate transit improvements are necessary. The Project Applicant shall fully fund the costs of implementing the transit priority improvements prior to approval of subsequent phases of development.

Project Mitigation Measure 13.2: Should Project Mitigation Measure 13.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the T-Third. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Providing an exclusive right-of-way for the T-Third would reduce all delays associated with traffic congestion on Third Street during both AM and PM peak periods, such that transit travel times in year 2030 with the Project would be less than under than existing conditions.

Implementation of Project Mitigation Measure 13.2, on the other hand, would allow operation of headways as described under Project Mitigation Measure 7. However, given the congestion along Third Street, implementation of Project Mitigation Measure 13.2 alone, without Project Mitigation Measure 13.1, might not be sufficient to reduce the impact to less than significant levels.

Implementation of mitigation measure Project Mitigation Measure 13.2 would also exacerbate automobile LOS F conditions at intersections along Third Street that were identified as significant and unavoidable impacts. Additional impacts of these mitigation measures would be similar to Project impacts regarding traffic circulation, parking supply, loading supply and operations, and bicycle circulation.

Because a feasibility study of the improvements contemplated in Project Mitigation Measure 13.1 would be required, implementation of Project Mitigation Measure 13.1 is uncertain. Because implementation of Project Mitigation Measure 13.2 alone, without Project Mitigation Measure 13.1, might not be sufficient to reduce the impacts on the T-Third to a less than significant level, the Project impacts on the T-Third would remain *significant and unavoidable.*

28L-19th Avenue/Geneva Limited – Increased congestion associated with Project vehicle trips would impact the operations of the 28L-19th Avenue/Geneva Limited, which would be a significant impact. In the Project vicinity, the 28L-19th Avenue/Geneva Limited would generally travel in the exclusive BRT lanes, but would be subject to delays at the intersection of Geneva Avenue and Bayshore Boulevard. Overall, the Project-related congestion would add up to 4 minutes of delay per bus during peak hours. The intersection of Bayshore/Geneva would be reconfigured as part of the Geneva Avenue Extension project, and the provision of transit-only lanes on Geneva Avenue on the eastbound and westbound approaches to the intersection would reduce the impact of cumulative congestion.

Project Mitigation Measure 14.1: The City of Brisbane, as part of the Geneva Avenue Extension Project, shall account for existing traffic, background traffic growth, and the most recent forecasts of traffic expected to be associated with each of several adjacent development projects, including the Project. The San Francisco County Transportation Authority (SFCTA) and SFMTA shall coordinate with the City of Brisbane to ensure transit preferential treatment is accounted for in the design of the Geneva Avenue Extension.

Project Mitigation Measure 14.2: Should Project Mitigation Measure 14.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 28L-19th Avenue/Geneva Limited. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Since implementation of Project Mitigation Measure 14.1 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Implementation of Project Mitigation Measure 14.2, on the other hand, would allow operation of headways as described under Project Mitigation Measure 7. However, given the congestion along Geneva Avenue, implementation of Project Mitigation Measure 14.2 alone, without Project Mitigation Measure 14.1, might not be sufficient to reduce the impact to less than significant levels.

Because implementation of Project Mitigation Measure 14.2 alone, without Project Mitigation Measure 14.1, might not be sufficient to reduce the impacts on the 28L-19th Avenue/Geneva Limited to a less than significant level, the Project impacts on the 28L-19th Avenue/Geneva Limited would remain *significant and unavoidable.*

9X, 9AX, 9BX-Bayshore Expresses, 14X-Mission Express, CPX-Candlestick Express and HPX-Hunters Point Express – As described in traffic section above, the Project would contribute to cumulative traffic impacts on U.S. 101 northbound and southbound. The projected increases in congestion would affect transit lines operating on U.S. 101, notably the 9X, 9AX, and 9BX-Bayshore Expresses, and the 14X-Mission Express (the 14X-Mission Express operates southbound on U.S. 101, and northbound on I-280). The Project's new CPX-Candlestick Express between Candlestick Point and downtown would also use U.S. 101, and the HPX-Hunters Point Express would use I-280, and both would be subject to increased travel times due to freeway congestion. The Project's contribution to cumulative traffic congestion on U.S. 101 and associated delays to express bus service operating on U.S. 101 would be considered a significant impact on transit operations.

Potential strategies to reduce congestion impacts on transit travel times could include bus-only operation on the shoulders of U.S. 101, re-opening of the U.S. 101 northbound Silver Avenue on-ramp for transit only, and creating transit-only lanes on I-280 along with rerouting of the transit lines to I-280. Additional studies and coordination with Caltrans would be required to determine the feasibility of these strategies. As feasibility of these strategies is uncertain, the impact on the 9X, 9AX, 9BX-Bayshore Expresses, the 14X-Mission Express, and the new CPX-Candlestick Express and the HPX-Hunters Point Express operations would remain *significant and unavoidable*.

Regional Transit - As described above in the traffic intersection and freeway impact analysis, the Project would increase congestion and contribute to cumulative traffic congestion on Bayshore Boulevard and on U.S. 101, which would impact the travel times of SamTrans buses using these facilities. Potential strategies to reduce transit delay could include providing transit-only lanes on Bayshore Boulevard, permitting bus-only use of the shoulders of U.S. 101, and providing transit-only lanes on I-280 (and rerouting SamTrans buses from U.S. 101 to I-280).

Additional studies and coordination with SamTrans, Caltrans, and the City of Brisbane would be required to determine the feasibility of these strategies. Since implementation of these strategies is uncertain the impact on SamTrans bus operations would remain *significant and unavoidable*.

Project Variants

During the AM peak hour Project Variants 1 and 2 would require additional transit vehicles on the same routes as the Project. During the PM peak hour, Project Variants 1 and 2 would require additional vehicles on the same routes as the Project, except that the Variants would also require additional vehicles on the 48-Quintara-24th Street. The number of vehicles required for each peak hour for the Project and the two Project Variants is shown in **Table 75**, above. Impacts associated with Project Variants 1 and 2 would be somewhat more extensive than those for the Project. Project Variant 1 would require 10 additional vehicles in the AM peak hour, and 15 additional vehicles in the PM peak hour. Project Variant 2 would require 8 additional vehicles in the AM peak hour, and 12 additional vehicles in the PM peak hour. As with the Project, these vehicles would be in addition to those required to maintain 2030 No Project headways.

Project Mitigation Measures 7 though 14.2 above would be applicable for Project Variants 1 and 2, and reduce the impacts associated with Project Variants 1 and 2 by similar amounts as described above. However, as with the Project, impacts on transit operations would remain *significant and unavoidable*.

6.2.2 Alternatives to the Project

This section describes the transit impacts associated with Project Alternatives.

Transit Capacity Utilization

For each of the Project Alternatives, **Table 79** summarizes the additional transit trips and overall capacity utilization for each of the three study area Muni cordons during the AM and PM peak hours. **Table 80** presents the Project Alternative additional transit trips and capacity utilization at the Muni downtown screenlines, while **Table 81** presents the Alternative additional transit trips and capacity utilization for the regional screenlines. It should be noted that Alternatives 2, 3, 4 and 5 assumed the same transit improvements as the Project, and therefore capacity during the AM and PM peak hours would be the same. Alternative 1 (the No Project condition) would only include the planned TEP improvements, and, as indicated in **Table 72**, peak hour capacity within the study area and at the cordons would decrease slightly.

Table 79
Muni Ridership and Capacity Utilization at Study Area Cordons
Alternatives to the Project – Weekday AM and PM Peak Hours

Peak Hour/Cordon	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.
AM Peak Hour										
East of Third Cordon										
Inbound	1,353	79%	2,547	64%	2,191	55%	2,381	60%	2,511	63%
Outbound	1,577	92%	1,540	39%	1,284	32%	1,348	32%	1,504	38%
North Cordon										
Inbound	2,065	117%	2,458	69%	2,216	62%	2,349	66%	2,455	69%
Outbound	1,901	107%	2,151	61%	2,069	58%	2,083	59%	2,134	60%
West Cordon										
Inbound	2,053	92%	3,163	79%	2,853	71%	3,063	77%	3,056	76%
Outbound	1,536	69%	1,869	47%	1,732	43%	1,753	44%	1,857	46%
PM Peak Hour										
East of Third Cordon										
Inbound	1,382	81%	2,002	50%	1,529	38%	1,704	43%	2,004	50%
Outbound	848	49%	2,091	52%	1,470	37%	1,871	47%	2,148	54%
North Cordon										
Inbound	2,049	116%	2,675	75%	2,262	64%	2,469	70%	2,630	74%
Outbound	1,628	92%	2,231	63%	1,821	51%	2,065	58%	2,227	63%
West Cordon										
Inbound	1,196	54%	1,937	48%	1,602	40%	1,791	45%	1,915	47%
Outbound	1,249	56%	2,374	59%	2,017	50%	2,250	56%	2,401	60%

Source: Fehr & Peers.

Table 80
Muni Ridership and Capacity Utilization at Downtown Screenlines
Alternatives to the Project – Weekday AM and PM Peak Hours

Peak Hour/Screenline	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.
AM Peak Hour										
Northeast	3,008	78%	3,008	78%	3,008	78%	3,008	78%	3,008	78%
Northwest	8,949	75%	8,949	75%	8,949	75%	8,949	75%	8,949	75%
Southeast	7,248	71%	7,536	74%	7323	72%	7460	73%	7550	74%
Southwest	7,674	76%	7,674	76%	7,674	76%	7,674	76%	7,674	76%
Total All Screenlines	26,879	74%	27,167	75%	27,167	75%	27,167	75%	27,167	75%
PM Peak Hour										
Northeast	3,140	67%	3,140	78%	3,140	78%	3,140	78%	3,140	78%
Northwest	8,155	70%	8,155	75%	8,155	75%	8,155	75%	8,155	75%
Southeast	7,733	78%	8,223	83%	7847	79%	8098	81%	8254	83%
Southwest	8,829	82%	8,829	82%	8,829	82%	8,829	82%	8,829	82%
Total All Screenlines	27,857	75%	28,347	80%	28,347	80%	28,347	80%	28,347	80%

Source: Fehr & Peers.

Table 81
Ridership and Capacity Utilization at Regional Screenlines
Alternatives to the Project – Weekday AM and PM Peak Hours

Peak Hour/Regional Cordon	Alternative 1 No Project		Alternative 2 No Bridge		Alternative 3 49ers at Candlestick		Alternative 4 Lesser Build		Alternative 5 No Park Agreement	
	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.	Total Ridership	% Util.
AM Peak Hour										
East Bay										
BART	36,202	185%	36,202	185%	36,195	185%	36,193	185%	36,198	185%
AC Transit	3,347	61%	3,347	61%	3,347	61%	3,347	61%	3,347	61%
Ferries	1,971	83%	1,971	83%	1,971	83%	1,971	83%	1,971	83%
subtotal	41,520	151%	41,520	151%	41,513	151%	41,511	151%	41,516	151%
North Bay										
Golden Gate Transit	2,621	106%	2,621	106%	2,621	106%	2,621	106%	2,621	106%
Ferries	1,647	97%	1,647	97%	1,647	97%	1,647	97%	1,647	97%
subtotal	4,268	102%	4,268	102%	4,268	102%	4,268	102%	4,268	102%
South Bay										
BART	12,409	89%	12,416	89%	12,396	89%	12,396	89%	12,413	89%
Caltrain	4,454	70%	4,451	70%	4,432	69%	4,443	69%	4,449	70%
SamTrans	794	75%	799	75%	784	74%	794	75%	798	75%
Ferries	152	51%	152	51%	152	51%	152	51%	152	51%
subtotal	17,809	82%	17,818	82%	17,765	82%	17,785	82%	17,812	82%
Total All Screenlines	***63,597***	***119%***	***63,606***	***119%***	***63,546***	***119%***	***63,564***	***119%***	***63,596***	***119%***
PM Peak Hour										
East Bay										
BART	30,241	154%	30,268	154%	30,247	154%	30,258	154%	30,267	154%
AC Transit	4,485	68%	4,485	68%	4,485	68%	4,485	68%	4,485	68%
Ferries	2,147	79%	2,147	79%	2,147	79%	2,147	79%	2,147	79%
subtotal	36,873	128%	36,900	128%	36,879	128%	36,890	128%	36,899	128%
North Bay										
Golden Gate Transit	2,513	114%	2,513	114%	2,513	114%	2,513	114%	2,513	114%
Ferries	1,630	96%	1,630	96%	1,630	96%	1,630	96%	1,630	96%
subtotal	4,143	106%	4,143	106%	4,143	106%	4,143	106%	4,143	106%
South Bay										
BART	10,631	76%	10,707	76%	10,647	76%	10,684	76%	10,708	76%
Caltrain	3,959	62%	4,008	63%	3,964	62%	3,995	62%	4,013	63%
SamTrans	362	39%	404	43%	367	39%	396	42%	408	43%
Ferries	75	25%	75	25%	75	25%	75	25%	75	25%
subtotal	15,027	69%	15,194	70%	15,053	70%	15,150	70%	15,204	70%
Total All Screenlines	***56,043***	***103%***	***56,237***	***103%***	***56,075***	***103%***	***56,183***	***103%***	***56,246***	***103%***

Source: AECOM, Fehr & Peers.

The Alternatives would contribute slightly fewer trips to the South Bay cordon in the off-peak directions (southbound in the AM peak hour and northbound in the PM peak hour) than in the peak directions. Off-peak direction ridership would remain within available capacity in the AM and PM peak hours. Generally, the project cordons would operate at similar or lower capacity utilization under Alternatives 2, 3, 4, and 5 than with the Project. The exception to this is that Alternative 5 would have slightly higher capacity utilization on the East of Third Cordon and the West Cordon in the outbound direction in the PM peak hour only. However, all cordons would operate within Muni's 85 percent capacity utilization under Alternatives 2, 3, 4, and 5. As described in the previous chapter, the study area cordons would exceed the 85 percent capacity utilization standard under Alternative 1 on the North Cordon, in both the inbound and outbound directions during the AM and PM peak hours. During the AM peak hour, the East of Third Cordon in the outbound direction and the West Cordon in the inbound direction would exceed Muni's capacity utilization standard.

The Alternatives to the Project would add trips to the southeast downtown screenline. Under Alternatives 1, 2, 3, 4, and 5, the capacity utilization of the southeast screenline would be the same as or lower than it would be with the Project, and in all cases, would operate below Muni's 85 percent capacity utilization standard.

Regional cordons would operate at the same percentage of capacity utilization with the Project Alternatives as under 2030 No Project conditions, with one exception. The capacity utilization for the South Bay would increase from 69 to 70 percent during the PM peak hour for each of the Alternatives compared to the 2030 No Project condition. Overall, the Alternatives would not increase the capacity utilization by more than one percentage point on any cordon expected to exceed available capacity without the project. Further, the project alternatives would not cause any cordon expected to operate within available capacity without the project to exceed its capacity.

Alternative 1 – No Project: Under Alternative 1 (No Project) transit ridership at the cordons would increase due to projected development within the India Basin area and Hunters Point Shipyard. The North, West and East of Third cordons would operate at more than the capacity utilization standard of 85 percent, and therefore there would be significant cumulative (2030 No Project) transit impacts at these cordons.

The existing Hunters Point Shipyard Mitigation Monitoring and Reporting Program (MMRP) includes adoption of a TDM program (including forming a Transportation Management Association) and a Transportation System Management Plan (including measures such as transit pass sales, transportation option information, employee transit subsidies, expansion of transit service, secure bicycle parking, parking management guidelines, flexible work hours, and shuttle service). The measure shall be implemented per the requirements of the existing MMRP.

Since implementation of the mitigation measures included in the Hunters Point Shipyard MMRP is not certain, Project Alternative 1 impacts on transit capacity at the study area cordons would remain *significant and unavoidable.*

Alternative 1 contributions to the significant transit impacts at the regional screenlines under 2030 No Project conditions would be *less than significant.*

Alternative 2 – No Bridge: The transit operating plan assumed for Alternative 2 would be the same as for the Project. However, since the Yosemite Slough bridge would not be constructed, and the BRT route would travel around Yosemite Slough. The alternate route would extend west on Carroll Avenue, north on Hawes Street, west on Armstrong Avenue to an abandoned railroad right-of-way, previously operated by the United States Navy. The BRT route would then travel along this right-of-way, just east of Ingalls Street, to its intersection with Shafter Street, just east of Hawes Street. The BRT route would travel east on Shafter Street to Arelious Walker Drive, where it would resume its primary proposed route into Hunters Point Shipyard.

Although the alternate route around Yosemite Slough would be technically feasible, it would not be the optimal configuration for a BRT system. A fundamental component of BRT service is direct, fast, and reliable travel in dedicated right-of-way, typically with signal priority given to the BRT vehicles. When these elements are combined, the BRT service takes on a higher-quality character than typical local bus service. The Yosemite Slough bridge would provide such a service in the project study area by providing dedicated right-of-way and providing the most direct route of travel between the Hunters Point Shipyard and points to the west, including Candlestick Point, the Bayshore Caltrain station, and the Balboa Park BART station.

If the Yosemite Slough bridge were not in place, only one transit route (the 28L-19th Avenue/Geneva BRT route) would be affected. BRT travel times, particularly between major development and regional transit connections (e.g., Caltrain and BART) would increase by approximately five minutes. As a result, BRT ridership to and from the Hunters Point Shipyard would decrease by approximately 15 percent to the forecasts presented for the Project. However, because this represents a relatively small portion of the overall project transit ridership, the additional traffic generated by the Project Alternative 2 would be minimal, and thus, a separate analysis was not conducted.

With the Muni transit capacity increases assumed for Alternative 2, compared to the No Project Alternative 1, the total transit travel demand on Muni would be accommodated at each of the three the cordons during the AM and PM peak hours. At the regional screenlines, Alternative 2 would contribute minimally to future ridership and contributions to future cumulative impacts would be less than significant. As with the Project, Alternative 2 impacts on transit capacity would be *less than significant.*

Alternative 3 – 49ers at Candlestick: Under Alternative 3, the 49ers would remain at Candlestick Park and proposed development would occur primarily in the Hunters Point Shipyard. The transit operating plan assumed for Alternative 3 would be the same as for the Project. Under Alternative 3, the Yosemite Slough bridge would only be for pedestrians, bicycles, and the BRT route. Therefore, the bridge would be somewhat narrower than proposed for the Project, but would function the same as under the Project on non-game days.

Transit ridership associated with Alternative 3 would be less than with the Project. With the Muni transit capacity increases assumed for Alternative 3, the total transit travel demand on Muni would be accommodated at each of the three cordons during the AM and PM peak hours. At the regional screenlines, Alternative 3 would contribute minimally (and less than the Project) to future ridership and contributions to future regional cumulative transit impacts would be less than significant. As with the Project, Alternative 3 impacts on transit capacity would be *less than significant.*

Alternative 4 – Lesser Build: Alternative 4 assumes a general reduction in development as compared to the Project, and therefore transit travel demand would be less. The transit operating plan assumed for Alternative 4 would be the same as for the Project. Under Alternative 4, the Yosemite Slough bridge would not be constructed, and, as with Alternative 2, the BRT route would travel around Yosemite Slough using the former railroad right-of-way. Similar to Alternative 2, the increased travel time of approximately five minutes for the BRT route would somewhat reduce ridership on the BRT line for trips to and from the Hunters Point Shipyard, but overall, the increase in project-generated automobile traffic associated with this travel time increase would be negligible.

With the Muni transit capacity increases assumed for Alternative 4, the total transit travel demand on Muni would be accommodated at each of the three cordons during the AM and PM peak hours. At the regional screenlines, Alternative 4 would contribute minimally (and less than the Project) to future ridership and contributions to future regional cumulative transit impacts would be less than significant. As with the Project, Alternative 4 impacts on transit capacity would be *less than significant.*

Alternative 5 – No Park Agreement: Alternative 5 assumes a similar land use program as the Project Variant 2 (1,350 residential units more than the Project within Hunters Point Shipyard), and therefore transit travel demand would be greater than with the Project. The transit operating plan assumed for Alternative 5 would be the same as for the Project. Under Alternative 5, the Yosemite Slough bridge would not be constructed, and the proposed BRT route would be the same as for Alternatives 2 and 4, with similar effects on BRT travel times and ridership.

With the Muni transit capacity increases assumed for Alternative 5, the total transit travel demand on Muni would be accommodated at each of the three cordons during the AM and PM peak hours. At the regional screenlines, Alternative 5 would contribute minimally (and less than the Project) to future ridership and contributions to future regional cumulative transit impacts would be less than significant. As with the Project, Alternative 5 impacts on transit capacity would be *less than significant.*

Alternatives Transit Delay

Table 82 presents the travel time increases associated with the project alternatives for each transit line in the study area. Although neither Alternative 1 nor the existing conditions include extensions of transit routes into the project site, the analysis of increases to transit travel times over existing conditions associated with Alternative 1 was conducted for the same segments as the Project, to provide a meaningful comparison. **Table 83** identifies the number of additional vehicles that would be required to meet the proposed headways.

Alternative 1 – No Project: As shown on **Table 83**, under Alternative 1 - No Project, traffic and ridership demands would increase and result in the need for an additional 16 transit vehicles for seven routes in the AM peak hour, and an additional 16 vehicles for six routes in the PM peak hour. During the AM peak hour, additional vehicles would be required on the 9-San Bruno (5 vehicles), 24-Divisadero (1 vehicle), 28L-19th Avenue Limited (1 vehicle), 29-Sunset (1 vehicle), 44-O'Shaughnessy (2 vehicles), the 48-Quintara-24th Street (1 vehicle), the 54-Felton (1 vehicle) and the T-Third (2 train cars). In the PM peak hour, additional vehicles would be needed on the 9-San Bruno (7 vehicles), 23-Monterey (1 vehicle), 28L-19th Avenue Limited (1 vehicle), 44-O'Shaughnessy (3 vehicles), 48-Quintara-24th Street (1 vehicle), 54-Felton (1 vehicle), and the T-Third (1 train car). These would be significant No Project impacts.

Alternative 2 – No Bridge: Transit impacts associated with Alternative 2 would be the same as for the Project, with the exception of the 28L-19th Avenue/Geneva Limited. Under Alternative 2, the Yosemite Slough bridge would not be constructed, and the BRT travel times would increase by about 5 minutes since the BRT route would need to travel around the slough. During the AM peak hour, an additional 7 vehicles would be required to maintain projected headways, and during the PM peak hour and additional 12 vehicles would be required. As for the Project, these transit vehicles would be in addition to those identified to maintain 2030 No Project conditions (16 vehicles in the AM peak hour, and 16 vehicles in the PM peak hour).

Project Mitigation Measures 7 through 14.2 would also be applicable for Alternative 2. As with the Project, Project Mitigation Measures 7 through 14.2 would reduce, but not eliminate, Alternative 3 impacts on transit operations. Alternative 2 impacts on transit operations would therefore remain *significant and unavoidable.*

Table 82
Project Increases to Transit Travel Time (minutes:seconds)[1, 2]
Alternatives to the Project – Weekday AM and PM Peak Hours [3]

Route	Proposed Headway (min.)	Northbound / Eastbound			Southbound / Westbound		
		Alt. 1 No Project	Alt. 3 49ers at Candlestick	Alt. 4 Lesser Build	Alt. 1 No Project	Alt. 3 49ers at Candlestick	Alt. 4 Lesser Build
AM Peak Hour							
9-San Bruno	10	**39:27**	-1:06	**0:53**	**9:20**	0:25	**7:26**
23-Monterey	15	8:24	0:07	0:35	3:33	0:18	3:50
24-Divisadero	6	**2:58**	**9:19**	**9:11**	**5:52**	**-2:14**	**-1:33**
28L-19th Ave Ltd	5	**1:44**	0:00	1:21	**7:24**	0:00	0:00
29-Sunset	10	**6:19**	0:39	**6:21**	**3:42**	2:35	**8:40**
44-O'Shaughnessy	6	**11:06**	**6:11**	**4:24**	**8:25**	**5:09**	**4:58**
48-Quintara-24th St	15	**5:38**	**3:17**	**2:09**	**2:08**	**6:20**	**5:43**
54-Felton [4]	20	**4:24**	-0:02	-0:54	**4:59**	-2:18	-3:05
T-Third	8	**7:01**	0:54	1:13	**5:13**	1:39	1:39
PM Peak Hour							
9-San Bruno	10	**43:53**	0:52	**3:12**	**23:02**	1:21	**6:15**
23-Monterey	15	**8:14**	0:42	0:54	**10:26**	0:34	1:44
24-Divisadero	6	0:55	**3:35**	**4:35**	0:02	**4:33**	**7:33**
28L-19th Ave Ltd	5	**2:26**	**3:23**	-4:49	**5:33**	**0:03**	-4:57
29-Sunset	10	2:36	3:09	**13:56**	1:58	-1:14	**15:05**
44-O'Shaughnessy	6	**12:57**	**4:48**	**4:01**	**10:21**	**8:07**	**5:53**
48-Quintara-24th St	15	**5:49**	**7:19**	**6:07**	**7:48**	**7:13**	**4:47**
54-Felton [4]	20	**13:31**	**3:28**	**3:28**	**6:56**	**2:43**	**3:15**
T-Third	8	**4:16**	1:54	**2:17**	**5:13**	1:07	**1:58**

Notes:

1. Delays measured for each route between project site and key destination/transfer point away from the project. The study segment for each route is as follows:
   - 9-San Bruno: Bayshore Boulevard between Sunnydale Avenue and Jerrold Avenue
   - 23-Monterey: between Ingalls Street/Oakdale Avenue and the Glen Park BART Station
   - 24-Divisadero: between Hunters Point Shipyard and Mission Street
   - 28L-19th Avenue: between Hunters Point Shipyard and Mission Street
   - 29-Sunset: between Candlestick Point and Mission Street
   - 44-O'Shaughnessy: between Hunters Point Shipyard and the Glen Park BART Station
   - 48-Quintara-24th St: between Hunters Point Shipyard and the 24th Street BART Station
   - 54-Felton: between Jerrold Avenue/Earl Street and Mission Street
   - T-Third: Third Street between Thomas Avenue and Jerrold Avenue (This segment represents the section of the T-Third route that does not provide exclusive right-of-way for transit and would be most affected by increased traffic congestion.)
2. Routes where project would increase travel times such that additional vehicles would be required highlighted in **bold**.
3. Travel times for Alternative 2 same as for Project, and travel times for Alternative 5 same as Project Variant 2, as presented on Table 76. The exception is the 28L-19th Avenue Limited, were travel times in each direction would increase by five minutes per direction as neither Alternative 2 nor Alternative 5 would include the Yosemite Slough bridge.
4. Due to roadway improvements proposed by the Project and differences between the No Project and Project land use assumptions in the Hunters Point Shipyard, there would be less traffic congestion along 54-Felton route in the study area with the Project, than under 2030 No Project conditions.

Source: Fehr & Peers.

Table 83
Additional Muni Transit Vehicle Requirements
Alternatives to the Project – Weekday AM and PM Peak Hours

Route	Alternative 1 No Project	Alternative 2 No Bridge	Alternative 3 49ers at Candlestick	Alternative 4 Lesser Build	Alternative 5 No Park Agreement
AM Peak Hour					
9-San Bruno	5	1	0	1	1
23-Monterey	1	0	0	0	0
24-Divisadero	1	1	1	1	2
28L-19th Ave Ltd	1	1	0	0	1
29-Sunset	1	1	0	2	1
44-O'Shaughnessy	3	2	2	2	2
48-Quintara-24th St	1	1	1	1	1
54-Felton [2]	1	0	0	0	0
T-Third	2	0	0	0	0
Total	*16*	*7*	*4*	*7*	*8*
PM Peak Hour					
9-San Bruno	7	1	0	1	1
23-Monterey	1	0	0	0	0
24-Divisadero	0	3	1	2	2
28L-19th Ave Ltd	1	1	1	0	1
29-Sunset	0	3	0	3	3
44-O'Shaughnessy	4	2	2	2	2
48-Quintara-24th St	1	0	1	1	1
54-Felton	1	1	1	1	1
T-Third	1	1	0	1	1
Total	*16*	*12*	*6*	*11*	*12*

Note:
1. Transit vehicle requirements for Alternatives 2 through 5 are in addition to those required for the 2030 No Project condition (Alternative 1).
Source: Fehr & Peers.

Alternative 3 – 49ers at Candlestick: Alternative 3 would result in the need for additional transit vehicles beyond those required for 2030 No Project conditions on three routes in the AM peak hour and on five routes in the PM peak hour. During the AM peak hour, 4 vehicles would be required to maintain proposed headways on the 24-Divisadero (1 vehicle), 44-O'Shaughnessy (2 vehicles), and the 48-Quintara-24th Street (1 vehicle). During the PM peak hour, 6 additional vehicles would be needed for the 24-Divisadero (1 vehicle), 28L-19th Avenue Limited (1 vehicle), 44-O'Shaughnessy (2 vehicles), 48-Quintara-24th Street (1 vehicle), and 54-Felton (1 vehicle) routes. Impacts associated with Alternative 3 would be somewhat less than those for the Project.

Project Mitigation Measures 7 through 14.2 would also be applicable for Alternative 3. As with the Project, Project Mitigation Measures 7 through 14.2 would reduce, but not eliminate, Alternative 3 impacts on transit operations. Alternative 3 impacts on transit operations would therefore remain *significant and unavoidable.*

Alternative 4 – Lesser Build: Alternative 4 would result in the need for 7 additional transit vehicles beyond those required for 2030 No Project conditions on five routes during the AM peak hour, and an additional 11 vehicles for seven routes during the PM peak hour. During the AM peak hour, additional vehicles would be required on the 9-San Bruno (1 vehicle), 24-Divisadero (1 vehicle), 29-Sunset (2 vehicles), 44-O'Shaughnessy (2 vehicles), and the 48-Quintara-24th Street (1 vehicle). In the PM peak hour, additional vehicles would be required on the 9-San Bruno (1 vehicle), 24-Divisadero (2 vehicles), 29-Sunset (3 vehicles), 44-O'Shaughnessy (1 vehicle), 48-Quintara-24th Street (1 vehicle), 54-Felton (1 vehicle), and the T-Third (1 train car). Impacts associated with Alternative 4 would be somewhat less than those for the Project.

Project Mitigation Measures 7 through 14.2 would also be applicable for Alternative 4. As with the Project, Project Mitigation Measures 7 through 14.2 would reduce, but not eliminate, Alternative 4 impacts on transit operations. Alternative 3 impacts on transit operations would therefore remain *significant and unavoidable.*

Alternative 5 – No Park Agreement: Since the land use program and transit operating plan for Alternative 5 would be the same as for Project Variant 2, transit impacts for Alternative 5 would be the same as Project Variant 2, with the exception of the 28L-19th Avenue/Geneva Limited. Under Alternative 5, the Yosemite Slough bridge would not be constructed, and the BRT travel times would increase by about 5 minutes since the BRT would need to travel around the slough. Project Mitigation Measures 7 through 14.2 would also be applicable for Alternative 5. As with the Project, Project Mitigation Measures 7 through 14.2 would reduce, but not eliminate, Alternative 5 impacts on transit operations. Alternative 3 impacts on transit operations would therefore remain *significant and unavoidable.*

6.3 BICYCLE IMPACTS

6.3.1 Project and Project Variants

The street network proposed for Candlestick Point would be an extension of the existing grid of the adjacent Bayview neighborhood, which would facilitate access between the new uses and the rest of San Francisco, and provide a connection between existing Bayview/South Basin neighborhoods and the existing and proposed waterfront amenities.

A number of existing and proposed study area roadways would include bicycle facilities in the form of bicycle lanes (Class II facilities) or signed routes (Class III facilities – e.g., roadways with sharrow designations) that would facilitate bicycling within and in the vicinity of the Project area. Off-street Class I pathways would be provided around the bayside perimeter of

Candlestick Point, across the proposed Yosemite Slough bridge, and into Hunters Point Boulevard via Crisp Avenue. Within the Project area, the Bay Trail would also be completed. **Figure 8** in Chapter 2 presented the proposed improvements.

Outside of the Project site, street improvements would include striping of bicycle lanes on Innes Avenue, Gilman Avenue, Jamestown Avenue and on Harney Way. As noted in section 4.3.3, the Bicycle Plan includes a near-term project on Innes Avenue (Bicycle Route #68) between Donahue Street and Hunters Point Boulevard, however, a preferred option was not identified in the Final EIR for the Bicycle Plan. The CP-HPS Phase II Development Plan proposes to provide a bicycle lane in both directions on Innes Avenue between Donahue Street and Hunters Point Boulevard, which would require removal of on-street parking on the south side of Innes Avenue between Earl Street and Hunters Point Boulevard. The Project proposal is consistent with Option 1 in the Bicycle Plan, however, it would not preclude implementation of Option 2 (sharrows added to the existing Class III facility), if that option were determined to be preferable by SFMTA.

Overall, bicycle access and the environment for bicycling would improve within and in the vicinity of the Project site. The facilities would be adequate to meet the bicycling demand associated with the Project uses, and Project impacts on bicycle circulation would be *less than significant*.

However, outside of the project site Bicycle Route #70 and Bicycle Route #170 on Palou Avenue are designated as Class III signed routes, and the combination of the proposed transit preferential treatment and the substantial increase in traffic volumes and congestion would result in potentially significant impacts on bicycle travel on this route. When faced with traffic congestion and constrained environment bicyclists may chose to ride on other streets not designated as part of the bicycle route network. Since the proposed development in Candlestick Point and Hunters Point Shipyard had not been anticipated in the needs assessments conducted for the Bicycle Plan, this segment of Palou Avenue is not included in the Bicycle Plan for near-term or long-term improvement projects.

> ***Project Mitigation Measure 15***: Prior to issuance of the grading permit for Phase I, the Project Applicant shall fund a study to determine the feasibility of relocating Bicycle Routes #70 and #170. The study of the bicycle route relocation, necessary environmental clearance documentation, and implementation shall be the responsibility of SFMTA. Since the feasibility of the relocation of the routes is uncertain at this time, the Project impact on bicycle circulation on Palou Avenue would remain significant and unavoidable.

Because a feasibility study of the relocation of Bicycle Routes #70 and #170 on Palou Avenue would be required, the implementation of Project Mitigation Measure 15 is uncertain, and therefore the Project impact on bicycle circulation would remain *significant and unavoidable.*

Project Variants 1 and 2 include additional development within Hunters Point Shipyard (these variants assume that the 49ers would relocate to Santa Clara and that a new stadium would not be constructed within Hunters Point Shipyard) and would result in increased bicycle travel within and adjacent to the Project area. The bicycle trips associated with the increased development would be accommodated within the proposed street network, and impacts on bicycle circulation would *be less than significant*.

As with the Project, potential significant impacts on bicycle travel on Palou Avenue would occur under both Variants 1 and 2. Project Mitigation Measure 15, described above, would be applicable to both Project Variants 1 and 2. Because a feasibility study of the relocation of Bicycle Routes #70 and #170 on Palou Avenue would be required, the implementation of Project Mitigation Measure 15 is uncertain, and therefore the Project Variants 1 and 2 impacts on bicycle circulation would remain *significant and unavoidable.*

6.3.2 Alternatives to the Project

Alternative 1 – No Project: Under the No Project Alternative, the bicycle route network and bicycle lanes would not be changed from existing conditions, with the exception of the near-term improvements proposed as part of the Bicycle Plan on Cargo Way, Illinois Street, Bayshore Boulevard, Cesar Chavez Street, and on Innes Avenue (see section 4.3.3).

Travel demand associated with Hunters Point Shipyard would increase bicycle travel along Innes Avenue. In the Candlestick Point area, bicycle volumes would remain similar to current conditions, however, increased traffic volumes associated with Hunters Point Shipyard development using the south gate at Crisp Avenue would increase the potential for conflicts between motorists and bicyclists. As with the Project, Alternative 1 impacts on bicycle circulation would be *less than significant.*

Alternative 2 – No Bridge: Street network and bicycle facilities and amenities under Alternative 2 would be similar to the Project. However, the Yosemite Slough bridge would not be constructed. Without the Yosemite Slough bridge, bicycle connectivity between Hunters Point Shipyard and Candlestick Point would occur via the network of existing streets, including Palou Avenue, Ingalls Street, Carroll Avenue and Gilman Avenue. Ingalls Street between Carroll Avenue and Palou Avenue would be designated as a Class III bicycle route, signed with sharrows. While an inconvenience, the lack of the connection provided by the proposed Yosemite Slough bridge would not result in significant impacts on bicycling. As with the Project, Alternative 2 impacts on bicycle circulation would be *less than significant.*

As with the Project, potential significant impacts on bicycle travel on Palou Avenue would occur under Alternative 2. These impacts would be exacerbated somewhat from Project conditions, as Alternative 2 would not include the Yosemite Slough bridge and the direct connection to areas to the southwest of Hunters Point Shipyard.

Project Mitigation Measure 15, described above, would be applicable to Alternative 2. Because a feasibility study of the relocation of Bicycle Routes #70 and #170 on Palou Avenue would be required, the implementation of Project Mitigation Measure 15 is uncertain, and therefore the Alternative 2 impacts on bicycle circulation would remain *significant and unavoidable.*

Alternative 3 – 49ers at Candlestick: Under Alternative 3, the 49ers would remain at Candlestick Park and proposed development would occur primarily in Hunters Point Shipyard. However, within Candlestick Point about 1,210 residential units would be constructed. Bicycle facilities within Hunters Point Shipyard would be similar to the Project, and would be adequate to accommodate the bicycle travel associated with the new development. Alternative 3 would include construction of the Yosemite Slough bridge for the BRT service to Hunters Point Shipyard, and as a pedestrian and bicycle connector. As with the Project, Alternative 3 impacts on bicycle circulation would be *less than significant.*

As with the Project, potential significant impacts on bicycle travel on Palou Avenue would occur under Alternative 3. Project Mitigation Measure 15, described above, would be applicable to Alternative 3. Because a feasibility study of the relocation of Bicycle Routes #70 and #170 on Palou Avenue would be required, the implementation of Project Mitigation Measure 15 is uncertain, and therefore the Alternative 3 impacts on bicycle circulation would remain *significant and unavoidable.*

Alternative 4 – Lesser Build: Alternative 4 assumes a general reduction in development as compared to the Project, and therefore pedestrian travel demand would be less. The proposed street network and bicycle facilities would be similar to Project, however this alternative would not include construction of the Yosemite Slough bridge. As noted above for Alternative 2, without provision of the Yosemite Slough bridge, pedestrian connectivity between Hunters Point Shipyard and Candlestick Point would occur via the network of existing streets, including Palou Avenue, Ingalls Street, Carroll Avenue and Gilman Avenue. Ingalls Street between Carroll Avenue and Palou Avenue would be designated as a Class III facility, signed with sharrows. While an inconvenience, the lack of the connection provided by the proposed Yosemite Slough bridge would not result in significant impacts on bicycling. As with the Project, Alternative 4 impacts on bicycle circulation would be *less than significant.*

As with the Project, potential significant impacts on bicycle travel on Palou Avenue would occur under Alternative 4. These impacts would be exacerbated somewhat from Project conditions, as Alternative 4 would not include the Yosemite Slough bridge and the direct connection to areas to the southwest of Hunters Point Shipyard. Project Mitigation Measure 15, described above, would be applicable to Alternative 4. Because a feasibility study of the relocation of Bicycle Routes #70 and #170 on Palou Avenue would be required, the implementation of Project Mitigation Measure 15 is uncertain, and therefore the Alternative 4 impacts on bicycle circulation would remain *significant and unavoidable.*

Alternative 5 – No Park Agreement: Alternative 5 assumes a similar land use program as the Project Variant 2, and therefore bicycle travel demand would be greater than the Project. The proposed street network and bicycle facilities would be similar to the Project, however, Yosemite Slough bridge would not be constructed. Without the Yosemite Slough bridge, bicycle connectivity between Hunters Point Shipyard and Candlestick Point would occur via the network of existing streets, including Palou Avenue, Ingalls Street, Carroll Avenue and Gilman Avenue. Ingalls Street between Carroll Avenue and Palou Avenue would be designated as a Class III bicycle route, signed with sharrows. While an inconvenience, the lack of the connection provided by the proposed Yosemite Slough bridge would not result in significant impacts on bicycling. As with the Project, Alternative 5 impacts on bicycle circulation would be *less than significant.*

As with the Project, potential significant impacts on bicycle travel on Palou Avenue would occur under Alternative 5. These impacts would be exacerbated somewhat from Project conditions, as Alternative 4 would not include the Yosemite Slough bridge and the direct connection to areas to the southwest of Hunters Point Shipyard. Project Mitigation Measure 15, described above, would be applicable to Alternative 4. Because a feasibility study of the relocation of Bicycle Routes #70 and #170 on Palou Avenue would be required, the implementation of Project Mitigation Measure 15 is uncertain, and therefore the Alternative 4 impacts on bicycle circulation would remain *significant and unavoidable.*

6.4 PEDESTRIAN IMPACTS

6.4.1 Project and Project Variants

The street network proposed for Candlestick Point would be an extension of the existing grid of the adjacent Bayview neighborhood, which would facilitate access between the new uses and the rest of San Francisco, and provide a connection between existing Bayview/South Basin neighborhoods and the existing and proposed waterfront amenities.

Other pedestrian amenities would include: crosswalks at unsignalized intersection, pedestrian crosswalks and signals at all new signalized intersections, corner bulbouts, and completion of sidewalk network where currently incomplete (e.g., Arelious Walker Drive, Palou Avenue). Along Gilman Avenue between Earl Street and Hunters Point Boulevard, and on Palou Avenue and Gilman Avenue between Arelious Walker Drive and Third Street, sidewalks would be reconstructed and landscaping improvements would be implemented.

Sidewalk widths on new or improved streets within the Project site would range from 10-feet to 15-feet in width, with the majority of streets having sidewalks 12 feet or greater in width. The Project would also include new sidewalks, and minor sidewalk narrowing on a number of existing streets, including:

- Griffith Street – narrow east and west sidewalks between Palou Avenue and Thomas Avenue from 12 to 11 feet.
- Thomas Avenue – narrow north and south sidewalks between Griffith Street and Ingalls Street from 15 to 12 feet.
- Ingalls Street – narrow east and west sidewalks between Yosemite Ave and Carroll Ave narrow from 15 to 11 feet.
- Carroll Avenue – new 12 foot wide sidewalks between Ingalls Street and Arelious Walker Drive
- Harney Way – new 15 foot wide sidewalk on north side from Thomas Mellon Drive to Jamestown Avenue

Overall, with the Project, pedestrian access would improve over the No Project conditions, except where sidewalks would be narrowed. The proposed narrowing of sidewalks would still allow for maintenance of sufficient clear space for people using walking aids or wheelchairs, as needed to meet *American with Disabilities* (ADA) requirements. Development of the Project would increase pedestrian presence in the area. Since pedestrian volumes within the Project site are very low, the addition of pedestrian trips associated with the Project would be accommodated within the existing and proposed sidewalk network.

A qualitative assessment was also conducted of potential pedestrian impacts resulting from increased travel demand outside of the Project site. As noted in previous sections, the Project would increase vehicle and bicycle volumes in the Bayview Hunters Point area, which would increase the potential for pedestrian-vehicle and pedestrian-bicycle conflicts particularly in locations where the sidewalk network is incomplete or where vehicles park on sidewalks, causing pedestrians to walk in the roadway and mix with vehicular traffic. The Project-proposed sidewalk network improvements on Innes Avenue, Palou Avenue, Gilman Avenue, and Jamestown Avenue would improve and define the pedestrian network on these roadways. Along Third Street sidewalks have been improved and pedestrian signals and crosswalks were installed as part of the Third Street light rail project. As cumulative development occurs within the area, individual development projects would be required to address any sidewalk deficiencies adjacent to their site.

With the Project, the number of pedestrians on streets outside of the Project site would increase as a result of the expanded recreational uses, extension of transit lines, and overall increase in commercial activity in the area. While the presence of an increased number of pedestrians may partially offset risks associated with increased pedestrian-vehicle and pedestrian-bicycle conflicts, the enhanced pedestrian network and "safety in numbers" conditions due to increased pedestrian presence would cause drivers to expect and adapt to increased interactions with pedestrians.

SFMTA and SFCTA have recognized the existing inadequacies in the Bayview Hunters Point area to the pedestrian network. SFMTA has begun implementing the Bayview Traffic Calming Project, which was developed through a community-based process that identified problem locations with a study area roughly bounded by Jamestown Avenue, Third Street and Evans Avenue, and traffic calming measures. Community concerns included high traffic volumes, numerous trucks, speeding cars, and reckless driving. The study resulted in a list of traffic calming measures (such as gateway islands, speed humps, speed cushions, and traffic circles) along specific roadways. Implementation of improvements is being phased in, and most cost-efficient solutions are being implemented first. The Project improvements would not preclude implementation of the traffic calming measures and would complement the goals of the community to enhance pedestrian safety. SFCTA has recently initiated the Bayview Hunters Point Neighborhood Transportation Plan (NTP) study that is focusing on the existing needs and concerns of the community, to develop smaller-scale solutions that could be implemented in the near-term. Measures such as better bus stops, brighter lighting, and landscaping, as well as parking management and mobility strategies such as shuttle service will be explored with the community.

The San Francisco Department of Public Health (DPH) analyzes pedestrian injuries in traffic accidents from a public health perspective. DPH notes that traffic accidents in general are a leading cause of death and injury in the United States. Beyond direct injuries and deaths, as matter of public health, DPH states that increased pedestrian safety can encourage walking, which in turn can have direct health benefits such as reducing obesity and indirect benefits such as improved air quality resulting from lesser traffic volumes.

There are a number of factors that contribute to increased pedestrian-vehicle collisions, and the number of collisions at an intersection is a function of the traffic volume, travel speeds, intersection configuration, traffic control, surrounding land uses, location, and number of pedestrians. The Project would result in a substantial change in the street network in the Project site, and includes street improvements that would enhance pedestrian safety in the Project site and beyond. The increased potential for pedestrian-vehicle conflicts and pedestrian injury would be tempered by the "safety in numbers" factor in an area currently characterized by low pedestrian volumes and mix of industrial and residential land uses. Overall, the existing and proposed pedestrian facilities would be adequate to meet the pedestrian demand associated with the Project land uses, and the Project impacts on pedestrian circulation within and in the vicinity of the Project would be *less than significant.*

Project Variants 1 and 2 include additional development within Hunters Point Shipyard (these variants assume that the 49ers would relocate to Santa Clara and that a new stadium would not be constructed within Hunters Point Shipyard) and would result in increased pedestrian travel within and adjacent to the Project area. The pedestrian trips associated with the increased development would be accommodated within the proposed sidewalk network, and impacts on pedestrian circulation would *be less than significant*.

6.4.2 Alternatives to the Project

Alternative 1 – No Project: Under the No Project Alternative, sidewalks in the study area would not be changed, with the exception of any street network improvements within Hunters Point Shipyard. Travel demand associated with Hunters Point Shipyard would increase pedestrian travel between Innes Avenue and Third Street, which would be accommodated on the 7-foot to 10-foot wide sidewalks on Innes Avenue, Hunters Point Boulevard, and Evans Avenue.

In the Candlestick Point area, pedestrian volumes would remain similar to current conditions, however, increased traffic volumes associated with Hunters Point Shipyard development using the south gate at Crisp Avenue would increase the potential for conflicts between motorists and pedestrians, particularly on streets in the South Basin where vehicles frequently park on sidewalks, and where there are no sidewalks. As with the Project, Alternative 1 impacts on pedestrian circulation would be *less than significant.*

Alternative 2 – No Bridge: Street network and pedestrian facilities and amenities under Alternative 2 would be similar to the Project, with the exception of the Yosemite Slough bridge, which would not be constructed. Pedestrian connectivity between Hunters Point Shipyard and Candlestick Point would occur via the network of existing streets, including Palou Avenue, Ingalls Street, Griffith Street, Carroll Avenue and Gilman Avenue. In addition, some pedestrians may walk along the Bay Trail. While an inconvenience, the lack of the connection provided by the proposed Yosemite Slough bridge would not result in significant impacts on pedestrian operations. As with the Project, Alternative 2 impacts on pedestrian circulation would be *less than significant.*

Alternative 3 – 49ers at Candlestick: Under Alternative 3, the 49ers would remain at Candlestick Park and proposed development would occur primarily in Hunters Point Shipyard. However, within Candlestick Point about 1,210 residential units would be constructed. Pedestrian facilities within Hunters Point Shipyard would be similar to the Project, and would be adequate to accommodate the pedestrian travel associated with the new development. Alternative 3 would include construction of the Yosemite Slough bridge for the BRT service to Hunters Point Shipyard, and as a pedestrian and bicycle connector. As with the Project, Alternative 3 impacts on pedestrian circulation would be *less than significant.*

Alternative 4 – Lesser Build: Alternative 4 assumes a general reduction in development as compared to the Project, and therefore pedestrian travel demand would be less. The proposed street network and pedestrian facilities would be similar to Project, however this alternative would not include construction of the Yosemite Slough bridge. As noted above for Alternative 2, without provision of the Yosemite Slough bridge, pedestrian connectivity between Hunters Point Shipyard and Candlestick Point would occur via the network of existing streets, including Palou Avenue, Ingalls Street, Griffith Street, Carroll Avenue and Gilman Avenue. In addition, some pedestrians may walk along the Bay Trail. While an inconvenience, the lack of the connection provided by the proposed Yosemite Slough bridge would not result in significant impacts on pedestrian operations. As with the Project, Alternative 4 impacts on pedestrian circulation would be *less than significant.*

Alternative 5 – No Park Agreement: Alternative 5 assumes a similar land use program as the Project Variant 2 (1,350 residential units more than the Project within Hunters Point Shipyard), and therefore pedestrian travel demand would be greater. The proposed street network and pedestrian facilities would be similar to Project, however this alternative would not include construction of the Yosemite Slough bridge. As noted above for Alternative 2, without provision of the Yosemite Slough bridge, pedestrian connectivity between Hunters Point Shipyard and Candlestick Point would occur via the network of existing streets, including Palou Avenue, Ingalls Street, Griffith Street, Carroll Avenue and Gilman Avenue. In addition, some pedestrians may walk along the Bay Trail. While an inconvenience, the lack of the connection provided by the proposed Yosemite Slough bridge would not result in significant impacts on pedestrian operations. As with the Project, Alternative 5 impacts on pedestrian circulation would be *less than significant.*

6.5 PARKING IMPACTS

Parking impacts assessment associated with the Project, Variants, and Alternatives include the comparison of the parking demand to the maximum off-street parking permitted per the parking standards detailed in the draft D4D standards for CP-HPS Phase II Development Plan. Since maximum permitted parking controls are proposed for the project site (not minimum requirements), a discussion is also presented for conditions if no off-street parking is provided. In addition, the impact of the Project relative to on-street parking supply on existing and proposed roadways is discussed.

The parking demand calculations represent the number of spaces that would be required in order to accommodate all the vehicles anticipated to result from the Project if the proposed parking supply was unconstrained. Since the parking supply would be constrained, the actual parking demand would be expected to be less. Transportation Study Appendix J includes the parking demand calculations, and provides a summary by residential and non-residential/commercial uses.

As part of its "transit first" policy, the City and County of San Francisco does not require that the supply of parking spaces equal the demand. Consequently, even though it is anticipated that the maximum number of parking spaces permitted per the D4D standards would be provided, they may not be sufficient to accommodate the actual demand. If fewer spaces than the maximum permitted were to be constructed, the projected shortfall would increase. Therefore, individuals who would prefer to drive may use transit because the perceived convenience of driving is lessened by a shortage of parking. This shortage in proposed off-street parking is not considered a significant environmental effect because it implements a policy intended to reduce citywide traffic congestion and air quality effects. Even with a shortage of off-street parking, measures often are implemented that result in more efficient use of the parking spaces provided. By promoting carpooling, allowing for the shared use of parking, and implementing pricing strategies designed to encourage short-term parking, the spaces provided for non-residential use would likely be used by more individuals, be vacant for shorter periods of time, and attract drivers needing short-term parking.

6.5.1 Project and Project Variants

Table 84 summarizes the aggregate of the parking demand calculated for Project land uses, and also presents the maximum permitted parking supply per the parking standards detailed in the draft D4D standards as well as the proposed number of new on-street parking spaces that would be provided on new and reconfigured streets.[20] **Table 85** summarizes the parking demand, and

[20] The Project would include some on-street parking in the project site for both commercial and general/residential uses. About 683 on-street spaces would be provided within Hunters Point Shipyard and 1,360 spaces within Candlestick Point for a total of 2,043 spaces.

the resultant parking shortfalls assuming Project parking supply for two scenarios: based on the maximum permitted draft D4D standards; and, assuming provision of no off-street spaces but that only the on-street parking spaces would be available. Since the D4D standards do not include minimum requirements (instead specify the maximum parking supply that would be permitted to be provided) it is possible that the Project could be constructed without any off-street parking. However, most development projects in San Francisco develop the maximum permitted supply, and therefore the comparison of the parking demand to the maximum permitted off-street supply and to no off-street supply presents the range of potential parking impacts.

Table 84
Summary of Parking Demand and Maximum Permitted Supply
Project and Project Variants

Scenario/Project Component	Demand [1]				Supply [1]		
	Residential	Non-Residential		Total Demand	Maximum Permitted Off-Street [2]	New On-Street	Total Supply
	Long Term	Long Term	Short Term				
Project							
Hunters Point Shipyard	3,110	3,818	996	7,924	6,678	683	7,361
Candlestick Point	9,212	1,475	2,622	13,309	10,196	1,360	11,556
Total	*12,322*	*5,293*	*3,618*	*21,233*	*16,874*	*2,043*	*18,917*
Variant 1 (R&D)							
Hunters Point Shipyard	3,110	7,299	1,447	11,856	9,678	1,678	11,356
Candlestick Point	9,212	1,475	2,622	13,309	10,196	1,360	11,556
Total	*12,322*	*8,774*	*4,069*	*25,165*	*19,874*	*3,038*	*22,912*
Variant 2 (Housing)							
Hunters Point Shipyard	4,694	3,811	911	9,416	7,778	1,298	9,076
Candlestick Point	7,627	1,480	2,787	11,894	8,846	1,360	10,206
Total	*13,321*	*5,291*	*3,698*	*21,310*	*16,624*	*2,658*	*19,282*

Notes:
1. Does not include stadium parking supply or game day demand.
2. Maximum number of spaces permitted per draft Design for Development standard for Candlestick Point Hunters Point Shipyard Phase II Development Plan.
Source: CHS Consulting, LCW Consulting.

Table 85
Summary of Parking Shortfalls for No Minimum and Maximum Permitted Supply [1, 2]
Project and Project Variants

Scenario/Project Component	Total Demand	Minimum Supply		Maximum Supply	
		Supply	Shortfall	Supply	Shortfall
Project					
Hunters Point Shipyard	7,924	683	- 7,241	7,361	- 563
Candlestick Point	13,309	1,360	- 11,949	11,556	- 1,753
Total	*21,233*	*2,043*	*- 19,190*	*18,917*	*- 2,316*
Variant 1 (R&D)					
Hunters Point Shipyard	11,856	1,678	- 10,178	11,356	- 500
Candlestick Point	13,309	1,360	- 11,949	11,556	- 1,753
Total	*25,165*	*3,038*	*- 22,127*	*22,912*	*- 2,253*
Variant 2 (Housing)					
Hunters Point Shipyard	9,416	1,298	- 8,118	9,076	- 340
Candlestick Point	11,894	1,360	- 10 534	10,206	- 1,688
Total	*21,310*	*2,658*	*- 18,652*	*19,282*	*- 2,028*

Notes:
1. Includes off-street and new on-street supply.
2. Does not include stadium parking supply or demand.
Source: CHS Consulting, LCW Consulting.

As shown in **Table 84**, the demand analysis indicates a Project need for about 21,233 spaces, compared with a maximum permitted supply of about 18,917 spaces; therefore the maximum off-street parking supply would be approximately 2,316 spaces less than the estimated peak demand. Residential spaces would comprise approximately 79 percent of the total shortfall spaces, and non-residential commercial spaces the remaining 21 percent of the shortfall:

- The residential parking demand of 12,322 spaces, compared to a maximum permitted of 10,500 spaces (one space per unit), would result in a deficit of 1,822 spaces demand).
- The non-residential demand would be 8,911 spaces, of which 41 percent would be needed for short-term use, while the remaining 59 percent would be needed for long-term use. The non-residential commercial parking demand, compared with a maximum permitted number of about 8,417 spaces, would result in a deficit of 494 spaces.

If no off-street parking is provided, the parking shortfall associated with the Project would increase substantially, and there would be a deficit of about 19,190 spaces. As indicated above, this represents the maximum shortfall, as it is anticipated that most, if not all, maximum permitted parking would likely be constructed.

Due to parking supply constraints and accessibility to transit, future Project parking demand may be somewhat lower than estimated, and therefore the parking space shortfall would also be less than presented above in **Table 85.** Specifically:

- The parking demand estimates included in **Table 84** and **Table 85** represent the number of spaces that would be required in order to accommodate all the vehicles anticipated to result from the Project if the proposed parking supply was unconstrained. Since the parking supply would be constrained, the actual parking demand would be expected to be less.
- The parking demand estimates represent the peak parking demand calculated separately for each land use. Since all land uses do not experience the peak parking demands simultaneously, the peak parking demand may be less than presented. The Project-proposed parking ratios are generally less than the existing Planning Code requirement for similar uses to discourage auto use and to reflect the potential for shared parking opportunities among the various uses. For example, a restaurant can share parking with an office complex, since restaurant parking demand peaks in the evening, while office parking demand peaks during the middle of the day. Public parking facilities, such as the one proposed in Candlestick Point, and on-street parking spaces can usually be shared efficiently among many destinations. Accounting for the shared parking would reduce the non-residential parking demand, and the excess demand that would not be accommodated within the proposed parking supply would also be less.
- The Project includes a Travel Demand Management program that includes a number of parking strategies to make auto use and ownership less attractive, as well as strategies to encourage alternative modes. While the TDM program was assumed in developing Project travel demand, the residential parking demand was based on standard *SF Guidelines* parking demand rates that are based on Citywide averages.
- Residents within Hunters Point Shipyard and Candlestick Point would have new and improved existing transit routes connecting the Project site with downtown and with Caltrain and BART. Under Project conditions, capacity on local and regional lines would be available to accommodate additional Project transit trips.

As part of its “transit first” policy, the City and County of San Francisco does not require that the supply of parking spaces equals the demand. Consequently, even though it is anticipated that the Project would provide the maximum number of parking spaces permitted, they may not be sufficient to accommodate the actual demand. If fewer spaces than the maximum permitted were to be constructed, the projected shortfall would increase. Therefore, individuals who would prefer to drive may use transit because the perceived convenience of driving is lessened by a shortage of parking. This shortage is not considered a significant environmental effect because it implements a policy intended to reduce citywide traffic congestion and air quality effects. Even with a shortage of off-street parking, measures often are implemented that result in more efficient use of the parking spaces provided. By promoting carpooling, allowing for the shared use of parking, and implementing pricing strategies designed to encourage short-term parking, the spaces provided for non-residential use would likely be used by more individuals, be vacant for shorter periods of time, and attract drivers needing short-term parking.

Since the proposed parking supply in the Project site would not meet demand, it is possible that some drivers may seek available parking in adjacent Bayview residential areas to the west. The potential increase in parking demand in adjacent neighborhoods would likely spill over to streets with existing industrial uses in the Project vicinity, which could, in turn, increase demand for parking in nearby Bayview residential areas. Residential streets near the Project site do not currently have parking restrictions and are about 70 percent occupied during the weekday midday and evening periods. Commercial and industrial spillover into residential areas is not expected to be a substantial problem because parking demand in residential areas in Bayview would be highest at night, when the commercial and industrial parking demand is lowest. If parking demand is found to exceed supply in the Bayview residential area, the City's residential parking permit program could be introduced to the area to help ensure availability of parking for local residents. The extent of spillover into the nearby industrial and residential neighborhoods to the west would be limited by the existing topography (e.g., steep grades due to the Bayview Hill), the distance between the Project site and available parking supply, and concerns related to safety in the industrial area. Transit service with available capacity and on-site carsharing services would provide an alternative to seeking parking supply further afield.

On days when events were scheduled at the stadium, parking spaces in the Bayview and Candlestick Point area would be in great demand. Those arriving to the Project vicinity on weekends after drivers have started arriving for the stadium event would have difficulty parking on event days unless they have already-reserve parking, such as spaces allocated to residential units.

Additionally, no cumulative parking impacts are expected. Other cumulative projects in the area, such as most of the surrounding existing development, Executive Park, and India Basin, are located too far from the Project site to expect that drivers going to other projects would seek parking on the Project site, or that drivers going to the Project site would park far outside the Project boundaries. Additionally, in some areas, the topography is not conducive to parking beyond the Project site boundaries. Consequently, there is no potential for significant cumulative parking impacts.

As noted above, in San Francisco, parking supply is not considered a permanent physical condition, and changes in the parking supply would not be a significant environmental impact under CEQA, but rather a social effect. The loss of parking may cause potential social effects, which would include cars circling and looking for a parking space in neighboring streets. The secondary effects of drivers searching for parking is typically offset by a reduction in vehicle trips due to some drivers, who are aware of constrained parking conditions in a given area, shifting to other modes. Hence, any secondary environmental impacts that may result from a shortfall in parking would be minor. Therefore, the parking shortfall would not result in significant parking impacts, and Project impacts on parking would be *less than significant.*

Loss of On-Street Parking - Some existing parking spaces would also be lost because of Project changes to the existing roadway configuration. The bus transit preferential treatments and streetscape improvements on Palou Avenue between Third Street and Griffith Street would result in a net loss of approximately 60 parking spaces (about 40 spaces due to bus stop improvements and corner bulbouts, and 20 spaces on the north side of the street between Ingalls and Griffith Streets where vehicles park perpendicular off-street within the sidewalk right-of-way. In addition, on the following streets a total of about 77 on-street parking spaces would be displaced:

- Carroll Avenue between Hawes and Ingalls Streets – 26-spaces.
- Innes Avenue between Earl Street and Hunters Point Boulevard – 51-spaces.

Project intersection improvements and mitigation measures would require removal of some on-street parking at the approaches to intersections. These on-street losses include:

- Evans/Jenning/Middlepoint – 8 to 10 spaces on the west side of Jennings Street at the southbound approach to Evans.
- Palou/Griffith/Crisp – 8 to 10 spaces on the east side of Griffith Street at the northbound approach.
- Carroll/Ingalls – 8 to 10 spaces on the west side of Ingalls Street at the southbound approach.
- Blanken/Tunnel – 13 spaces on the east side of Tunnel Avenue at the northbound and southbound approaches.

Project mitigation measures related to transit improvements would also result in peak period parking prohibitions. At some locations, such as on Third Street and Paul Avenue, parking spaces would be eliminated.

- San Bruno Avenue – 5 spaces on the east side of San Bruno Avenue south of Silver Avenue, and 20 spaces on the west side of San Bruno Avenue between Woolsey Street and Olmstead Street.
- Palou Avenue – about 140 spaces on the north side and 130 spaces on the south side of Palou Avenue between Newhall Street and Crisp Avenue.
- Gilman Avenue – about 90 spaces on the north side and 80 spaces on the south side of Gilman Avenue between Arelious Walker Drive and Third Street.
- Paul Avenue – about 40 parking spaces on the north side of Paul Avenue between Third Street and Bayshore Boulevard.
- Third Street – about 110 spaces on the east and west curbs of Third Street between Thomas Avenue and Kirkwood Avenue.

The parking demand that would be displaced due to the temporary and permanent parking losses would be accommodated on other streets in the study area. At some locations, residents and visitors to commercial establishments would have to walk further between their parking space and destination, or switch to transit or other modes. The impact related to parking supply would be *less than significant.*

Project Variant 1 (R&D) and Variant 2 (Housing)

Under Project Variants 1 and 2, it is assumed that the 49ers relocate to Santa Clara and that a new stadium would not be constructed within Hunters Point Shipyard. Under Project Variant 1 the amount of research and development space within Hunters Point Shipyard would increase by 2,500,000 square feet from the Project. As indicated in **Table 81**, Project Variant 1 would result in a need for about 25,165 spaces, compared with a maximum supply of about 22,912 spaces; therefore the maximum off-street parking supply would be approximately 2,253 spaces less than the estimated peak demand. More on-street parking spaces would be provided under Variant 1 than the Project, and thus the overall parking shortfall for Variant 1 would be slightly less than for the Project. As with the Project, Project Variant 1 would not significantly impact parking conditions.

The development program for Variant 2 would be similar to the Project, however, about 1,350 residential units would be shifted from Candlestick Point to Hunters Point Shipyard. Parking impacts would be similar to the Project. Compared with a maximum supply of about 19,282 spaces, the parking demand of 21,310 spaces would result in an excess demand of 2,028 spaces. As with the Project, Variant 2 would not significantly impact parking conditions.

As indicated in **Table 82,** if no off-street parking is developed, the parking shortfall would be substantially greater than if the maximum permitted supply is provided. The parking shortfall would be 22,127 spaces for Variant 1, and 18,652 spaces for Variant 2. As noted above, if no parking is provided, drivers may park outside of the project area, or may switch to transit, carpool, bicycle or other modes of travel. Due to parking shortfalls, there may be impacts to pedestrians, bicycles and transit caused by parking on the sidewalks, double-parking, and parking at intersections or other illegal parking activities. However, parking impacts for Project Variant 1 and Project Variant 2 would be *less than significant*.

6.5.2 Alternatives to the Project

Table 86 summarizes the aggregate of the parking demand calculated for the land uses assumed for the project Alternatives and presents the parking supply for the maximum allowable per the parking standards detailed in the draft D4D standards for the Candlestick Point HPS II Development Program and the anticipated number of new on-street spaces that would be provided. **Table 87** summarizes the parking demand, and the resultant parking shortfalls assuming two scenarios: Alternative parking supply based on the maximum permitted draft D4D standards, and assuming provision of no off-street spaces.

Table 86
Summary of Parking Demand and Maximum Permitted Supply [1, 2]
Alternatives to the Project

Alternative/Project Area	Demand				Supply		
	Residential	Non-Residential		Total Demand	Maximum Permitted Off-Street [1]	New On-Street	Total Supply
	Long Term	Long Term	Short Term				
Alt. 1 - No Project							
Hunters Point Shipyard	2,122	3,929	3,107	9,148	6,727	683	7,410
Candlestick Point	--	--	--	--	--	--	0
Total	*2,122*	*3,929*	*3,107*	*9,148*	*6,727*	*683*	*7,410*
Alt. 2 - No Bridge							
Hunters Point Shipyard	3,110	3,818	996	7,924	6,678	683	7,361
Candlestick Point	9,212	1,475	2,622	13,309	10,196	1,360	11,556
Total	*12,322*	*5,293*	*3,618*	*21,233*	*16,874*	*2 043*	*18,917*
Alt. 3 - 49ers at Candlestick							
Hunters Point Shipyard	4,694	3,810	911	9,415	7,778	1,298	9,076
Candlestick Point	1,420	--	--	1,420	1,210	280	1,490
Total	*6,114*	*3,810*	*911*	*10,835*	*8,988*	*1,578*	*10,566*
Alt. 4 - Lesser Build							
Hunters Point Shipyard	2,177	2,717	808	5,702	5,770	683	6,453
Candlestick Point	7,627	1,062	2,355	11,044	7,272	1,460	8,732
Total	*9,804*	*3,779*	*3,163*	*16,746*	*13,042*	*2,043*	*15,185*
Alt. 5 - No Park Agreement							
Hunters Point Shipyard	4,694	3,811	911	9,416	7,778	1,298	9,076
Candlestick Point	7,627	1,480	2,787	11,894	8,846	1,265	10,111
Total	*12,321*	*5,291*	*3,698*	*21,310*	*16,624*	*2,563*	*19,187*

Notes:
1. Maximum number of spaces permitted per draft Design for Development standard for Candlestick Point Hunters Point Shipyard II Development Plan.
2. Does not include stadium parking demand or supply.
Source: CHS Consulting, LCW Consulting.

Table 87
Summary of Parking Shortfalls for No Minimum and Maximum Permitted Supply [1] Alternatives to the Project

Scenario/Project Area	Total Demand	Minimum Supply		Maximum Supply	
		Supply	Shortfall	Supply	Shortfall [1]
Alt. 1 - No Project					
Hunters Point Shipyard	9,148	683	- 8,465	7,410	- 1,738
Candlestick Point	--	0	--	--	0
Total	*9,148*	*683*	*- 8,465*	*7,410*	*- 1,738*
Alt. 2 – No Bridge [2]					
Hunters Point Shipyard	7,924	683	- 7,941	7,361	- 563
Candlestick Point	13,309	1,360	- 11,949	11,556	- 1,753
Total	*21,233*	*2,043*	*- 19,190*	*18,917*	*- 2,316*
Alt. 3 – 49ers at Candlestick					
Hunters Point Shipyard	9,415	1,298	- 8,117	9,076	- 339
Candlestick Point	1,420	280	- 1,140	1,490	70
Total	*10,835*	*1,578*	*- 9,257*	*10,566*	- 269
Alt. 4 – Lesser Build					
Hunters Point Shipyard	5,702	683	- 5,019	6,453	751
Candlestick Point	11,044	1,360	- 9,684	8,732	- 2,412
Total	*16,746*	*2,043*	*- 14,703*	*15,185*	- 1,661
Alt. 5 – Park Agreement					
Hunters Point Shipyard	9,416	1,298	- 8,118	9,076	- 340
Candlestick Point	11,894	1,265	- 10,629	10,111	- 1,783
Total	*21,310*	*2,563*	*- 18,747*	*19,187*	- 2,123

Notes:
1. Includes off-street and new on-street supply.
2. Does not include stadium parking demand or supply.
Source: CHS Consulting, LCW Consulting.

Alternative 1 – No Project: Alternative 1 assumes buildout of Hunters Point Shipyard Phase II per the Hunters Point Shipyard Redevelopment Plan and EIR (February 2000) and subsequent addendums dated November 19, 2003 and July 13, 2006. As indicated in **Table 86,** the demand analysis indicates for the Project a need for about 9,148 spaces, compared with a permitted supply of about 7,410 off-street and on-street spaces; therefore the maximum supply would be approximately 1,738 spaces less than the estimated peak demand. As for the Project, Alternative 1 impacts on parking conditions would be *less than significant*.

Alternative 2 – No Bridge: The Alternative 2 development program is the same as the Project; however, Alternative 2 would not include construction of the Yosemite Slough bridge. Therefore, the parking demand and supply analysis would be the same as for the Project, yielding an overall deficit of about 2,316 spaces. As indicated on **Table 87**, if no off-street parking is developed, the parking shortfall would be substantially greater (19,190-space shortfall) than if the maximum permitted supply is provided. As for the Project, Alternative 2 impacts on parking conditions would be *less than significant*.

Alternative 3 – 49ers at Candlestick: Construction activities associated with Alternative 3 would be less than for the Project. Within Candlestick Point the existing stadium would remain, and only 1,210 residential units would be constructed. Alternative 3 would result in a demand of about 10,835 spaces, and compared with a maximum supply of 10,566 spaces, would result in an excess demand of about 269 spaces. As indicated on **Table 87**, if no off-street parking is developed, the parking shortfall would be substantially greater (9,257-space shortfall) than if the maximum permitted supply is provided. Therefore, overall parking impacts would be less than identified for the Project. As for the Project, Alternative 3 impacts on parking conditions would be *less than significant*.

Alternative 4 – Lesser Build: Alternative 4 assumes a general reduction in development as compared to the Project (approximately a 30 percent reduction), and therefore associated parking demand and supply would be less than the Project. The demand analysis for Alternative 4 indicates a need for about 16,746 spaces, compared with a maximum supply of about 15,185 spaces; therefore the maximum parking supply would be approximately 1,661 spaces less than the estimated peak demand. As indicated on **Table 87,** if no off-street parking is developed, the parking shortfall would be substantially greater (14,703-space shortfall) than if the maximum permitted supply is provided. As for the Project, Alternative 4 impacts on parking conditions would be *less than significant*.

Alternative 5 – No Park Agreement: The Alternative 5 development program is similar to Project Variant 2. As shown in **Table 86**, Alternative 5 would result in a need for about 21,310 spaces, and compared with a maximum supply of about 19,187 spaces would result in an excess demand of 2,123 spaces. As indicated on **Table 87**, if no off-street parking is developed, the parking shortfall would be substantially greater (18,747-space shortfall) than if the maximum permitted supply is provided. As for the Project, Alternative 5 impacts on parking conditions would be *less than significant*.

6.6 LOADING IMPACTS

Loading impacts assessment associated with the Project, Variants, and Alternatives include the comparison of the demand for loading spaces to the number of loading spaces permitted per the loading standards detailed in the draft D4D standards for the Candlestick Point HPS II Development Program. The loading standards incorporated into the Candlestick Point Hunters Point II draft D4D standards would be the same as the San Francisco Planning Code standards. As indicated in section 4.2.6, the demand for loading spaces was estimated based on the development program and the daily truck trip generation rates for 1,000 gross square feet of use, then converted to hourly demand.

In general, if loading demand is not met on site and could not be accommodated within on-street loading zones, trucks could temporarily double-park and partially block local streets while loading and unloading goods which could result in disruptions and impacts to traffic and transit operations, as well as to bicyclists and pedestrians. Because any effects of unmet loading demand would be temporary inconveniences, any excess demand would not be a significant impact. The Project Design for Development standards establish a minimum number of loading spaces; more could be provided as part of individual development projects.

As noted in section 2.8, approximately 300 feet of curb space on the Stadium Outer Ring Road would be designated for truck parking. The parking areas would have 17-foot wide parking lanes which would fully accommodate wider trucks without impeding on adjacent bicycle or travel lanes. This designated truck parking area would meet the needs of truck drivers to take a ten-hour rest period that is governed by federal and state safety rules, and to stage when off-street loading facilities are not ready to accommodate deliveries. The designation of this on-street parking area would reduce the potential for truck drivers to seek long-term parking on residential streets in the project site and within the Bayview/South Basin area.

Stadium loading supply and demand is discussed in section 6.8.

6.6.1 Project and Project Variants

Table 88 summarizes the estimate of daily truck trips generated by the proposed land uses and the associated demand for loading dock spaces during the peak hour of loading activities (which generally occurs between 10:00 a.m. and 1:00 p.m.), and the estimated supply that would be provided per draft Design for Development. For the Project and Project Variant 2, the estimated loading supply would be greater than the loading demand during the peak hour of loading operations. Within the Hunters Point Shipyard the loading demand and estimated supply would be similar, while within Candlestick Point the supply would substantially exceed the demand. This is due primarily to the calculation for retail uses, which has the most intensive loading demand. For the regional retail uses within Candlestick Point, loading facilities would be located to meet multiple tenants within the retail development. For Project Variant 2, the loading demand within Hunters Point Shipyard would not be met within the on-site supply, and therefore, as noted above, would need to be accommodated on-street, which may result in temporary disruptions to traffic and transit operations, as well as to pedestrians and bicyclists. Overall, Project and Project Variants 1 and 2 impacts related to loading operations would be *less than significant.*

Table 88
Summary of Loading Demand and Supply
Project and Project Variants

Scenario/Project Area	Daily Truck Generation	Peak Hour Loading Dock Space Demand	Supply [1, 2,]
Project			
Hunters Point Shipyard	713	41	42
Candlestick Point	507	29	59
Total	*1,220*	*70*	*101*
Project – Variant 1 (R&D)			
Hunters Point Shipyard	1,238	72	67
Candlestick Point	507	29	59
Total	*1,745*	*101*	*126*
Project – Variant 2 (Housing)			
Hunters Point Shipyard	766	44	47
Candlestick Point	458	27	55
Total	*1,224*	*71*	*102*

Notes:
1. Minimum number of loading spaces permitted per draft Design for Development standard for the CP-HPS Phase II Development Plan.
2. Does not include stadium loading facilities.
Source: LCW Consulting.

6.6.2 Alternatives to the Project

Table 89 summarizes the estimate of daily truck trips, demand for loading dock spaces during the peak hour of loading activities, and the estimated supply for the Alternatives to the Project that would be provided per draft D4D standards.

Alternative 1 – No Project: Alternative 1 assumes buildout of Hunters Point Shipyard Phase II per the Hunters Point Shipyard Redevelopment Plan. As indicated in **Table 89,** the loading demand analysis indicates a demand for Hunters Point Shipyard of about 52 spaces, compared with a supply of about 36 spaces; therefore the off-street loading supply would be approximately 16 spaces less than the estimated peak demand. The excess loading demand could be met within on-street loading zones, or if not provided, trucks could temporarily double-park and partially block local streets while loading and unloading goods which could result in disruptions and impacts to traffic and transit operations, as well as to bicyclists and pedestrians. Because any effects of unmet loading demand would be temporary inconveniences, any excess demand would not result in a significant impact. The Redevelopment Plan design document used to calculate expected loading supply establishes a minimum number of loading spaces; more could be provided as part of individual development proposals. As for the Project, Alternative 1 impacts on loading conditions would be *less than significant*.

Table 89
Summary of Loading Demand and Supply
Alternatives to the Project

Alternative/Project Area	Daily Truck Generation	Peak Hour Loading Dock Space Demand	Supply [1, 2, 3]
Alt. 1 - No Project			
Hunters Point Shipyard	891	52	36
Candlestick Point	0	0	0
Total	*891*	*52*	*36*
Alt. 2 – Project - No Bridge			
Hunters Point Shipyard	713	41	42
Candlestick Point	507	29	59
Total	*1,220*	*70*	*101*
Alt. 3 – 49ers at Candlestick			
Hunters Point Shipyard	766	44	47
Candlestick Point	53	3	6
Total	*819*	*47*	*53*
Alt. 4 – Lesser Build			
Hunters Point Shipyard	518	30	31
Candlestick Point	358	21	42
Total	*876*	*51*	*73*
Alt. 5 – No Park Agreement			
Hunters Point Shipyard	766	44	47
Candlestick Point	458	27	55
Total	*1,224*	*71*	*102*

Notes:
1. Minimum number of loading spaces permitted per draft Design for Development standard for CP-HPS Phase II Development Plan.
2. Does not include stadium loading facilities.
3. Loading spaces for No Project conditions based on existing Design for Development standards for Hunters Point Shipyard Redevelopment Project.
Source: LCW Consulting .

Alternatives 2 through 5: For Alternative 2 (No Bridge), Alternative 3 (49ers at Candlestick), Alternative 4 (Lesser Build) and Alternative 5 (No Park Agreement) the estimated loading supply calculated per D4D standards would be greater than the loading demand during the peak hour of loading operations. Similar to the Project, the estimated supply within the Candlestick Point area would substantially exceed the demand. Alternative 2 through Alternative 5 impacts related to loading operations would be *less than significant.*

6.7 EMERGENCY VEHICLE ACCESS IMPACTS

The Project includes the construction of new roadways to facilitate emergency access. Existing emergency response routes would either be maintained in their existing locations or rerouted as necessary. Further, all development would be designed in accordance with City standards, which include provisions that address emergency access (e.g., minimum street widths, minimum turning radii). In addition, emergency vehicles would be able to utilize transit lanes when streets are congested. Therefore, Project impacts on emergency access would be less than significant.

Emergency vehicle access impacts under Project Variants 1 and 2, and Alternatives 1 through 5 would be similar to the Project; impacts on emergency access would be *less than significant.*

6.8 AIR TRAFFIC IMPACTS

The Project site is not near an airfield; San Francisco International Airport is about seven miles to the south. This distance is outside of the limit for objects near airports in the guidance published by the Federal Aviation Administration (FAA) (within 20,000 feet or less than 4 miles from an airport). The FAA requires notice of construction for any structures within 20,000 feet what would extend 200 feet above ground level.[21] The proposed height of the tallest buildings (420 feet) would be approximately 30 feet higher than the crest of the adjacent Bayview Hill (which reaches an elevation of about 390 feet). The Project applicant will notify FAA prior to construction of buildings exceeding 200 feet to ensure compliance with FAA requirements. For those reasons, the heights of the Project buildings would not interfere with or result in any changes to air traffic. Therefore, Project impacts on air traffic safety would be *less than significant*.

Air traffic impacts under Project Variants 1 and 2, and Alternatives 1 through 5 would be similar to the Project; impacts on air traffic safety would be *less than significant.*

6.9 HAZARDS DUE TO DESIGN FEATURES

The Project includes construction of new roadways within the Project site, the construction of the Yosemite Slough bridge, and streetscape and intersection improvements outside of the Project site. New and reconfigured roadways would be designed in accordance with City standards, and would need to be reviewed and approved by the City prior to construction. Therefore, Project impacts related to hazards would be *less than significant*.

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[21] Federal Aviation Administration, Advisory Circular AC 70/7460-2K, Proposed Construction or Alteration of Objects that May Affect the Navigable Airspace, March 1, 2000, available at http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/22990146db0931f186256c2a00721867/$FILE/ac70-7460-2K.pdf, accessed October 28, 2008.

Impacts related to hazards under Project Variants 1 and 2, and Alternatives 1 through 5 would be similar to the Project; *less than significant.*

6.10 CONSTRUCTION IMPACTS

6.10.1 Project and Project Variants

Buildout of the Project would occur over a 20-year period between 2010 and 2029. Initial construction activities would include demolition of existing structures, utility relocation and site clearance and grading at Hunters Point Shipyard to make the land available for the new stadium. The new stadium and the Yosemite Slough bridge are anticipated to be completed by 2017 in time for the 2017 football season.

Buildout of the project would occur over about a 20-year period as part of four overlapping phases (see **Table 2** for development phasing). The duration of each phase would vary, depending on the type of development (e.g., residential, retail, office) and the amount of building space included in each phase. The majority of development would occur and be occupied by the end of the second phase, which has a scheduled completion date of 2021. The majority of the roadway network improvements would occur by 2017 (Phase I), and most transit improvements would be phased in by 2021 (within Phase I and Phase II). Construction impacts within the Project site would affect new residents, employees, and visitors to the area. Overall, throughout the construction period the addition of worker-related vehicles and transit trips would be less than those associated with Project conditions at full buildout.

During construction of the Project phases, building activities would generate traffic volumes from construction workers, truck deliveries of supplies and construction equipment, and the hauling of soils during Project grading and excavation. **Table 90** presents the phases for the Hunters Point Shipyard and Candlestick Point development, the number of construction workers that would be on-site on a daily basis, as well as the maximum number of construction truck trips that would travel to and from the sites on a daily basis. These truck trip estimates assume that approximately 40 percent of the required import fill materials would be brought onto the site via barge, with the remaining arriving by truck. **Table 91** presents the number of daily construction truck trips and construction workers, as well as the annual number of barge trips associated with improvements to the shoreline at both Hunters Point Shipyard and Candlestick Point.

The peak phases of construction activities would occur between 2012 and 2016, when grading and infrastructure improvements would be ongoing at both Candlestick Point and Hunters Point Shipyard. During this phase, there would be between 50 and 180 construction workers that would be on-site on a daily basis, and between 140 and 570 construction truck trips that would travel to and from the site on a daily basis. These truck trip estimates assume that about 40 percent of the required import fill materials would be brought onto the site via barge, with the remaining arriving by truck.

Table 90
Construction Workers and Trucks by Phase
Hunters Point Shipyard and Candlestick Point

Project Area/Construction Phase	Construction Duration	Daily Construction Workers	Daily Construction Truck Trips
Hunters Point Shipyard			
Phase 1 – Site Preparation [1]			
Abatement & Demolition	2010 – 2015	10-50	8-48
Grading and Infrastructure	2012 - 2016	30-145	128-424
Phase 1 – Building Construction [1]			
Structure/Rough In	2012 - 2017	10-60	8-32
Interior and Exterior Finishes	2012 - 2017	8-10	8-16
Phase 2 – Site Preparation			
Abatement & Demolition	2014 – 2017	16-20	8-16
Grading and Infrastructure	2016 - 2019	26-85	224-256
Phase 2 – Building Construction			
Structure/Rough In	2016 - 2021	26-68	16-64
Interior and Exterior Finishes	2016 - 2021	30-60	16-64
Candlestick Point			
Phase 1 – Site Preparation			
Abatement & Demolition	2010 - 2015	10-20	8-24
Grading and Infrastructure	2012 – 2016	16-33	8-144
Phase 1 – Building Construction			
Structure/Rough In	2023 - 2017	14-18	8-16
Interior and Exterior Finishes	2023 - 2017	8-10	8-16
Phase 2 – Site Preparation			
Abatement & Demolition	2014 – 2017	10-40	8-48
Grading and Infrastructure	2016 - 2019	24-63	8-40
Phase 2 – Building Construction			
Structure/Rough In	2016 - 2021	14-18	8-16
Interior and Exterior Finishes	2016 - 2021	8-10	8-16
Phase 3 – Site Preparation			
Abatement & Demolition	2018 – 2021	16-20	16-24
Grading and Infrastructure	2020 - 2023	24-60	8-40
Phase 3 – Building Construction			
Structure/Rough In	2019 – 2025	14-40	8-32
Interior and Exterior Finishes	2019 – 2025	8-20	8-32
Phase 4 – Site Preparation			
Abatement & Demolition	2022 – 2024	16-20	16-24
Grading and Infrastructure	2024 - 2026	24-35	8-16
Phase 4 – Building Construction			
Structure/Rough In	2024 - 2028	10-20	8-16
Interior and Exterior Finishes	2024 – 2028	8-20	8-32
Yosemite Slough Bridge	2015 – 2016	62-78	24-32
HPS Off-site Improvements	2011 – 2016	24-30	8-16
CP Off-site Improvements	2011 – 2015	24-30	8-16

Note:
1. Includes stadium construction.
Source: MACTEC, 2009.

Table 91
Daily Construction Workers and Trucks by Phase and Yearly Barge Trips
Shoreline Improvements

Project Area/Construction Year	Construction Duration (months)	Daily Construction Workers	Daily Construction Truck Trips	Yearly Barge Trips
Hunters Point Shipyard				
2013 Shoreline	9	12-14	--	0
2014 Shoreline	9	12-14	2-4	6
2015 Shoreline	10	33-38	2-4	35
2016 Shoreline	10	35-40	2-4	70
2017 Shoreline	10	35-40	2-4	70
2018 Shoreline	10	35-40	2-4	60
Candlestick Point				
2019 Shoreline	2	5-7	--	2
2022 Shoreline	2	5-7	--	2
2023 Shoreline	3	5-7	--	4
2024 Shoreline	1	5-7	--	3
2026 Shoreline	3	5-7	--	4
2027 Shoreline	4	5-7	--	6

Note:
1. Includes stadium construction.
Source: MACTEC, 2009.

Shoreline improvements at both Hunters Point Shipyard and Candlestick Point would peak in 2016 and 2017, and would require an additional 40 to 50 construction workers on-site.

Construction related activities would generally occur Monday through Saturday, between 7:00 A.M. and 8:00 P.M., and the typical work shift for most construction workers would be from 7:00 A.M. to about 3:30 P.M. Construction is not anticipated to occur on Sundays or major legal holidays, but may occur on an as-needed basis. The hours of construction would be stipulated by the Department of Building Inspection, and the contractor would be required to comply with the San Francisco Noise Ordinance.[22] Delivery and removal of extra long or wide bridge construction components, equipment, or materials may occur outside theses hours on an as-needed basis.

Construction staging would mostly occur within the individual sites under construction or along existing street right-of-way. Construction staging would involve staging of construction vehicles, storage of construction materials, construction worker vehicles, delivery, and hauling trucks. Due to the large amount of vacant land in the Project site, construction staging would occur on-site,

[22] The San Francisco Noise Ordinance permits construction activities seven days a week, between 7:00 A.M. and 8:00 P.M.

and construction-worker vehicles would likely park near construction sites in the Project site during most phases, and would not occupy spaces on neighborhood streets.

While the exact routes that construction trucks would be using would depend on the location of individual construction sites, it is expected that Harney Way, Hunters Point Expressway, Innes Avenue, Evans Avenue, Cesar Chavez Street, and Third Street would be the primary haul routes between U.S. 101 and the various components of the Project.

In general, construction related transportation impacts would include impacts in the immediate vicinity of the development project under construction, on roadways within the Project site, and cumulative construction traffic impacts along the roadways in the Bayview Hunters Point neighborhood. Since the Project includes building construction as well as construction of a new street system and transit route extensions into the Project site, all Project construction operations would include plans for the closure of traffic/parking lanes and sidewalks adjacent to construction sites. The closure of sidewalks and parking lanes could last throughout the entire construction phase for each building or group of buildings. It is possible that more than one location within the Project site could be under construction at any one time and that multiple travel lane closures may be required.

During the construction period, temporary and intermittent disruption to existing and proposed transit routes and bus stops may occur, and some bus routes may need to be temporarily rerouted (for example, the 29-Sunset on Gilman Avenue and Giants Drive, the 54-Felton on Ingalls, the 23-Monterey and 44-O'Shaughnessey on Palou Avenue, and the 19-Polk on Innes Avenue. In addition, temporary and intermittent interference to transit operations caused by increased truck movements to and from the construction sites may occur. Any change in transit routes and stops would have to be coordinated and approved by the SFMTA.

Due to the reduction in travel lanes, the remaining travel lanes would become more congested with automobiles, trucks and buses, which would pose a greater challenge for bicycle travel in the area. Since bicycle traffic in the Project vicinity is relatively low, this impact is not anticipated to be significant. Existing pedestrian volumes along the key access routes and at the proposed construction sites are low and, therefore, any sidewalk closures or rerouting of the walkway would not significantly affect pedestrian circulation. In general, temporary pedestrian walkways must be maintained in order to facilitate pedestrian movements.

The construction activities associated with the Project would overlap with construction activities of other development projects in the area, notably the HPS Phase I, Executive Park site, Brisbane Baylands, Visitacion Valley, India Basin Shoreline, and the Hunters View site. In addition, the Project construction activities would also overlap with nearby proposed transportation improvement projects, such as the U.S. 101/Harney interchange improvements, and the Geneva Avenue Extension. These overlapping construction activities would increase the number of construction worker vehicles and trucks traveling to and from the project sites along Harney Way and Jamestown Avenue for the Executive Park project and for development within Candlestick Point, and on Cesar Chavez Street and Evans Avenue for the India Basin Shoreline, Hunters View project, and development within Hunters Point Shipyard. For example, construction activities of one or more projects that adversely affect roadway capacity (e.g., Harney Way widening), combined with construction vehicle traffic traveling to and from the roadway project and nearby development projects under construction (e.g., Executive Park and Candlestick Point), could result in increased delays due to traffic diversions and substantial increases in truck traffic.

Given the magnitude of development proposed for the area, the Project's prolonged construction period, and the lack of certainty about the timing of the projects in the area, significant Project-related and significant Project contributions to cumulative traffic and circulation impacts could occur on some roadways, such as U.S. 101, Cesar Chavez Street, Evans Avenue, Harney Way, and Bayshore Boulevard. Cumulative impacts would include construction detours and increased travel times, although the extent and duration of delay would vary depending on individual driver's origin and destination, time of travel and use of alternate routes. Implementation of individual traffic control plans would minimize impacts associated with each project and reduce each project's contribution to cumulative impacts in overlapping areas. However, some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related traffic impacts on local and regional roadways could still occur.

> ***Project Mitigation Measure 16***: The Project Applicant shall develop and implement a Candlestick Point–Hunters Point Shipyard Phase II Construction Traffic Management Program to minimize impacts of the Project and its contribution to cumulative impacts related to construction activities and construction traffic. The program shall provide necessary information to various contractors and agencies as to how to maximize the opportunities for complementing construction management measures and to minimize the possibility of conflicting impacts on the roadway system, while safely accommodating the traveling public in the area. The program shall supplement and expand, rather than modify or supersede any manual, regulations, or provisions set forth by SFMTA, DPW or other City departments and agencies.
>
> Preparation of the Construction Management Program shall be the responsibility of the Project Applicant, and shall be reviewed and approved by SFMTA and DPW prior to initiation of construction. The Project Applicant shall update the program prior to approval of development plans for Phase 2, Phase 3 and Phase 4 of construction to reflect any change to Project development schedule, reflect transportation network changes, to update status of other development construction activities, and to reflect any changes to City requirements.

The program shall:

- Identify construction traffic management practices in San Francisco, as well as other jurisdictions that although not being implemented in the City could provide useful guidance for a project of this size and characteristics.
- Describe procedures required by different departments and/or agencies in the City for implementation of a construction management plan, such as reviewing agencies, approval process, and estimated timelines.
- Describe coordination efforts associated with the Navy remediation efforts and scheduling regarding construction vehicle routing via the Crisp gate.
- Identify construction traffic management strategies and other elements for the Project, and present a cohesive program of operational and demand management strategies designed to maintain acceptable levels of traffic flow during periods of construction activities in the Bayview Hunters Point area. These could include construction strategies, demand management strategies, alternate route strategies, and public information strategies.
- Coordinate with other projects in construction in the immediate vicinity, so that they can take an integrated approach to construction-related traffic impacts.
- Present guidelines for selection of construction traffic management strategies.

Implementation of Project Mitigation Measure 16 would help minimize the Project construction-related transportation impacts, and the Project's contribution to cumulative-construction related transportation impacts. However, some disruption and increased delays could still occur even with implementation of Mitigation Measure 16, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable*.

Project Variants: Construction activities associated with the Variant 1 and Variant 2 would be similar to the Project. These variants do not include construction of a new stadium at Hunters Point Shipyard, instead assume an additional 2,500,000 square feet of research and development uses under Variant 1, and reallocation of 1,350 residential units from Candlestick Point to Hunters Point Shipyard under Variant 2. Depending on the phasing of the additional development, the Variants 1 and 2 may result in fewer construction traffic impacts between future years 2012 and 2017 when the new stadium is proposed to be constructed, and somewhat greater impacts in the years the additional R&D space or housing units would be constructed. Implementation of a traffic control plan would reduce the project's contribution to significant cumulative impacts of overlapping construction traffic. However, as with the Project, cumulative transportation impacts associated with construction activities would be considered *significant and unavoidable.*

Implementation of Project Mitigation Measure 16 would be applicable to Project Variants 1 and 2. A Hunters Point Shipyard – Candlestick Point Construction Traffic Management Program would help minimize the Project Variants' construction-related transportation impacts and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of the mitigation measure, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

6.10.2 Alternatives to the Project

Alternative 1 – No Project: Construction activities associated with Alternative 1 would be less than the Project. Alternative 1 assumes buildout of Hunters Point Shipyard Phase II per the Hunters Point Shipyard Redevelopment Plan and EIR (February 2000) and subsequent addendums dated November 19, 2003 and July 13, 2006. Under Alternative 1, the existing stadium would remain and no construction activities would occur within Candlestick Point. Due to the reduced level of development anticipated for Hunters Point Shipyard construction impacts associated with Alternative 1 would be *less than significant*.

Alternative 2 – No Bridge: The Alternative 2 development program is the same as the Project; however, Alternative 2 would not include construction of the Yosemite Slough bridge. Therefore, Alternative 2 would not include the construction impacts associated with the bridge and access roads (proposed to occur between 2015 and 2016). All other construction activities and impacts would be the same as described for the Project above. As with the Project, cumulative traffic impacts during construction would be considered *significant.*

Project Mitigation Measure 16 would be applicable to Alternative 2. Implementation of this measure would help minimize Alternative 2's construction-related transportation impacts, and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

Alternative 3 – 49ers stay at Candlestick: Construction activities associated with Alternative 3 would be less than for the Project within the Candlestick Point area. Construction within Hunters Point Shipyard would be similar to the Project; however, 1,350 residential units would be developed within Hunters Point Shipyard. Within Candlestick Point the existing stadium would remain, and only 1,210 residential units would be constructed. Overall construction activities and impacts would be somewhat less than identified for the Project, however, as with the Project cumulative traffic impacts during construction would be *significant*.

Project Mitigation Measure 16 would be applicable to Alternative 3. Implementation of this measure would help minimize Alternative 3's construction-related transportation impacts, and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

Alternative 4 – Lesser Build: Alternative 4 assumes a general reduction in development as compared to the Project (approximately a 30 percent reduction), and therefore construction activities and impacts would be similar to the Project, however, the extent and duration would likely be somewhat less than identified for the Project. As with the Project, cumulative traffic impacts during construction would be *significant*.

Project Mitigation Measure 16 would be applicable to Alternative 4. Implementation of this measure would help minimize Alternative 4's construction-related transportation impacts, and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

Alternative 5 – Park Agreement: The Alternative 5 development program is similar to Project Variant 2, which assumes 1,350 more residential units in Hunters Point Shipyard rather than in Candlestick Point. Alternative 5 does not include construction of a new stadium or a Yosemite Slough bridge, and therefore construction activities associated with these elements would not occur. As with the Project, cumulative traffic impacts during construction would be *significant.* As with the Project, cumulative traffic impacts during construction would be considered *significant.*

Project Mitigation Measure 16 would be applicable to Alternative 5. Implementation of this measure would help minimize Alternative 5's construction-related transportation impacts, and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of traffic control plans, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

6.11 STADIUM AND ARENA IMPACTS

This section describes the impacts associated with replacing Candlestick Park stadium with a new 49ers stadium that would be located in the Hunters Point Shipyard. In addition, this section analyzes impacts associated with the proposed arena in Candlestick Point. A Sunday 49ers game and a weekday secondary event are analyzed for the stadium, and a weekday event was analyzed for the arena.

6.11.1 Stadium 49ers Game Impacts

No Project

<u>*Auto Congestion*</u>

Due to projected increases in background traffic on the study area freeways and traffic associated with buildout of land uses already approved for HPS, congestion following a football game would worsen somewhat over existing conditions on area roadways and freeways. On freeway facilities, substantial congestion and delays could be anticipated on U.S. 101 northbound and southbound at Hospital Curve, and at U.S. 101 near the new Geneva/Harney interchange, mainly near on- and off-ramp merge and diverge points. The existing post-game congestion that extends upstream from the Bay Bridge to the U.S. 101/I-280 merge would worsen in terms of extent of queue from existing conditions. **Table 92** presents freeway mainline segment and ramp merge and diverge section operating conditions under No Project alternative for conditions immediately following a football game.

On local streets, the primary locations of congestion following a football game are along the existing stadium's main exit routes. The main exit routes of the existing stadium (No Project conditions) are as follows:

- Harney Way, between Candlestick Park and U.S. 101
- Jamestown, Ingerson, Gilman, and Carroll Avenues, between Candlestick Park and Third Street
- Paul Avenue, between Third Street and Bayshore Boulevard
- Third Street, between Jamestown and Cesar Chavez Street

The analysis of No Project impacts assumes the proposed extension of Geneva Avenue from its current terminus at Bayshore Boulevard to connect across U.S. 101 to Harney Way would be in place. As part of the interchange project, additional capacity onto U.S. 101 would be provided. As a result, although queuing and congestion may worsen compared to existing conditions, due to background growth in traffic, actual stadium clearance times may improve somewhat over existing conditions due to the increased capacity at the new Geneva Avenue/Harney Way/U.S. 101 interchange. The improved capacity associated with this new interchange may be limited in terms of game day operations, though, depending on the operation of ramp meters.

Table 92
Freeway LOS Analysis – 2030 No Project Conditions
Sunday Peak Hour Following Football Game at Candlestick Park

Freeway	Direction	Location	2030 No Project Conditions	
			Density[1]	LOS
Basic Sections				
U.S. 101	NB	Cesar Chavez to I-80 Merge	**>45**	**F**
U.S. 101	NB	Harney Way to Third/Bayshore	**>45**	**F**
U.S. 101	SB	Third/Bayshore to Harney Way	**>45**	**F**
U.S. 101	SB	Harney Way to Sierra Point	**>45**	**F**
I-280	SB	Alemany off-ramp to Alemany on-ramp	35.4	**E**
Weaving Sections [2]				
I-280	NB	25th on-ramp to Mariposa off-ramp	1,310[2]	C
Merge Sections				
U.S. 101	NB	Harney Way (future)	**>45**	**F**
U.S. 101	NB	NB Bayshore Boulevard	**>45**	**F**
U.S. 101	NB	Alemany/Industrial	**>45**	**F**
U.S. 101	NB	NB Bayshore/Cesar Chavez	**>45**	**F**
U.S. 101	SB	EB Cesar Chavez/Potrero	**>45**	**F**
U.S. 101	SB	Alemany/San Bruno	21.2	C
U.S. 101	SB	SB Third Street/Bayshore	**>45**	**F**
U.S. 101	SB	Harney Way (future)	**>45**	**F**
U.S. 101	SB	Sierra Point Pkwy/Lagoon	**>45**	**F**
I-280	NB	NB Indiana/25th	**>45**	**F**

Notes:
1. Density measured in passenger cars per lane per mile. Density is undefined for LOS F conditions.
2. For weaving section, weaving volume is reported.
Source: Fehr & Peers.

Queuing

Queuing impacts associated with the post-game period at the stadium under the No Project conditions would be similar to those occurring under existing conditions. Following a football game at the existing stadium, the existing egress system effectively meters the traffic that can merge onto U.S. 101 and other routes so as to minimize mainline congestion. Virtually all egress routes from the stadium suffer congestion. Post-game field observations indicate that spectators begin leaving the stadium approximately one hour prior to the end of the game (between 3:00 and 4:00 p.m.) to avoid the peak congestion period. The percentage of spectators leaving prior to the end of the game depends on factors such as game score, weather, and/or traffic conditions. Typically, depending on the nature of the game and the weather, approximately 20 percent to 30 percent of the spectators leave during the one-half hour prior to the end of the game. These vehicles are able to exit the project vicinity (e.g., get onto the freeway or Third Street) under unconstrained conditions as the capacity of the egress system can accommodate these vehicles.

However, immediately following the end of the game is the time when the vast majority of the spectators begin to leave the stadium and enter the roadway egress system, thus resulting in queues along the roadways leading to the freeway and Third Street. For example, vehicles directed to use Harney Way for egress develop queues that extend from the U.S. 101/Harney Way interchange along Harney Way to Hunters Point Expressway. Under existing conditions, all queues in the study area begin to dissipate sometime between approximately 1.5 to 2 hours following the end of the game.

Parking

Under the No Project conditions, the off-street parking supply provided as part of stadium operations would not substantially change from the 18,880 spaces described in section 3.7.2. Approximately 9,110 spaces would continue to be located in the stadium lots, 5,470 on undeveloped state park land, and 4,300 in satellite parking lots. An additional 3,000 spaces are currently estimated to be provided on private lots. However, some of the satellite and private lots may not be available in the future due to development of other uses on that land (e.g., Executive Park development project). Development of the satellite and private lots would likely occur gradually so that the parking deficit would increase incrementally over time. Without the use of satellite lots, and without the provision of additional parking on-site (such as in a garage) or off-site (on adjacent properties such as Brisbane Baylands), stadium spectators would park on-street further from the stadium (such as in the Bayview or Little Hollywood neighborhoods), or switch to alternative modes of transportation such as transit or charter buses.

Project

Traffic Impacts

With the Project, the existing traffic management of pre-game and post-game traffic would be adjusted to reflect the new stadium location and access routes. The Project calls for a new Traffic Management Center, to be staffed by City employees, to dynamically monitor and operate traffic signals along primary ingress and egress routes to efficiently move traffic into and out of the area prior to and after games. In addition, similar to existing conditions, traffic control officers would be stationed at key locations to ensure efficient traffic movements. The overall game day traffic control plan is shown in **Figure 35.**

Similar to existing conditions, the majority of stadium bound traffic would use a portion of U.S. 101 to access the project site on game days. Traffic from the south would predominantly use northbound U.S. 101 and access the site via Harney Way, while traffic from the north would predominantly use southbound U.S. 101 and I-280 and access the site via Cesar Chavez Street, Cargo Way, Evans Avenue, and Innes Street. Some trips to the site would use Bayshore Boulevard or Third Street to access the area via Carroll Avenue, Gilman Avenue and Ingalls Street.

SOURCE: Fehr & Peers; AECOM

FIGURE 35: GAME DAY TRAFFIC CONTROL PLAN

Prior to and after games in the proposed stadium, special measures (similar to those in place for existing football games) would be taken to allow the site's circulation system to accommodate unique game day traffic flows. **Figure 36** presents the site's pre-game circulation plan and **Figure 37** presents the site's post-game circulation plan. Prior to games, the site's roadways would be geared towards inbound flow and after games the roadways would be geared towards outbound flow.

Vehicles accessing the new stadium from the south would use Harney Way. Harney Way would be configured to provide four inbound lanes (to the stadium) and one outbound lane between U.S. 101 and Arelious Walker Drive. Arelious Walker Drive, between Harney Way and Crisp Avenue would provide four inbound lanes. Crisp Avenue would provide seven inbound lanes between Arelious Walker Drive and the new stadium. The lane configurations would be reversed for post-game conditions.

Vehicles accessing the new stadium from the south, would be routed via the routes described above to Crisp Avenue, where it would be channeled to a Ring Road on the southern portion of the stadium. Access to the internal parking aisles would be from the Ring Road.

Vehicles accessing the new stadium from the north would use Evans Avenue and Cargo Way. These inbound routes would merge at Hunters Point Boulevard/Jennings/Evans. From there, the inbound route along Hunters Point Boulevard and Innes Avenue would provide four inbound lanes and one outbound lane. The lane configurations along Hunters Point Boulevard and Innes Avenue would be reversed for post-game conditions.

Under typical traffic conditions, traffic impacts are measured in terms of intersection levels of service. However, due to the unique circumstances following a football game, including manual and dynamic control of intersections by traffic control officers and complex travel patterns, traditional methods of calculating intersection levels of service may not be appropriate. Instead, for post-game conditions, traffic impacts associated with the new stadium are described in terms of the magnitude, duration, and expected locations of congestion.

The one hour period immediately following the conclusion of a football game is generally the most congested period. The amount of vehicular traffic associated with the new stadium is expected to be similar to, or even slightly less than, the amount of traffic associated with the existing stadium because of the improved transit service proposed to serve the new stadium. However, because under the project conditions, there would be additional development around the stadium compared to the No Project alternative, the additional vehicle trips associated with the new stadium and increased surrounding development would somewhat increase congestion and delays following a football game from 2030 No Project conditions.

SOURCE: Fehr & Peers; AECOM

FIGURE 36: PROPOSED STADIUM GAME DAY INGRESS ROUTES

SOURCE: Fehr & Peers; AECOM

FIGURE 37: PROPOSED STADIUM GAME DAY EGRESS ROUTES

As shown on **Table 93**, the proposed location of the new stadium would create additional exit routes such that more streets would be congested following a game than under the No Project conditions. Providing additional egress routes would spread the post-game congestion, and provide a quicker parking lot clearance time. However, it would result in game day traffic congestion along Innes Avenue, Evans Avenue, and Cargo Way, which would not experience substantial congestion following a game under the 2030 No Project condition.

Table 93
Locations of Congestion Following San Francisco 49ers Football Game

Exit Route	No Project (Existing Stadium)	Project (HPS Stadium)
Harney Way, between Candlestick Park and U.S. 101	X	X
Jamestown, Ingerson, Gilman, and Carroll Avenues, between Candlestick Park and Third Street	X	X
Paul Avenue, between Third Street and Bayshore Boulevard	X	X
Third Street, between Jamestown and Cesar Chavez Street	X	X
Innes Avenue/Hunters Point Boulevard, between Earl Street and Jennings Street		X
Jennings Street/Cargo Way/Illinois Street, between Evans Avenue and 25th Street		X
Evans Avenue, between Jennings Street and Cesar Chavez Street		X
Cesar Chavez Street, between U.S. 101 and I-280		X

Note:
Analysis based on expected stadium exit routes. Other exit routes identified in **Figure 37**, but not shown on this table are downstream of major bottlenecks and, although expected to carry additional post-game traffic, are not expected to function at capacity.
Source: Fehr & Peers.

One result of providing additional egress routes from the proposed new stadium is that traffic congestion is expected to clear the area quicker. **Table 94** presents the expected parking lot clearance time under No Project conditions (based on the current stadium exit capacity) and Project conditions, based on the existing and proposed stadium travel demand scenarios described in the travel demand discussion. The total travel demand assumed in the calculations for the proposed stadium is based on the number of vehicles parked in the stadium parking lot. Although there may be some additional vehicles parked off-site (i.e., outside of the Project study area), they would be parked beyond the expected area bottlenecks, and therefore, would not likely increase the amount of time to clear post-game congestion.

Table 94
Post-Game Exit Demand and Clearance Times

Scenario	Assumptions	Exit Demand (vehicles)		Clearance Time (hours:minutes)	
		Existing Stadium	HPS Stadium	Existing Stadium[1]	HPS Stadium: With U.S. 101 Interchange[2]
Most Conservative	Sold-out event, everyone leaves at end of event	21,875	17,075	2:50	1:28
	Sold-out event, 10% leave early, 5% stay late	18,590	14,510	2:25	1:14
	90% attendance, 10% leave early, 5% stay late	16,730	13,060	2:10	1:11
Average	90% attendance, 15% leave early, 5% stay late	15,750	12,290	2:03	1:07
	80% attendance, 15% leave early, 5% stay late	14,000	10,930	1:49	1:00
	80% attendance, 20% leave early, 5% stay late	13,130	10,250	1:42	0:56
Least Conservative	70% attendance, 20% leave early, 5% stay late	11,480	8,960	1:29	0:49

Notes:
1. Based on existing stadium clearance capacity of 7,700 vehicles per hour.
2. Ultimate HPS Stadium clearance capacity is projected to be 11,000 vehicles per hour, which is constrained by the exit gates at the stadium parking lot. Under this condition, the 1,000 spaces in the Candlestick Point retail structure are unconstrained and would be able to clear faster than the stadium parking lot. Therefore, demand from these spaces is not included in the calculation of parking clearance times. However, to be conservative, the analysis assumes that for non-sellout games, all parking occurs in the stadium lots and that the parking adjacent to the Candlestick Point retail structure is unused.
Source: Fehr & Peers.

As shown in **Table 95,** although the number of roadways expected to experience post-game traffic congestion is expected to increase with the Project, the total duration of expected post-game congestion is expected to be considerably less than under the 2030 No Project condition.

Similar to the roadway analysis, because the post-game traffic is expected to be spread out over a greater number of exit routes. As a result more freeway interchanges are expected to handle larger numbers of game day traffic. As shown in **Table 95,** two freeway facilities, I-280 southbound between the Alemany Street off- and on-ramps and U.S. 101 northbound at the on-ramp from Bayshore Boulevard would actually see improvements, compared to the 2030 No

Project conditions. This is because traffic from the proposed stadium location would use different routes to reach the freeway. The Project would impact the segment of I-280 northbound between 25th Street/Indiana Street and Mariposa Street.

Table 95
Freeway LOS Analysis – 2030 No Project and Project Conditions
Sunday Peak Hour Following Football Game at Candlestick Park

Freeway	Direction	Location	2030 No Project Conditions		2030 Project Conditions	
			Density[1]	LOS	Density[1]	LOS
Basic Sections						
U.S. 101	NB	Cesar Chavez to I-80 Merge	**>45**	**F**	**>45**	**F**
U.S. 101	NB	Harney Way to Third/Bayshore	**>45**	**F**	**>45**	**F**
U.S. 101	SB	Third/Bayshore to Harney Way	**>45**	**F**	**>45**	**F**
U.S. 101	SB	Harney Way to Sierra Point on-ramp	**>45**	**F**	**>45**	**F**
I-280	SB	Alemany off- to Alemany on-ramp	**35.4**	**E**	30.8	D
Weaving Section [2]						
I-280	NB	25th on-ramp to Mariposa off-ramp	1,220	C	>1,900	**F**
Merge Sections						
U.S. 101	NB	Harney Way (future)	**>45**	**F**	**>45**	**F**
U.S. 101	NB	NB Bayshore Boulevard	**>45**	**F**	34.6	D
U.S. 101	NB	Alemany/Industrial	**>45**	**F**	**>45**	**F**
U.S. 101	NB	NB Bayshore/Cesar Chavez	**>45**	**F**	**>45**	**F**
U.S. 101	SB	EB Cesar Chavez/Potrero	**>45**	**F**	**>45**	**F**
U.S. 101	SB	Alemany/San Bruno	21.2	C	22.4	C
U.S. 101	SB	SB Third Street/Bayshore	**>45**	**F**	**>45**	**F**
U.S. 101	SB	Harney Way (future)	**>45**	**F**	**>45**	**F**
U.S. 101	SB	Sierra Point Pkwy/Lagoon	**>45**	**F**	**>45**	**F**
I-280	NB	NB Indiana/25th	**>45**	**F**	**>45**	**F**

Note:
1. Density measured in passenger cars per lane per mile. Density undefined for LOS F conditions.
2. For weave section, weaving volume is reported.
3. Although analysis is conducted for peak hour, depending on game conditions (attendance, weather, game score, etc.), duration of peak post-game conditions may be longer than one hour (see Table 91).
Source: Fehr & Peers.

The Project would result in new freeway facilities operating unacceptably. However, the duration of expected congestion would likely be less due to the higher level of transit use, the Transportation Management Center housed within the stadium to increase efficiency of exiting traffic, and the greater amount of identified post-game exit routes and freeway access points. Overall, since new facilities, including local streets and freeway facilities, would experience congested traffic following a football game, traffic impacts associated with the new stadium during game days would be considered *significant.*

The Project includes measures to reduce the magnitude of the traffic impacts associated with the new stadium, including limiting the parking supply, providing a more robust transit system, and locating the stadium so as to better disperse traffic following a game. As a result, the exit capacity of the new stadium would be greater than that of the existing stadium. Mitigation measures associated with additional roadway widening would degrade pedestrian and bicycle conditions during non-game days, which represent the vast majority of the time, and were therefore not considered further. However, Project Mitigation Measure 17 is required to ensure that a management plan for accommodating the increased vehicle, transit, pedestrian and bicycle demands during game days is prepared and implemented.

Project Mitigation Measure 17: The stadium operators shall develop and maintain a Transportation Management Plan (TMP) for the stadium. The stadium operator shall work with representatives from the SFMTA, the State Highway Patrol, the Police Department, private charter operators, Caltrain and others on a continuing basis to develop and refine the TMP, as determined appropriate by SFMTA. The final stadium TMP shall be approved by SFMTA. Preparation of the TMP shall be fully funded by the stadium operator, and shall be completed in time for implementation on opening day of the stadium.

The following actions shall be included in the TMP:

- Information on transportation options to the stadium, including game day service by the various regional service providers shall be distributed to season ticket holders, employees, and other patrons if possible.
- A brochure, information packet, and/or web page providing full information on transit access to the stadium, similar to that currently offered at the 49ers website, shall be updated and maintained.
- The use of charter buses to the stadium shall be encouraged and expanded. A number of measures shall be considered that could be implemented at low-cost to expand the use of group charters, including reduced parking costs, publicize the groups in 49ers publications and mailings, provide priority parking, provide lounges for bus drivers and provide support services for rooter clubs.
- Residential Permit Parking Program and/or additional parking restrictions, such as time limits, during game days, particularly in the Bayview Hunters Point areas, shall be explored with residents to reduce potential for intrusion of stadium vehicles into the adjacent neighborhood during a football game or secondary event.
- The stadium operator shall implement measures to encourage carpools of 4-plus persons per vehicle.
- The stadium operator shall charge a higher parking cost for low occupancy vehicles.
- The stadium operator shall develop a separate TDM plan for employees of the stadium and concessionaires. The plan shall consider measures such as providing

employees and concessionaires with free or subsidized transit passes to encourage transit use and reduce vehicular travel to the stadium. Employees shall not receive preferential parking.

- The stadium operator shall develop measures with CPSRA to ensure that game day spectators do not park in CPSRA day use parking lots. Strategies to be explored include limiting parking in CPSRA lots to a limited duration during game days (e.g., to a two-hour period), or an increase in parking fees equivalent to game day parking, and ticketing and enforcement.
- The TMP shall ensure that regular transit routes operate acceptably near the stadium. The plan should consider providing alternate routes for those transit lines that do not have exclusive right of way on game days (48-Quintara-24th Street, 44-O'Shaughnessy, 29-Sunset) onto transit-only facilities such as the BRT right of way to the south and Palou Avenue to the north (which would be a transit-only facility on game days).

Implementing this mitigation measure would likely reduce automobile travel to the stadium and encourage transit usage. However, even with implementation of Project Mitigation Measure 17, the Project's impacts on Sunday pre-game and post-game period traffic conditions would remain *significant and unavoidable.*

Transit Impacts

During game days, the regularly scheduled bus service adjacent to the stadium would continue to operate on normal routes, providing direct service to the stadium and into the Hunters Point Shipyard Transit Center. **Figure 38** presents the game day transit service. Special game day transit, including charter buses and public transit express service would access the stadium via Palou Avenue, which would be converted to transit-only on game days. These buses would conduct passenger loading and unloading on Crisp Avenue, in front of the stadium. The stadium parking program calls for 340 bus parking spaces to store empty buses during the game.

During sellout games, about 16,388 spectators and 652 game day employees are expected to use transit to access the stadium, a total of 17,040 transit riders. Assuming similar transit ridership from regional providers (including charter service expected to replace service previously provided by Golden Gate Transit, the Santa Clara Valley Transportation Authority, and SamTrans) and other private charters, the expected Muni ridership to the stadium would be 12,040 (an increase of about 5,500 patrons from existing conditions). This ridership includes transit patrons who use regional transit, such as Caltrain and BART, and transfer to Muni to access the stadium.

SOURCE: Fehr & Peers; AECOM

FIGURE 38: PROPOSED STADIUM GAME DAY TRANSIT

As presented in **Table 96,** the combination of regularly scheduled transit service and game day express routes, similar to what is provided to the existing stadium, is expected to be approximately 8,400 passengers per hour. Therefore, with a projected Muni ridership of 12,040 patrons and capacity of 8,400 passengers per hour, there would be a capacity shortfall of approximately 3,640 passengers per hour. This shortfall in transit capacity would be considered significant.

Table 96
Game Day Muni Capacity by Line

Route	One-Way Hourly Capacity (passengers per hour)
24-Divisadero	400 [1]
28L-19th Avenue/Geneva Avenue	800 [1]
44-O'Shaughnessy	450 [1]
48-Quintara-24th Street	250 [1]
Game Day Express Service (75X, 77X, 78X, 79X, 86, and 87)	6,500 [2]
Total	**8,400**

Notes:
1. Assumes Sunday peak hour capacity is 75 percent of typical weekday peak hour capacity, per SFMTA TEP assumptions.
2. Based on existing ridership on these express routes
Source: SFMTA, Fehr & Peers.

> ***Project Mitigation Measure 18***: SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area on game days. In addition, the stadium operator shall fund additional Muni shuttle service between the stadium and regional transit service, including BART (Balboa Park and/or Glen Park Station) and Caltrain (Bayshore Station). Although the specific frequencies of individual routes should be determined based on patron characteristics that may evolve over time, the increased transit service, taken as an aggregate, should generally compensate for the projected shortfall of 3,600 passengers per hour on the existing and proposed transit lines.
>
> Prior to opening day at the new stadium, the City and stadium operator shall determine costs associated with the increased service and determine funding sources. Examples of funding sources that shall be considered include a surcharge on game tickets or other such revenue mechanism. Implementation of increased transit service would be the responsibility of SFMTA and the stadium operator, and would be implemented when projected attendance warrants additional service.

With implementation of Project Mitigation Measure 18, the Project's impacts to transit service on Sundays during a football game could be reduced to less-than-significant levels. However, area roadways would experience congestion during post-game conditions that could be lessened but not eliminated with mitigation, and the transit lines serving the Project vicinity would be subject to traffic congestion. Therefore, the effectiveness of providing additional capacity may be limited due to the traffic impacts on transit operations, and therefore, the impact on transit operations would remain *significant and unavoidable.*

Bicycle Impacts

The Project would improve bicycle access to the area in terms of new bicycle lanes on existing and reconfigured roadways, and bicycle access within and in the vicinity of the Project site would be maintained on game days. However, bicycle access would be constrained due to the heavy traffic volumes at locations further away from the Project site where bicycle lanes are not provided. At these locations, bicyclists would likely divert to roadways not designated as stadium access routes (e.g., bicyclists may use Revere Avenue instead of Gilman Avenue for access to and from the stadium).

For those patrons arriving by bicycle, the proposed stadium would provide improved amenities compared to the existing stadium. Bicycle racks and lockers would be provided at the stadium entrances. In addition, a bicycle valet, similar to the service operated at AT&T Park for San Francisco Giants baseball games would be provided.

Bicycle access to the stadium on football game days would be difficult, as at present, due to heavy traffic volumes. However, bicycle access to the new stadium would be provided, and impacts on bicycle operations would therefore be *less than significant.*

Pedestrian Impacts

Pedestrian access to the stadium from external locations would be provided via 15-foot sidewalks on either side of Crisp Avenue. All other streets leading into the stadium site would provide 12 to 15-foot-wide sidewalks. Near the stadium, game day pedestrians would be allowed to cross the Crisp Avenue at two locations where the Ring Road intersects Crisp Avenue. In addition, pedestrians traveling between the stadium and the 3,000 parking spaces in the Hunters Point Shipyard R&D campus would cross the Ring Road on the south side of Crisp Avenue. Because of the need to balance pedestrian flows with efficient auto egress, temporary pedestrian overcrossings, similar to the one recently installed across Hunters Point Expressway, would be provided. Traffic control officers would also be stationed at the overcrossings, as well as at other at-grade crossings.

Pedestrian travel throughout the Project site may be disrupted by game day traffic, and pedestrian travel near the new stadium, would experience crowding. However, this is expected and understandable for large events, and would be similar to conditions at the existing stadium.

Pedestrian access to the stadium during game days would be difficult, as at present, due to heavy traffic volumes. However, since pedestrian access would be maintained, stadium game day impacts on pedestrian circulation would be *less than significant.*

State Park Access Impacts

With the Project, the Bay Trail around Yosemite Slough would be completed, and all existing connections to the Bay Trail would be maintained. Pedestrian and bicycle access to the developed state park lands would be maintained, and the Project's extensive improvements to the area bicycle and pedestrian network would facilitate access to the state parks lands. Pedestrian and bicycle access to state park lands on game days would be similar to existing condition; that is, heavy traffic congestion in the pre- and post-game periods could discourage bicycle use to and from CPSRA during these periods, generally during two hours before and after each game.

Because there would be at least one lane open to traffic in each direction during pre- and post-game operations on roadways providing access to CPSRA facilities, vehicle access to state parks would still be accommodated on game days. However, as with bicycle access, heavy traffic congestion during game days could discourage vehicular access to and from the state parks during these periods.

Overall, since vehicle, bicycle and pedestrian access to state park facilities would be maintained during game days, impacts related to access would be *less than significant.*

Parking Impacts

The 49ers stadium area would have a total supply of 17,415 game day parking spaces, as presented on **Figure 11.** A total of 12,665 of the 17,415 parking spaces would be adjacent to the stadium, and accessible via a new loop road on the southern portion of the stadium. Of the 12,665 spaces, 340 spaces adjacent to the stadium would be reserved for buses, and the remaining 12,325 would be for private autos, RVs, limos, etc. Parking structures on the north side of Crisp Avenue, immediately across from the stadium, would accommodate an additional 750 vehicles, and would be accessible from Crisp Avenue. The R&D campus in Hunters Point Shipyard would provide an additional 3,000 spaces, of which 2,747 would be in structures and 253 would be on street.[23] These spaces would be accessible from internal roadways, which, in turn, would be accessible from Crisp Avenue. An additional 1,000 spaces would be provided in Candlestick Point retail parking structure that on game days would be reserved for stadium spectators.

A sell-out event at the stadium would result in a total game day travel demand of 20,134 vehicles (excluding buses) that would need to be accommodated. The Project would have a total game day parking supply of 17,415 spaces, of which 17,075 would be available for vehicle parking

[23] The on-street parking spaces in Area C would be made available for fixed-rate, longer-term parking by football patrons and controlled by City parking control officers on game days.

(340 spaces would be designated for buses). The 20,134-space parking demand would not be met within the 17,075-space parking supply, thus resulting in a shortfall of 3,059 spaces.

It is anticipated that the shortfall would be met similar to existing conditions, where spectators park in satellite parking lots, on street, or within private lots in the area. Currently about 4,300 parking spaces are available within satellite lots, and about 3,000 spaces on private lots that are generally restricted for use by residents, customers, and employees of private businesses. The likely result is that many patrons may elect to park in other off-site parking lots and either walk or take transit to the stadium. Some patrons may park within the CPSRA day use parking lots. Additionally, some patrons may also elect to take transit instead. Through effective parking management, including real-time information, public relations campaigns, and parking pricing strategies, the additional parking demand can be effectively managed.

The satellite parking lots identified in the parking supply are privately owned and operated and are not under the control of the stadium operator. Some of the satellite and private lots may not be available in the future due to development of other uses on that land (e.g., Executive Park development project). Development of the satellite and private lots would likely occur gradually so that the parking deficit would increase incrementally over time. Without the use of satellite lots, and without the provision of additional parking on-site (such as in a garage) or off-site (on adjacent properties such as Brisbane Baylands), stadium spectators would park on street further from the stadium (such as in the Bayview), or switch to alternative modes of transportation such as transit or charter buses.

As noted above, during game days, 1,000 parking spaces in the Candlestick Point retail parking structure would be reserved for stadium spectators, and as a result fewer spaces would be available for Candlestick Point retail patrons. In general, peak parking demand for shopping centers is lower on Sundays than on Saturdays or weekdays, and it is expected that during game days retail patrons would adjust their shopping trip to outside of the game day period, find short-term parking on-street, or access the shopping center via transit. During December when parking demand at shopping centers increases due to holiday shopping, the number of retail patrons that would be affected would increase. However, these patrons could be accommodated within the transit service provided pre- and post-game days.

Since stadium game day parking demand would be accommodated within the proposed parking facilities, privately owned satellite parking lots, and on street, and since alternative modes of transportation such as transit and charter buses would be available for spectators, stadium game day impacts on parking would be *less than significant.*

Loading Impacts

The preliminary design for the new stadium includes loading dock accommodating four semi-trailer trucks and an adjacent TV staging and loading area. The TV staging and loading area would be used for loading/unloading on the days leading up to a game. Separate trash and recycling areas would be provided. The loading facilities for the stadium would be designed based on experience at the existing stadium, and for the needs for large special events such as Monday Night Football games or the Super Bowl.

A total of 100 delivery trucks are expected to serve the stadium in the week prior to a game. The majority of these trucks would serve the concession and food service functions. Stadium-bound delivery trucks would make their deliveries in advance of events to avoid peak travel periods that occur in the hours leading up to a game. Vendors would be notified by the stadium of appropriate delivery times.

Based on information obtained from the 49ers for the existing stadium, for a Sunday afternoon game, truck deliveries would occur in the middle of the week, with about 10 percent occurring on Wednesday, 40 percent on Thursday, and 50 percent on Friday. This truck traffic would be spread over the entire day. The peak stadium delivery day would be Friday, when approximately 50 trucks would make deliveries to the stadium. As is currently done, television trucks would arrive in advance of events to allow for appropriate set-up time and to avoid peak travel periods.

The proposed stadium loading facilities would be sufficient to accommodate projected demand, and therefore the impacts related to loading would be *less than significant.*

Emergency Vehicle Access

During game days, two-way inbound and outbound vehicular circulation would be provided at all times, via three primary routes. On the Harney Way/Arelious Walker Drive route, emergency vehicles would be allowed to use the BRT-only lanes (the BRT-only lanes break off from the primary auto route and continue on Harney Way, east of Arelious Walker Drive, and on Egbert Street before reconnecting with Arelious Walker Drive immediately south of the Yosemite Slough bridge). Emergency vehicles would also be allowed to use Palou Avenue, which would be transit-only on game days. Both of these routes would be free of congestion, and would offer emergency vehicle access between regional facilities and Crisp Avenue. Emergency vehicles would be able to enter the stadium parking lot via Crisp Avenue. Emergency vehicles would also be able to use Innes Avenue, as there would be at least one lane in each direction on this route open to traffic. However, since immediately following games the outbound direction may be congested, this may not be a desirable route as the Harney Way BRT lanes or Palou Avenue.

Since multiple emergency access routes would be provided, stadium game day impacts on emergency access would be *less than significant.*

Project Variants

Project Variant 1 and Variant 2 would be similar to the Project, but would not involve construction of a new stadium. Furthermore, the existing stadium at Candlestick Point would be demolished, and the 49er games would be played elsewhere. Game day impacts for Project Variant 1 and Variant 2 are *not applicable*.

Project Variant 3 would be similar to the Project and would include the proposed new football stadium. However, instead of being the exclusive home to the San Francisco 49ers, the stadium would be shared with another National Football League team, the Oakland Raiders. Game day operations and impacts under this scenario would be the same as the Project. The primary difference would be twice as many regular season games would be played at the stadium, and the chances of hosting post-season playoff games would be increased. Project Mitigation Measure 17 and Project Mitigation Measure 18 would be applicable to Project Variant 3. Similar to the Project, traffic and transit impacts related to the new stadium would be *significant and unavoidable*, and *b*icycle, pedestrian, State Park access, parking, loading and emergency access impacts related to the new stadium would be *less than significant*.

Alternatives to the Project

Alternative 1 – No Project: Game day conditions for Alternative 1 would be the same as for No Project conditions. Due to a projected increase in development in the area, traffic congestion on the local street network would increase compared to existing conditions, and traffic and transit impacts would be *significant and unavoidable.*

Alternative 2 – No Bridge*:* Alternative 2 would be the same as the Project, except that the Yosemite Slough bridge would not be constructed. Because the Yosemite Slough bridge is expected to accommodate four lanes of auto traffic into and out of the stadium before and after games, respectively, this would substantially reduce the ingress and egress capacity of the stadium. During the peak egress time, the egress capacity would be reduced by nearly 40 percent, as the stadium would lose 4 out of the proposed 11 total auto lanes exiting the stadium. This would serve to meter the amount of traffic leaving the stadium, which would mean similar or less congestion on area roadways, particularly those leading toward the U.S. 101/Harney Way interchange. However, the lower exit capacity would likely render the proposed new stadium site infeasible as a desirable option for an NFL football team. Project Mitigation Measure 17 and Project Mitigation Measure 18 would be applicable to Alternative 2. Similar to the Project, even with mitigation, traffic and transit impacts associated with the new stadium under Alternative 2 would be *significant and unavoidable*.

Similar to the Project, bicycle, pedestrian, State Park access, parking, loading and emergency access impacts related to the new stadium would be *less than significant.*

Alternative 3 – 49ers stay at Candlestick: Alternative 3 would involve less development overall, with slightly more development at the Hunters Point Shipyard site and virtually no change to the Candlestick Point area. Candlestick Park stadium would remain at its existing site. Assuming the 49ers would remain at that location, the game day operations under Alternative 3 would be similar to the Alternative 1, the No Project condition. Traffic and transit impacts associated with the existing stadium under Alternative 3 would be *significant and unavoidable.*

Alternative 4 – Lesser Build: Alternative 4 would be similar to the Project, however, the amount of development in the project site would be reduced compared to the Project. Under Alternative 4, the Candlestick Park stadium would be demolished, and no new stadium would be constructed. The 49er football games would be played elsewhere, and therefore there would not be any impacts related to game day operations. Game day impacts for this alternative are *not applicable*.

Alternative 5 – No Park Agreement*:* Alternative 5 would be similar to Project Variant 2, in which the Project is constructed, the Candlestick Park stadium would be demolished, and no new stadium would be constructed. The 49er football games would be played elsewhere, and therefore there would not be any impacts related to game day operations. Game day impacts for this alternative *are not applicable*.

6.11.2 Stadium Secondary Event Impacts

No Project Conditions

Under the No Project scenario, the existing Candlestick Park would remain and development would occur in the Hunters Point Shipyard site. Due to its age and the availability of other nearby newer facilities, the existing Candlestick Park does not host a great deal of special events. Although the background traffic would be higher than existing conditions under the 2030 No Project scenario and the combination of background traffic and special event traffic at Candlestick Park would be somewhat more severe than today's situation, special events at Candlestick Park would continue to be rare events.

Project

As indicated in section 4.2.4, other types of events, such as soccer games or concerts, may also be scheduled at the new stadium during the year. A typical secondary event could occur at any time of day and on any day of the week. The analysis of a secondary event at the stadium considers an expected crowd of about 37,500 spectators, with a weekday evening start time of about 7:00 p.m. The weekday PM peak hour was analyzed for pre-event conditions, for future year 2030 conditions with the Project.

Similar to football game day events, the majority of stadium bound traffic would use a portion of U.S. 101 to access the stadium site prior to secondary events. Traffic from the south would predominantly use northbound U.S. 101 and access the site via Harney Way, while traffic from the north would predominantly use southbound U.S. 101 and I-280 and access the site via Cesar Chavez Street, Cargo Way, Evans Avenue, and Innes Street. Some trips to the site would use Bayshore Boulevard or Third Street to access the area via Carroll Avenue, Gilman Avenue and

Ingalls Street. The Yosemite Slough bridge would not be used for secondary event vehicle traffic.

Traffic Impacts

The impact analysis of a secondary event at the new stadium assumed a weekday evening event with an attendance of 37,500 spectators. Secondary events could occur at any time of the day, and on any day of the week. Secondary events at the stadium would be limited to 20 total occurrences per year. The weekday PM peak hour was analyzed for pre-event conditions.

After exiting regional freeways, traffic generated by a secondary event would access the site via Cesar Chavez Street, Cargo Way, Evans Avenue, Innes Avenue, Bayshore Boulevard, Third Street, Carroll Avenue, Gilman Avenue, and Ingalls Street. The Yosemite Slough bridge would not be used for secondary event vehicle traffic. The number of vehicles on the roadways accessing the stadium would vary by route and the size of the event.

During a weekday evening secondary event, it is projected that approximately one half of vehicle trips generated by a secondary event, or 4,688 vehicles would arrive approximately one hour prior to an event start time, likely between 5:00 and 6:00 p.m., coinciding with the weekday evening peak hour. Project vehicle trips would be added to the following freeway facilities that would operate at LOS E or LOS F during the weekday PM peak hour:

- U.S. 101 northbound from Harney Way to Third/Bayshore
- U.S. 101 northbound from Sierra Point Parkway to Harney Way
- U.S. 101 southbound from Mariposa Street to Cesar Chavez
- U.S. 101 southbound off-ramp to Harney Way
- I-280 southbound off-ramp to Pennsylvania/25th

In addition, the secondary event would cause an additional off-ramp to operate at LOS F conditions:

- U.S. 101 southbound off-ramp to Bayshore/Cesar

Table 97 compares the intersection LOS operating conditions for the Project weekday PM peak hour conditions without a secondary event to conditions with a secondary event. The table includes only the intersections along the access routes that would be primarily affected by secondary event traffic. Although other study intersections may experience traffic increases immediately preceding and following an event, the increase is not expected to be substantial since those locations would not be on primary routes between regional transportation facilities and the stadium.

Table 97
Intersection Level of Service
Project and Secondary Event – Weekday PM Peak Hour – 2030 Conditions

Intersection		Project No Event		Project with Secondary Event	
		Delay [1]	LOS [2]	Delay	LOS
1	Third St/25th St	**>80**	**F**	**>80**	**F**
2	Third St/Cesar Chavez	**>80**	**F**	**>80**	**F**
4	Third St/Evans Ave	**>80**	**F**	**>80**	**F**
8	Third St/Carroll Ave	**75**	**E**	**74**	**E**
9	Third St/Paul Ave	**>80**	**F**	**>80**	**F**
10	Third St/Ingerson Ave	43	D	39	D
11	Third St/Jamestown Ave	**>80**	**F**	**>80**	**F**
12	Third/Le Conte/US 101 nb off	23	C	28	C
14	25th St/Pennsylvania Ave	40	D	45	D
16	Cesar Chavez St/Evans Ave	**>80**	**F**	**>80**	**F**
17	Cesar Chavez St/Illinois St	23	C	40	D
27	Alana Way/Beatty Ave [3]	**>80**	**F**	**>80**	**F**
28	Alana Way/Harney Way/Mellon [3]	**>80**	**F**	**>80**	**F**
29	Harney Way/Jamestown Ave [4]	41	D	**>80**	**F**
30	Crisp Ave/Palou Ave [4]	54	D	**>80**	**F**
31	Ingalls St/Thomas Ave [4]	33	C	**>80**	**F**
32	Ingalls St/Carroll Ave [4]	38	D	**>80**	**F**
34	A.Walker/Gilman Ave [4]	36	D	**>80**	**F**
35	Amador St/Cargo Way	**59**	**E**	**>80**	**F**
46	Innes Ave/A.Walker Drive [4]	6	A	**67**	**E**
47	Innes Ave/Earl St	19.4(sb)	C	22.4(sb)	C
48	Evans Ave/Jennings St	31	C	**>80**	**F**
58	Evans/Napoleon/Toland	**>80**	**F**	**>80**	**F**
59	Harney Way/Executive Park East	26	C	**>80**	**F**
60	Harney Way/Thomas Mellon	26	C	**>80**	**F**

Notes:
1. Delay in seconds per vehicle.
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold.**
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.

Source: Fehr & Peers.

With a secondary event, an additional 9 intersections would operate at LOS E or LOS F conditions, beyond those identified for the PM peak hour under Project conditions, including:

- Harney/Jamestown
- Crisp/Palou
- Ingalls/Thomas
- Ingalls/Carroll
- Arelious Walker/Gilman

- Amador/Cargo
- Innes/Arelious Walker
- Evans/Jennings
- Harney/Executive Park East
- Harney/Thomas Mellon

Additionally, traffic associated with a secondary event would exacerbate traffic operations at 11 intersections that would operate at LOS E or LOS F conditions without a secondary event in the PM peak hour, including:

- Third/25th
- Third/Evans
- Third/Carroll
- Third/Paul
- Third/Jamestown
- Cesar Chavez/Evans
- Alana Way/Beatty
- Alana Way/Harney/Mellon
- Amador/Cargo Way
- Innes/Arelious Walker
- Evans/Napoleon/Toland

Overall, since new facilities, including local streets and freeway facilities, would experience congested traffic following prior to a secondary event, traffic impacts associated with the new stadium during secondary events would be *significant.*

> ***Project Mitigation Measure 19:*** The stadium operator shall develop as part of a stadium Transportation Management Plan (TMP), a strategy for coordinating with representatives of SFMTA and the SF Police Department for deploying traffic control officers in the Project vicinity to increase efficiency of pre- and post- event traffic, similar to what would be in place for football game days. The secondary event component of the stadium TMP shall be approved by SFMTA. The stadium operator shall fully fund implementation of the secondary event (i.e., non-49ers football events) measures.

Implementation of this mitigation measure would likely improve vehicle entrance and exit flows to the stadium site, maintain orderly traffic operations, and reduce intrusion onto neighborhood streets near the stadium. However, even with the implementation of Project Mitigation Measure 19 on days when special events are held at the stadium, the Project's impacts to the study roadway network would be *significant and unavoidable.*

<u>*Transit Impacts*</u>

During secondary events, regularly scheduled bus service adjacent to the stadium would continue to operate, providing direct service to the stadium and into the Hunters Point Shipyard Transit

Center. Additional secondary event-related transit service is not proposed. As shown in **Table 98**, the total one-way transit capacity serving the stadium site during a typical weekday PM peak hour would be 3,100 passengers per hour.

Table 98
PM Peak Hour One-Way Muni Capacity to Stadium by Line

Route	Peak Hour Frequency (minutes)	One-Way Hourly Capacity (passengers per hour)
24-Divisadero	6	635
28L-19th Avenue/Geneva Avenue	5	1,130
44-O'Shaughnessy	6	635
48-Quintara-24th Street	10	380
HPX – Hunters Point Express	12	320
Total		**3,100**

Notes:
Source: SFMTA, Fehr & Peers.

During the weekday evening period, up to 4,688 additional transit riders would be generated by a secondary event during the peak hour prior to the event. These would be in addition to the 1,037 transit trips inbound to the study area in the PM peak hour on routes serving the stadium area (e.g., 24-Divisadero, 28L-19th Avenue Limited, 44-O'Shaughnessey, 48-Quintara-24th Street, and HPX as extended to serve the event). Therefore, the overall one-way transit demand in the PM peak hour on days when a special event is being held at the stadium could be up to 5,725 riders. As shown in **Table 92,** the total one-way transit capacity serving the stadium site during a typical weekday PM peak hour would be 3,100 passengers per hour, which would result 2,625 riders that would not be accommodated. This would be considered a *significant impact*.

Project Mitigation Measure 20: SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area prior to large special events. In addition, the stadium operator shall fund additional Muni shuttle service between the stadium and regional transit service, including BART (Balboa Park and/or Glen Park stations) and Caltrain (Bayshore station).

- Routes 24-Divisadero, 28L-19th Avenue Limited, and 44-O'Shaughnessey would already be operating near their maximum frequency. Therefore, this mitigation measure primarily applies to the 48-Quintara-24th Street route and the new HPX service. If each of these routes were increased to have five-minute frequencies (typically considered the maximum frequency that can be regularly maintained), the transit capacity toward the stadium would increase by 828 passengers per hour, for a total of 3,928 passengers. Even with the additional service on these two lines, there would be a shortfall of 1,797 passengers per hour in transit capacity.

- Additional express service to key regional transit destinations and regional charter express service, similar to what is offered on football game days, would offset a portion of the shortfall in transit capacity. The amount and nature of special service to special stadium events would depend on the type and size of the special event. Generally, the capacity of the express service should compensate for the shortfall of 1,797 passengers per hour for a 37,500-person event (transit supply, would of course, be designed on a case-by-case basis depending on the expected size of the secondary event).
- SFMTA and the stadium operator shall implement a stadium transportation systems plan similar to that developed for game-day operations (except that the Yosemite Slough bridge shall not be available for private automobiles), on a case-by-case basis depending on the expected size of the secondary event.

Prior to opening day at the new stadium, the City and the stadium operator shall determine costs associated with the increased service and determine funding requirements. Examples of funding sources that shall be considered include a surcharge on game tickets, parking or admission surcharge, or other such revenue mechanism. Implementation of increased transit service would be the responsibility of SFMTA and the stadium operator, and would be implemented when projected attendance warrants additional service.

With implementation of Project Mitigation Measure 20, the Project's impacts to transit service on special event days would be reduced, but not to less-than-significant levels. In addition, traffic impacts during secondary events would not be mitigated, and would impact transit operations. Therefore, the impact on transit operations would remain *significant and unavoidable.*

Bicycle Impacts

During secondary events, bicyclists would have access to the proposed bicycle facilities on existing and reconfigured roadways, as it is not anticipated that any special roadway network restrictions would be required to accommodate secondary event traffic. Bicycle access would be maintained on all study area roadways.

For those patrons arriving to the stadium by bicycle, the stadium would include bicycle racks and lockers would be provided at the stadium entrances. In addition, a bicycle valet, similar to the service operated at AT&T Park for the San Francisco Giants would also be provided. Overall, while traffic volumes on area roadways would increase during secondary events, the increase would not be sufficient to substantially affect bicycle circulation, and impacts on bicycle operations would therefore be *less than significant.*

<u>*Pedestrian Impacts*</u>

The proposed street and sidewalk network in the vicinity of the stadium is designed to accommodate sell-out football game day crowds accessing and leaving the stadium site. Pedestrian access to the stadium during secondary events would be accommodated within the existing and proposed sidewalk network, although due to large number of pedestrians and vehicles accessing the stadium, pedestrians may experience crowding. However, this is expected and would be managed during large events as part of the stadium operations. Therefore, secondary event impacts on pedestrian circulation would be *less than significant.*

<u>*Parking Impacts*</u>

The parking supply associated with secondary events would vary, depending on the size of the event. For a secondary event with 37,500 spectators, it is anticipated that the stadium parking supply of 12,665 spaces would be made available. These include the dual-use fields, paved lot, structured parking facilities, and on-street parking.

A stadium secondary event with 37,500 spectators is expected to generate up to 10,100 vehicles, or about one half that of a sell-out football game day. These vehicles would be accommodated within the stadium parking supply. Impacts of stadium secondary events on parking would be *less than significant.*

Variants

Project Variants 1 and 2 would be similar to the Project but would not involve construction of a new stadium. Furthermore, the existing stadium at Candlestick Point would be demolished. No stadium facilities would be present in the study area under Project Variants 1 and 2 and therefore there would be no secondary event venues capable of accommodating large crowds (i.e., more than 10,000 spectators). Secondary event impacts for Project Variants 1 and 2 would be *not applicable.*

Project Variant 3 would be similar to the Project and would include the proposed stadium at Hunters Point Shipyard. However, instead of being the exclusive home to the San Francisco 49ers, the stadium would be shared with the Oakland Raiders. In this case, the stadium would still likely host secondary events and would have the same impacts as the Project. Project Mitigation Measure 20 and Project Mitigation Measure 21 would be applicable to Project Variant 3. Traffic and transit impacts related to the stadium secondary events would be *significant and unavoidable*, and bicycle, pedestrian, and parking impacts would be *less than significant.*

Alternatives to the Project

Alternative 1 – No Project: Under Alternative 1, the existing Candlestick Park would remain and development would occur in the Hunters Point Shipyard site. Due to its age and the availability of other nearby newer facilities, the existing Candlestick Park does not host a great deal of special events. Although the background traffic would be higher than existing conditions under the 2030 No Project scenario and the combination of background traffic and special event traffic at Candlestick Park would be somewhat more severe than today's situation, special events at Candlestick Park would continue to be rare. Due to the rarity of special events at Candlestick Park, impacts would be *less than significant.*

Alternative 2 – No Bridge: Since special event traffic would not be able to use the Yosemite Slough bridge, special event conditions under Alternative 2 would be the same as described above for the Project. Project Mitigation Measure 20 and Project Mitigation Measure 21 would be applicable to Alternative 2. As with the Project, traffic and transit impacts would remain *significant and unavoidable,* and bicycle, pedestrian, and parking impacts would be *less than significant*

Alternative 3 – 49ers stay at Candlestick: As described in the No Project scenario, due to its age and the proximity of other newer stadiums, Candlestick Park would rarely hold large special events. Although background traffic volumes would be higher than under existing conditions or No Project conditions, the rarity of special events at Candlestick Park result in *less than significant* impacts.

Alternative 4 – Lesser Build: Alternative 4 would include less overall development, and would not include construction of a new stadium. Secondary event impacts for Alternative 4 are *not applicable*.

Alternative 5 – No Park Agreement: Alternative 5 would be similar to Variant 2, however, the existing stadium would be demolished, and a new stadium would not be constructed. Secondary event impacts for Alternative 5 are *not applicable*.

6.11.3 Arena Event Impacts

As described earlier, the Project includes a 10,000-seat arena in the Candlestick Point area. Although most events would have less than 10,000 attendees, preliminary economic analysis has indicated that the arena could hold up to 250 events annually with an average attendance of 5,000. The transportation analysis examines the worst-case scenario, in which a 10,000-person event is held on a weekday evening.

No Project Conditions

Under the No Project scenario, no arena would be constructed at the project site. Arena impacts for No Project conditions are *not applicable*.

Project

Traffic Impacts

The impact analysis of arena events assumed a weekday evening sell-out event at the 10,000-seat arena. Although no specific program has been developed for events at the arena, sell-out events with 10,000 attendees occurring during weekday evenings would likely be infrequent. Smaller-sized events during the weekday evening, and events occurring during the day and on weekends would have fewer impacts due to the lower traffic volumes demands on the study area roadways.

Access to the arena would be via the existing roadway network: U.S.101, Harney Way, Gilman Avenue, and Third Street—as well as local streets within Candlestick Point. The number of vehicles would vary by route and the size of the event.

During a weekday evening event, it is projected that approximately one half of vehicle trips generated by an arena event, or 1,333 vehicles would arrive approximately one hour prior to an event beginning, likely between 5:00 and 6:00 p.m., coinciding with the weekday evening peak hour. These vehicles would add project vehicle trips to regional facilities that would operate at LOS E or LOS F during the weekday PM peak hour for 2030 Project conditions:

- U.S. 101 northbound from Harney Way to Third/Bayshore
- U.S. 101 northbound from Sierra Point to Harney Way
- U.S. 101 southbound from Mariposa Street to Cesar Chavez
- U.S. 101 southbound off-ramp to Harney Way

Table 99 presents a comparison of intersection LOS operating conditions for the Project weekday PM peak hour conditions without a sell-out event to conditions with a sell-out event at the arena. The table includes only the intersections along the access routes that would be primarily affected by arena traffic.

Table 99
Intersection Level of Service
Project No Event and Arena Event – Weekday PM Peak Hour – 2030 Conditions

Intersection		Project No Event		Project with Arena Event	
		Delay [1]	LOS [2]	Delay	LOS
1	Third St/25th St	**>80**	**F**	**>80**	**F**
2	Third St/Cesar Chavez	**>80**	**F**	**>80**	**F**
3	Third St/Cargo Way	**>80**	**F**	**>80**	**F**
4	Third St/Evans Ave	**>80**	**F**	**>80**	**F**
5	Third St/Oakdale Ave	**60**	**E**	**60**	**E**
6	Third St/Palou Ave	**>80**	**F**	**>80**	**F**
7	Third St/Revere Ave	**>80**	**F**	**>80**	**F**
8	Third St/Carroll Ave	**75**	**E**	**74**	**E**
9	Third St/Paul Ave	**>80**	**F**	**>80**	**F**
10	Third St/Ingerson Ave	43	D	41	D
11	Third St/Jamestown Ave	**>80**	**F**	**>80**	**F**
12	Third/Le Conte/US 101 nb off	23	C	24	C
19	Bayshore Blvd/Paul Ave	**>80**	**F**	**>80**	**F**
27	Alana Way/Beatty Ave [3]	**>80**	**F**	**>80**	**F**
28	Alana Way/Harney Way/Mellon [3]	**>80**	**F**	**>80**	**F**
29	Harney Way/Jamestown Ave [4]	41	D	**>80**	**F**
34	A.Walker/Gilman Ave [4]	36	D	37	D
56	Third/Williams/Van Dyke	**>80**	**F**	**>80**	**F**
57	Third St/Jerrold Ave	**>80**	**F**	**>80**	**F**
59	Harney Way/Executive Park East	26	C	30	C
60	Harney Way/Thomas Mellon	26	C	42	D

Notes:
1. Delay in seconds per vehicle.
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold.**
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.

Source: Fehr & Peers.

During the weekday PM peak hour, the LOS at the intersection of Harney/Jamestown would change from LOS D under Project conditions without an event to LOS F conditions for Project conditions with an event. This would be a significant impact.

Additionally, traffic associated with a sell-out arena event would exacerbate traffic operations at 11 intersections that would operate at LOS E or LOS F conditions under Project conditions without an event, including:

- Third/25th
- Third/Cesar Chavez
- Third/Evans

- Third/Oakdale
- Third/Revere
- Third/Carroll
- Third/Jamestown
- Alana Way/Beatty
- Alana Way/Harney/Mellon
- Third/Williams/Van Dyke
- Third/Jerrold

Overall, since local streets and freeway facilities would experience increased congested prior to an arena event, traffic impacts associated with the new arena would be *significant.*

> ***Project Mitigation Measure 21***: The arena operator shall develop a Transportation Management Plan (TMP) for coordinating with representatives of SFMTA and the SF Police Department for deploying traffic control officers in the Project vicinity to increase efficiency of pre- and post- event traffic, and for developing incentives to increase transit ridership to the arena. Implementation of this mitigation measure would likely speed vehicle entrance and exit to the arena site as well as maintain orderly traffic operations and reduce intrusion onto minor routes to and from the arena. Traffic control officers would facilitate traffic flow at the intersection of Harney/Jamestown that would operate at LOS F conditions with a sell-out arena event. The final arena TMP shall be approved by SFMTA. Preparation of the TMP Plan shall be fully funded by the arena operator, and shall be completed in time for implementation on opening day of the arena.

However, even with the implementation of Project Mitigation Measure 21, the Project's impacts to the study roadway network during a sell-out event at the arena would be *significant and unavoidable*.

Transit Impacts

Arena events would be served by the existing and proposed transit routes serving Candlestick Point. Additional transit service is not planned as part of special events at the arena. As shown in **Table 100,** the total one-way transit capacity serving the stadium site during a typical weekday PM peak hour would be 2,278 passengers per hour.

Table 100
PM Peak Hour One-Way Muni Capacity to Arena by Line

Route	Peak Hour Frequency (minutes)	One-Way Hourly Capacity (passengers per hour)
29-Sunset	5	768
28L-19th Avenue/Geneva Avenue	5	1,130
CPX – Candlestick Point Express	10	380
Total		**2,278**

Notes:
Source: SFMTA, Fehr & Peers.

As presented in the travel demand section, up to 1,000 transit riders would be generated in the peak hour prior to an event. These would be added to the 1,023 transit trips inbound to the project study area in the PM peak hour (i.e., inbound trips to Candlestick Point and Hunters Point Shipyard) on routes serving the arena (Routes 29-Sunset, 28L-19th Avenue Limited, and the proposed CPX service). Therefore, the overall one-way transit demand in the PM peak hour on days when an event is being held at the arena could be up to 2,023.

During the weekday evening period, up to 1,000 transit riders would be generated in the peak hour prior to an event. These would be added to the 1,023 transit trips inbound to the study area during the PM peak hour on routes serving the arena (e.g., 29-Sunset, 28L-19th Avenue Limited, and the proposed CPX service). Therefore, the overall one-way transit demand in the PM peak hour on days when an event is being held at the arena could be up to 2,023. As shown in Table 97, the total one-way transit capacity serving the arena during a typical weekday PM peak hour would be 2,278 passengers per hour, which would be adequate to serve the arena event and background demand generated by the Project land uses.

As described above, traffic associated with a sell-out event at the arena would add to already congested conditions on the study area roadway network, and these conditions could not be mitigated to less-than-significant levels. Therefore, traffic impacts would impact transit service accessing the Project site. Providing transit-priority treatments on Gilman Avenue, as described in Mitigation Measure 10.1 would reduce travel time impacts on the 29-Sunset (the 28L-19th Avenue/Geneva Avenue and the CPX would be traveling with the proposed transit-only lanes and would not be subject to increased traffic congestion).

The impact of traffic congestion on transit service could be avoided with implementation of Project Mitigation Measure 10.1 (Gilman transit lanes). Implementation of this mitigation measure would reduce impacts on transit operations to less-than-significant. However, due to the uncertainty of this mitigation, the impact would remain *significant and unavoidable*.

<u>*Bicycle Impacts*</u>
During arena events, bicyclists would have access to the proposed bicycle facilities on existing and reconfigured roadways, as it is not anticipated that any special roadway network restrictions would be required to accommodate arena event traffic. Bicycle impacts would be similar to those described for the Project.

For those patrons arriving to the arena by bicycle, the arena would include bicycle racks and lockers would be provided at the stadium entrances. Overall, while traffic volumes on area roadways would increase during arena events, the increase would not be sufficient to affect bicycle circulation, and impacts on bicycle operations would therefore be less than significant.

<u>*Pedestrian Impacts*</u>
In the vicinity of the arena, 12- to 15-foot-wide sidewalks would be provided. In addition, the arena would be set back from the street to provide a pedestrian plaza area for gathering pedestrians. Pedestrian access to the arena events would be accommodated within the proposed sidewalk network, although due to large number of pedestrians and vehicles accessing the arena during a sell-out event, pedestrians may experience crowding. However, this is expected and would be managed during large events by the arena operator. Therefore, arena event impacts on pedestrian circulation would be *less than significant.*

<u>*Parking Impacts*</u>
No separate parking facilities would be provided for arena patrons. Visitors would utilize proposed public off-street and on-street parking spaces in the vicinity of the proposed arena. A sell-out arena event would generate a demand for 2,860 vehicles (including patrons and employees), which would be accommodated within the approximately 2,300 parking spaces within structured parking in Candlestick Point, and within the approximately 1,000 on-street parking spaces in the Candlestick Point North, South and Central areas. See **Figure 10.**

During the weekday evenings, parking demand associated with the commercial uses in Candlestick Point that would utilize the public parking garage would be less than during the day, and spaces would be available for arena events. There would generally be a shortfall in parking supply, compared to Project parking demand, and therefore depending on the time of day of the arena event, surplus capacity may not be available to accommodate the arena parking demand. Arena events during peak periods of commercial activity would increase the shortfall in parking spaces. It is possible that some drivers may seek available parking in the available Bayview area, or others may shift to transit. As discussed above, the secondary effects of drivers searching for parking is typically offset by a reduction in vehicle trips due to some drivers, who are aware of constrained parking conditions in a given area, shifting to other modes. Hence, any secondary environmental impacts that may result from a shortfall in parking would be minor. Therefore, the parking shortfall would not result in significant parking impacts, and Project impacts on parking would be *less than significant.*

Project Variants

Project Variants 1 and 2 would each include somewhat more development in the Hunters Point area and development in the Candlestick Point area would be the same as the Project, including construction of a 10,000-seat arena. Overall, since new facilities, including local streets and freeway facilities, would experience congested traffic prior to an arena event, traffic impacts associated with the new Arena during arena events would be *significant*. Implementation of Project Mitigation Measure 21 would be applicable to Project Variants 1 and 2. However, even with the implementation of Project Mitigation Measure 21, the Project Variants 1 and 2's impacts to the study roadway network during a sell-out event at the arena would be *significant and unavoidable*.

As described earlier, transit demand with a sold-out arena event under the Project conditions were approaching, but not above, the amount of available transit capacity. However, since the amount of background transit demand under Variants 1 and 2 would be higher, it is possible that the added transit demand associated with a sold-out arena event would create demand for transit service greater than the capacity of the transit supply to the arena.

> ***Project Variant 1 Mitigation Measure 20 and Project Variant 2 Mitigation Measure 18***: SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area prior to large events at the arena. Routes 29-Sunset and 28L-19th Avenue Limited would already be operating near their maximum frequency. Therefore, this mitigation measure primarily applies to Route CPX. If headways on this route were increased to five-minute frequencies in the one to two-hours prior to an event at the arena, the hourly transit capacity toward the arena would increase by 380 passengers per hour, for a total of 2,658. This would likely be adequate capacity, but may still leave some routes over-capacity and others below-capacity. Therefore, additional shuttle service to key regional transit destinations, such as BART, Caltrain, and the T-Third light rail route shall also be provided by the arena operator.

With implementation of Project Variant 1 Mitigation Measure 20 and Project Variant 2 Mitigation Measure 18, the Project's impacts to transit service during sell-out events at the arena would be reduced, but not to less-than-significant levels. In addition, traffic impacts during secondary events would not be mitigated, and would impact transit operations. Therefore, the impact on transit operations would remain *significant and unavoidable.*

Alternatives to the Project

Alternative 1 – No Project: Under No Project conditions, an arena would not be constructed. No impacts related to arena events.

Alternative 2 – No Bridge: Since arena traffic would not be able to use the Yosemite Slough bridge, conditions with a special event at the arena under Alternative 2 would be the same to those as for the Project. Implementation of Project Mitigation Measure 21 would be applicable to Alternative 2. However, even with the implementation of Project Mitigation Measure 21, the Alternative 2's impacts to the study roadway network during a sell-out event at the arena would be *significant and unavoidable*.

Alternative 3 – 49ers at Candlestick: Under Alternative 3, no arena would be constructed. There would be no special events at an arena. *No impact.*

Alternative 4 – Lesser Build: Alternative 4 would include the arena, but would have less overall development than the Project. Implementation of Project Mitigation Measure 21 would be applicable to Alternative 4. However, even with the implementation of Project Mitigation Measure 21, the Alternative 4's impacts to the study roadway network during a sell-out event at the arena would be *significant and unavoidable*.

Alternative 5 – No Park Agreement: Alternative 5 would be similar to Project Variant 2. Implementation of Project Mitigation Measure 21 would be applicable to Alternative 5. However, even with the implementation of Project Mitigation Measure 21, the Alternative 5's impacts to the study roadway network during a sell-out event at the arena would be *significant and unavoidable*.

Chapter 7
MITIGATION MEASURES

This chapter presents the transportation mitigation measures to reduce the impacts of the 2030 No Project, Project, Project Variants, and Alternatives to the Project. It also identifies locations where mitigation measures would not be feasible and therefore impacts would remain significant and unavoidable.

7.1 PROJECT

7.1.1 Traffic

Project Mitigation Measure 1: TDM Plan

The Project Applicant shall prepare and implement a final TDM plan, which shall include the following elements:

- Visitor Variable, Market-Rate Parking Pricing
- Maximum Permitted Parking Ratios
- Flexible Parking Management Strategies
- Unbundled Residential Parking
- Transit Strategies and Support Strategies
- Central Transit Hub
- Enhanced Transit Service and Bicycle Facilities
- Bicycle Support Facilities
- Wayfinding Signs
- EcoPass for Residents
- Carshare Services
- Employee TDM Programs
    - Information Boards/Kiosks
    - In-building Real-Time transit monitors with sightlines of transit hubs
    - Commuter Benefits
    - Employee EcoPass
    - Carpool/Vanpools
    - Guaranteed Ride Home Program
    - Compressed Work Weeks, Flex Time, and Telecommuting
- CP-HPS Transportation Management Association
- On-Site Transportation Coordinator and Website
- Targeted Marketing
- Monitoring of Transportation Demand
- Monitoring Effectiveness of Congestion-Reducing and Traffic-Calming Efforts

With implementation of the Project Mitigation Measure 1, alternative modes would be encouraged, the use of single-occupant vehicles would be discouraged, and the impact of additional vehicles generated by the Project would be lessened. However, as described in Impact discussions below, the Project would still result in significant and unavoidable impacts on traffic and transit operations, and would still make considerable contributions to cumulative impacts related to substantial increases in traffic. Thus, the Project and Project's contribution to traffic would remain *significant and unavoidable.*

Project Mitigation Measure 2: Intersection of Tunnel/Blanken

Reconfigure the northbound and southbound approaches to the intersection of Tunnel/Blanken to provide dedicated left-turn lanes adjacent to shared through/right-turn lanes. This reconfiguration would require prohibition of parking for 160 feet in the southbound approach (loss of eight parking spaces) and for 100 feet in the northbound approach (loss of five parking spaces).

Implementation of the intersection reconfiguration shall be the responsibility of SFMTA, and shall be implemented when intersection improvements associated with the Visitacion Valley Redevelopment Plan (i.e., signalization) are no longer sufficient to maintain acceptable intersection level of service conditions. Since these improvements were determined to be required even without the Project under 2030 No Project conditions, the Project Applicant shall contribute its fair-share toward the cost of improvements. Prior to payment of the contribution, the City shall create a mechanism to determine and receive fair share contributions from the Project Applicant. The SFMTA and DPW shall design and implement the measure as necessary.

With implementation of ***Project Mitigation Measure 2***, operations at this intersection would improve, but not to acceptable LOS D or better conditions in the AM and PM peak hours. Therefore, project-related impacts at this intersection would be *significant and unavoidable*.

Project Mitigation Measure 3: Harney Interchange Project

The City of Brisbane and Caltrans, as part of the Harney Interchange Project, shall account for existing traffic, background traffic growth, and the most recent forecasts of traffic expected to be associated with each of several adjacent development projects, including the Project. The San Francisco County Transportation Authority (SFCTA) shall coordinate with the City of Brisbane and Caltrans to ensure Project-generated vehicle trips are accounted for in the Harney Interchange analyses and design.

Mitigations and associated fair-share funding measures for cumulative regional roadway system impacts, including freeway segment impacts, shall be formulated through the current interjurisdictional Bi-County Transportation Study effort being led by the SFCTA. The Project Applicant shall contribute its fair share to the Harney Interchange Project.

Because the environmental review of the interchange project is not yet complete and the interchange would be approved by Caltrans, the implementation of **Project Mitigation Measure 3** is uncertain and is outside of the City/Agency jurisdiction. Therefore, Project-related contributions to cumulative traffic impacts at these two intersections would remain *significant and unavoidable*.

Project Mitigation Measure 4: Intersection of Amador/Cargo/Illinois

SFMTA shall conduct a feasibility study of the intersection of Amador/Cargo/Illinois with the Port of San Francisco to determine the feasibility of reconfiguring the southbound approach on Illinois Street to provide a dedicated southbound left turn lane and a dedicated right-turn lane. Sufficient right-of-way is available to implement this improvement, however, provision of two southbound lanes would require narrowing a portion of the island to the west of the southbound approach to Cargo Way. Implementation of the intersection improvements shall be the responsibility of SFMTA and the Port of San Francisco, and shall be implemented when traffic operating conditions with the existing intersection configuration worsens to unacceptable levels. If determined feasible, the Project Applicant shall contribute its fair share to the intersection improvements.

With implementation of Project Mitigation Measure 4, operations at this intersection would improve to acceptable LOS C conditions during the AM and PM peak hours. However, since a feasibility study would be required, implementation of Mitigation Measure 3 is uncertain, and therefore, Project-related impacts at this intersection would remain *significant and unavoidable.*

Project Mitigation Measure 5: Intersection of Bayshore/Geneva

The City of Brisbane, as part of the Geneva Avenue Extension Project, shall account for existing traffic, background traffic growth, and the most recent forecasts of traffic expected to be associated with each of several adjacent development projects, including the Project. The San Francisco County Transportation Authority (SFCTA) and SFMTA shall coordinate with the City of Brisbane to ensure projected traffic volumes are accounted for in the design of the Geneva Avenue Extension.

Mitigations and associated fair-share funding measures for cumulative regional roadway system impacts, including freeway segment impacts, shall be formulated through the current interjurisdictional Bi-County Transportation Study effort being led by the SFCTA. The Project Applicant shall contribute its fair share to the Geneva Avenue Extension Project.

Since implementation of Project Mitigation Measure 5 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Therefore, the Project-related impacts at this intersection would remain *significant and unavoidable.*

Project Mitigation Measure 6: Harney Way Widening

Prior to issuance of the grading permit for Phase II of the Project, the Project Applicant shall widen Harney Way as shown in **Figure 5.** Prior to the issuance of grading permits for Phases II, III and IV, the Project Applicant shall fund a study to evaluate traffic conditions on Harney Way and determine whether additional traffic associated with the next phase of development would result in the need to modify Harney Way to its ultimate configuration, as shown in **Figure 6,** unless this ultimate configuration has already been built. This study shall be conducted in collaboration with the SFMTA, which would be responsible for making final determinations regarding the ultimate configuration. The ultimate configuration would be linked to intersection performance, and it would be required when study results indicate intersection LOS at one or more of the three signalized intersection on Harney Way at mid-LOS D (i.e., at an average delay per vehicle of more than 45 seconds per vehicle). If the study and SFMTA conclude that reconfiguration would be necessary to accommodate traffic demands associated with the next phase of development, the Project Applicant shall be responsible to fund and complete construction of the improvements prior to occupancy of the next phase.

With implementation of the Project Mitigation Measure 6, Harney Way would be widened and improved to its final configuration when traffic demand warrants additional capacity. Therefore, potential Project impacts and Project contribution to cumulative impacts on traffic capacity on Harney Way would be reduced to *less than significant*.

7.1.2 Transit

Project Mitigation Measure 7: Transit Operating Plan

The Project Applicant shall work with SFMTA to develop and implement the Project's Transit Operating Plan. Elements of the Project Transit Operating Plan shall include:

- Extension of the 24-Divisadero, the 44-O'Shaughnessy, and the 48-Quintara-24th Street into Hunters Point Shipyard.
- Increased frequency on the 24-Divisadero to 6 minutes in the AM and PM peak periods. Extension of the 29-Sunset from its current terminus near the Alice Griffith housing development, near Gilman Avenue and Giants Drive, into the proposed Candlestick Point retail area. The 29-Sunset would operate a short line between Candlestick Point and the Balboa Park BART station. This would increase frequencies on the 29-Sunset by reducing headways between buses from 10 minutes to 5 minutes during the AM and PM peak periods between Candlestick Point and the Balboa BART station. Every other bus would continue to serve the Sunset District (to the proposed terminus at Lincoln Drive and Pershing Drive in the Presidio) at 10-minute headways.
- Convert T-Third service between Bayview and Chinatown via the Central Subway from one-car to two-car trains or comparable service improvement.
- Extension of the 28L-19th Avenue Limited from its TEP-proposed terminus on Geneva Avenue, just east of Mission Street, into the Hunters Point Shipyard transit center. The

28L-19th Avenue Limited would travel along Geneva Avenue across U.S. 101 via the proposed Geneva Avenue extension and new interchange with U.S. 101, to Harney Way. East of Bayshore Boulevard, the 28L-19th Avenue Limited would operate as BRT, traveling in exclusive bus lanes into the Candlestick Point area. The BRT route would travel through the Candlestick Point retail corridor, and cross over Yosemite Slough into the Hunters Point Shipyard transit center.

- The 28L-19th Avenue Limited would operate a short line to the Balboa Park BART station. This would increase frequencies on the 28L-19th Avenue Limited by reducing headways between buses from 10 minutes to 5 minutes for the segment between Hunters Point Shipyard and the Balboa Park BART station. Every other bus would continue to the Sunset District (to the proposed terminus at North Point Street and Van Ness Avenue) at 10-minute headways. If the TEP-proposed extension of the 28L has not been implemented by the SFMTA by Phase 2 of Project development, the Project Applicant shall fund the extension of that line between its existing terminus and Bayshore Boulevard.
- New CPX-Candlestick Express to downtown serving the Candlestick Point site, traveling along Harney Way (with potential stops at Executive Park), before traveling on U.S. 101 toward downtown, terminating at the Transbay Terminal.
- New HPX-Hunters Point Shipyard Express to downtown serving the Hunters Point Shipyard site, traveling from the Hunters Point Shipyard Transit Center, along Innes Avenue, with stops at the India Basin and Hunters View areas, before continuing along Evans Avenue to Third Street, eventually entering I-280 northbound at 25th/Indiana. The HPX would continue non-stop to the Transbay Terminal in Downtown San Francisco.

Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources. With implementation of the Transit Plan, Project-generated transit trips would be accommodated within the existing and proposed transit capacity, and therefore Project impacts on transit capacity would be *less than significant.*

Project Mitigation Measures 8.1 and 8.2: 9-San Bruno

Project Mitigation Measure 8.1: To address Project impacts to the 9-San Bruno, prior to issuance of a grading permit for Phase 1, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvements which could reduce Project impacts on transit operations along the San Bruno Avenue corridor, generally between Campbell Avenue and Silver Avenue. The study shall create a monitoring program to determine the implementation extent and schedule (as identified below) to maintain the proposed headways of the 9-San Bruno.

- Install a transit-only lane on northbound San Bruno Avenue for the one-block section (400 feet) between Silliman Street and Silver Avenue. This would involve removal of five metered spaces on the east side of San Bruno Avenue, just south of Silver Avenue. Treatment for transit-only lanes can range from striping to physical elevation changes or barriers to protect transit right-of-way from mixed-flow traffic.

- Install a transit-only lane on southbound San Bruno Avenue at the approach to Dwight Street/Paul Avenue. This lane would function as a so-called “queue-jump” lane, allowing buses to bypass queues on southbound San Bruno Avenue at the intersection. The lane should begin approximately 200 feet north of Dwight Street and extend one block (about 300 feet) south of Paul Avenue to Olmstead Street. This would involve the removal of up to 20 on-street parking spaces on the west side of San Bruno Avenue. This treatment could be limited to peak hours only, which would minimize the impact of the parking loss. The segment of San Bruno Avenue between Dwight Street and Olmstead Street is designated as Bicycle Routes #705 and 5 (Class III signed routes).
- At the intersection of San Bruno/Silver install signal priority treatments on westbound Silver Avenue, where buses waiting to turn left from Silver Avenue onto southbound San Bruno Avenue must currently wait through almost an entire signal cycle due to the heavy oncoming traffic on eastbound Silver Avenue. Installation of a transit signal pre-emption at this location that provides a “green” signal for westbound vehicles but holds eastbound vehicles when buses are present would allow transit vehicles to turn left onto San Bruno Avenue without having to wait for opposing eastbound through traffic to clear.

The Project Applicant shall fully fund the costs of implementing the transit priority improvements (either the improvements identified above, or alternative improvements of equal or greater effectiveness and comparable cost) as determined by the study and the monitoring program. Other options to be evaluated in the study could include comprehensive replacement of stop-controlled intersections with interconnected traffic signals equipped with transit priority elements.

<u>Project Mitigation Measure 8.2</u> - Should Project Mitigation Measure 8.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 9-San Bruno. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA’s associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Because a feasibility study of the improvements contemplated in mitigation measure Project Mitigation Measure 8.1 would be required, implementation of Project Mitigation Measure 8.1 is uncertain. Because implementation of Project Mitigation Measure 8.2 alone, without Project Mitigation Measure 8.1, might not be sufficient to reduce the impacts on the 9-San Bruno to a less than significant level, the Project impacts on the 9-San Bruno would remain *significant and unavoidable.*

Project Mitigation Measures 9.1 and 9.2: 23-Monterey, 24-Divisadero, 4-O'Shaughnessy

Project Mitigation Measure 9.1: To address Project impacts to the 23-Monterey, 24-Divisidero and the 44-O'Shaughnessy, prior to issuance of a grading permit for Phase 1, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvements which could reduce Project impacts on transit operations along the Palou Avenue corridor, generally between Griffith Street and Newhall Street. The study shall create a monitoring program to determine the implementation extent and schedule (as identified below) to maintain the proposed headways of the 23-Monterey, 24-Divisidero and the 44-O'Shaughnessy.

- Convert one of the two westbound travel lanes on Palou Avenue between Keith Street and Newhall Street (three blocks) to a transit-only lane at all times. Treatment for transit-only lanes can range from striping to physical elevation changes to protect right-of-way from mixed-flow traffic. Because the westbound lanes between Third Street and Newhall Street are relatively narrow, parking would likely need to be prohibited on the north side of Palou Avenue between Third Street and Newhall Street (approximately 600 feet) during peak periods to maximize the effectiveness of the transit-only lane.
- Convert one of the two eastbound travel lanes on Palou Avenue between Newhall Street and Third Street (one block) to a transit-only lane at all times. Because the eastbound travel lanes between Newhall Street are relatively narrow, parking would likely need to be prohibited on the south side of Palou Avenue between Newhall Street and Third Street (approximately 600 feet) during peak periods to maximize the effectiveness of the transit-only lane. In the eastbound direction, east of Third Street, buses would re-enter the single mixed-flow traffic lane at the bus stop on the far (east) side of Third Street.
- There are currently pedestrian corner bulbs on the northwest and southwest corners of the intersection of Palou Avenue and Third Street. In order to accommodate the transit-only lanes west of Third Street, these bulbouts would be reconfigured or removed. Although removing pedestrian bulb-outs may increase pedestrian crossing distances and is generally inconsistent with the City's desire to prioritize pedestrian activity, in this case, the improvement would offer substantial benefits to transit travel times by allowing a transit-only lane through a congested intersection. This would be consistent with the City's transit-first policy.
- During the PM peak period only, prohibit parking on westbound Palou Avenue for the four-block segment between Griffith Street/Crisp Avenue and Keith Street, to provide for a PM peak period curb transit-only lane along this segment. This would create a continuous westbound transit-only lane on Palou Avenue between Griffith Street/Crisp Avenue and Newhall Street during the PM peak period.

- As an alternative to the bulleted measures above, narrow the existing sidewalks on Palou Avenue from Third Street to Crisp Avenue (seven blocks) from 15 feet to 12 feet in width. The pedestrian bulb-outs on the west side of Third Street would be removed. The resulting 12-foot-wide sidewalks would be consistent with the Better Streets Plan guidelines. The reduction in sidewalk width would allow for the provision of a 7-foot-wide on-street parking lane, an 11-foot-wide transit-only lane, and a 10-foot-wide mixed-flow lane in each direction on Palou Avenue. This would preserve on-street parking along the corridor and provide a seven-block transit-only lane on Palou Avenue between Griffith Street/Crisp Avenue and Newhall Street. Treatment for transit-only lanes can range from striping to physical elevation changes to protect right-of-way from mixed-flow traffic.

The Project Applicant shall fully fund the costs of implementing the transit priority improvements (either the improvements identified above, or alternative improvements of equal or greater effectiveness and comparable cost) as determined by the study and the monitoring program. Other options to be evaluated in the study could include signal priority treatments at other signalized intersections including at Bayshore/Cortland, Bayshore/Industrial, and Bayshore/Oakdale.

<u>Project Mitigation Measure 9.2:</u> Should Project Mitigation Measure 9.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 23-Monterey, the 24-Divisadero and the 44-O'Shaughnessy. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Because a feasibility study of the improvements contemplated in Project Mitigation Measure 9.1 would be required, implementation of this measure is uncertain. Because implementation of Project Mitigation Measure 9.2 alone, without Project Mitigation Measure 9.1, might not be sufficient to reduce the impacts on the 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy to a less than significant level, the Project impacts on the 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy would remain *significant and unavoidable.*

Project Mitigation Measures 10.1 and 10.2: 29-Sunset

<u>Project Mitigation Measure 10.1:</u> To address Project impacts to the 29-Sunset, prior to issuance of a grading permit for Phase I, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvements which could reduce Project impacts on transit operations along the Gilman Avenue and Paul Avenue corridor,

generally between Arelious Walker Drive and Bayshore Boulevard. The study shall create a monitoring program to determine the implementation extent and schedule to maintain the proposed headways of the 29-Sunset.

- For the five-block segment of Gilman Avenue between Arelious Walker Drive and Third Street, prohibit on-street parking on westbound Gilman Avenue during the AM and PM peak periods to provide for three westbound travel lanes. During the peak periods convert one of the three westbound travel lanes to transit-only. During off-peak periods, parking would be allowed, and buses would travel in one of the two mixed-flow lanes. The peak period transit lanes would impact 90 parking spaces.
- For the same five-block segment of Gilman Avenue between Arelious Walker Drive and Third Street, restripe the eastbound direction to provide two travel lanes, one of which would accommodate on-street parking and one of which would be a mixed-flow travel lane. During the AM and PM peak periods, prohibit on-street parking in the eastbound direction, and operate one of the two eastbound lanes as transit-only lanes. The peak period transit lanes would impact 80 parking spaces.
- As an alternative to the two bulleted measures above, narrow the existing sidewalks on Gilman Avenue from Third Street to Griffith Street (four blocks) from 15 feet to 12 feet in width. The resulting 12-foot-wide sidewalks would be consistent with the Better Streets Plan guidelines. The reduction in sidewalk width would allow for the provision of a 7-foot-wide on-street parking lane, an 11-foot-wide transit-only lane, and a 10-foot-wide mixed-flow lane in each direction on Gilman Avenue. This would preserve on-street parking along the corridor and provide four-block transit-only lanes on Gilman Avenue between Griffith Street and Third Street. Treatment for transit-only lanes can range from striping to physical elevation changes to protect right-of-way from mixed-flow traffic.
- Prohibit on-street parking on the north side of Paul Avenue, between Third Street and Bayshore Boulevard to create two westbound through lanes. Convert one westbound through lane to transit-only in the AM and PM peak periods. The peak period transit-only lane would impact 40 parking spaces. At the intersection of Paul Avenue and Bayshore Avenue, provide transit signal priority treatment (i.e., queue jump) to allow transit vehicles to maneuver into the mixed flow left-hand lane, facilitating a left-turn movement immediately west of Bayshore Boulevard from westbound Paul Avenue to southbound San Bruno.

The Project Applicant shall fully fund the costs of implementing the transit priority improvements (either the improvements identified above, or alternative improvements of equal or greater effectiveness and comparable cost) as determined by the study and the monitoring program. Other options to be evaluated in the study could include transit priority treatments on San Bruno Avenue, on the portions where the 29-Sunset travels.

Project Mitigation Measure 10.2: Should Project Mitigation Measure 10.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 29-Sunset. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Because a feasibility study of the improvements contemplated in mitigation measure Project Mitigation Measure 10.1 would be required, implementation of Project Mitigation Measure 10.1 is uncertain. Because implementation of Project Mitigation Measure 10.2 alone, without Project Mitigation Measure 10.1, might not be sufficient to reduce the impacts on the 29-Sunset to a less than significant level, the Project impacts on the 29-Sunset would remain *significant and unavoidable.*

Project Mitigation Measures 11.1 and 11.2: 48-Quintara-24th Street

Project Mitigation Measure 11.1: To address Project impacts to the 48-Quintara-24th Street, prior to issuance of a grading permit for Phase I, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvements which could reduce Project impacts on transit operations along the Evans Avenue corridor, generally between Hunters Point Boulevard and Napoleon Street. The study shall create a monitoring program to determine the implementation extent and schedule (as identified below) to maintain the proposed headways of the 48-Quintara-24th Street.

- On Evans Avenue, between Jennings Street and Napoleon Street (a nine-block segment—about 6,000 feet), convert one of the two travel lanes in each direction to a transit-only lane at all times. Treatment for transit-only lanes can range from striping to physical elevation changes or barriers to protect transit right-of-way from mixed-flow traffic.

The Project Applicant shall fully fund the costs of implementing the transit priority improvements (either the improvements identified above, or alternative improvements of equal or greater effectiveness and comparable cost) as determined by the study and the monitoring program. Other options to be evaluated in the study could include extension of transit only lanes in one or both directions between Napoleon Street and Cesar Chavez Street or onto Hunters Point Boulevard and Innes Avenue.

Project Mitigation Measure 11.2: Should Project Mitigation Measure 11.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 48-Quintara-24th Street. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Because a feasibility study of the improvements contemplated in Project Mitigation Measure 11.1 would be required, implementation of Project Mitigation Measure 11.1 is uncertain. Because implementation of Project Mitigation Measure 11.2 alone, without Project Mitigation Measure 11.1, might not be sufficient to reduce the impacts on the 48-Quintara-24th Street to a less than significant level, the Project impacts on the 48-Quintara-24th Street would remain *significant and unavoidable.*

Project Mitigation Measure 12: 54-Felton

SFMTA shall purchase additional transit vehicles and contribute to operating costs and facility improvements to mitigate the Project impacts and Project contribution to cumulative impacts to headways on 54-Felton. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

While the provision of additional transit vehicles for the 54-Felton would reduce impacts associated with increased travel times, the transit vehicles would still be subject to delays resulting from increased congestion, and therefore Project impacts on the 54-Felton would remain *significant and unavoidable.*

Project Mitigation Measures 13.1 and 13.2: T-Third

<u>Project Mitigation Measure 13.1:</u> To address Project impacts to the T-Third, prior to issuance of a grading permit for Phase I, the Project Applicant in cooperation with SFMTA shall conduct a study to evaluate the effectiveness and feasibility of the following improvement that could reduce Project impacts on transit operations along Third Street between Thomas Avenue and Kirkwood Avenue. The study shall create a monitoring program to determine the implementation extent and schedule (as identified below) to maintain the proposed headways of the T-Third.

- Reconfigure the section of Third Street between Thomas Avenue and Kirkwood Avenue (9 blocks) where the light rail vehicles currently share the travel lane with auto traffic to provide a dedicated transit right-of-way, consistent with the rest of the route. This would require either removal of one travel lane in each direction on Third Street, or removal of on-street parking and some sidewalk bulbouts. In addition, left-turns from Third Street in this segment would be restricted in both directions. Treatment for transit-only lanes can range from striping to physical elevation or barriers to protect transit right-of-way from mixed-flow traffic.

Implementation of the intersection reconfiguration shall be the responsibility of SFMTA, and shall be implemented when the results of the study described above indicate transit improvements are necessary. The Project Applicant shall fully fund the costs of implementing the transit priority improvements prior to approval of subsequent phases of development.

Project Mitigation Measure 13.2: Should Project Mitigation Measure 13.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the T-Third. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Because a feasibility study of the improvements contemplated in Project Mitigation Measure 13.1 would be required, implementation of Project Mitigation Measure 13.1 is uncertain. Because implementation of Project Mitigation Measure 13.2 alone, without Project Mitigation Measure 13.1, might not be sufficient to reduce the impacts on the T-Third to a less than significant level, the Project impacts on the T-Third would remain *significant and unavoidable.*

Project Mitigation Measures 14.1 and 14.2: 28L-19th Avenue/Geneva Limited

Project Mitigation Measure 14.1: The City of Brisbane, as part of the Geneva Avenue Extension Project, shall account for existing traffic, background traffic growth, and the most recent forecasts of traffic expected to be associated with each of several adjacent development projects, including the Project. The San Francisco County Transportation Authority (SFCTA) and SFMTA shall coordinate with the City of Brisbane to ensure transit preferential treatment is accounted for in the design of the Geneva Avenue Extension.

Project Mitigation Measure 14.2: Should Project Mitigation Measure 14.1 not be feasible or effective, the Project Applicant shall work with SFMTA to purchase additional transit vehicles and contribute to operating costs and facility improvements as necessary to mitigate the Project impacts and Project contribution to cumulative impacts to headways on the 28L-19th Avenue/Geneva Limited. Funds for the implementation of this mitigation measure are expected to be generated from a combination of Project revenues that accrue to the City, and other funding sources not otherwise accessible to Muni, adequate and sufficient to provide for SFMTA's associated ongoing operating costs, transit vehicle capital costs, and facility costs to store and maintain these vehicles.

Since implementation of Project Mitigation Measure 14.1 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Because implementation of Project Mitigation Measure 14.2 alone, without Project Mitigation Measure

14.1, might not be sufficient to reduce the impacts on the 28L-19th Avenue/Geneva Limited to a less than significant level, the Project impacts on the 28L-19th Avenue/Geneva Limited would remain *significant and unavoidable.*

7.1.3 Bicycle

Project Mitigation Measure 15: Bicycle Routes #70 and #170 on Palou Avenue

Prior to issuance of the grading permit for Phase I, the Project Applicant shall fund a study to determine the feasibility of relocating Bicycle Routes #70 and #170. The study of the bicycle route relocation, necessary environmental clearance documentation, and implementation shall be the responsibility of SFMTA. Since the feasibility of the relocation of the routes is uncertain at this time, the Project impact on bicycle circulation on Palou Avenue would remain significant and unavoidable.

Because a feasibility study of the relocation of Bicycle Routes #70 and #170 on Palou Avenue would be required, the implementation of Project Mitigation Measure 15 is uncertain, and therefore the Project impact on bicycle circulation would remain *significant and unavoidable*.

7.1.4 Pedestrian

No significant environmental impacts have been identified; no mitigation required.

7.1.5 Parking

No significant environmental impacts have been identified; no mitigation required.

7.1.6 Loading

No significant environmental impacts have been identified; no mitigation required.

7.1.7 Construction

Project Mitigation Measure 16: Construction Traffic Management Program

The Project Applicant shall develop and implement a Candlestick Point–Hunters Point Shipyard Phase II Construction Traffic Management Program to minimize impacts of the Project and its contribution to cumulative impacts related to construction activities and construction traffic. The program shall provide necessary information to various contractors and agencies as to how to maximize the opportunities for complementing construction management measures and to minimize the possibility of conflicting impacts on the roadway system, while safely accommodating the traveling public in the area. The program shall supplement and expand, rather than modify or supersede any manual, regulations, or provisions set forth by SFMTA, DPW or other City departments and agencies.

Preparation of the Construction Management Program shall be the responsibility of the Project Applicant, and shall be reviewed and approved by SFMTA and DPW prior to initiation of construction. The Project Applicant shall update the program prior to approval of development plans for Phase 2, Phase 3 and Phase 4 of construction to reflect any change to Project development schedule, reflect transportation network changes, to update status of other development construction activities, and to reflect any changes to City requirements.

The program shall:

- Identify construction traffic management practices in San Francisco, as well as other jurisdictions that although not being implemented in the City could provide useful guidance for a project of this size and characteristics.
- Describe procedures required by different departments and/or agencies in the City for implementation of a construction management plan, such as reviewing agencies, approval process, and estimated timelines.
- Describe coordination efforts associated with the Navy remediation efforts and scheduling regarding construction vehicle routing via the Crisp gate.
- Identify construction traffic management strategies and other elements for the Project, and present a cohesive program of operational and demand management strategies designed to maintain acceptable levels of traffic flow during periods of construction activities in the Bayview Hunters Point area. These could include construction strategies, demand management strategies, alternate route strategies, and public information strategies.
- Coordinate with other projects in construction in the immediate vicinity, so that they can take an integrated approach to construction-related traffic impacts.
- Present guidelines for selection of construction traffic management strategies.

Implementation of Project Mitigation Measure 16 would help minimize the Project construction-related transportation impacts, and the Project's contribution to cumulative-construction related transportation impacts. However, some disruption and increased delays could still occur even with implementation of Project Mitigation Measure 16, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable*.

7.1.8 Stadium

Project Mitigation Measure 17: Stadium 49ers Game Days Transportation Management Plan

The stadium operators shall develop and maintain a Transportation Management Plan (TMP) for the stadium. The stadium operator shall work with representatives from the SFMTA, the State Highway Patrol, the Police Department, private charter operators, Caltrain and others on a continuing basis to develop and refine the TMP, as determined appropriate by SFMTA. The final stadium TMP shall be approved by SFMTA. Preparation of the TMP shall be fully funded by the stadium operator, and shall be completed in time for implementation on opening day of the stadium.

The following actions shall be included in the TMP:

- Information on transportation options to the stadium, including game day service by the various regional service providers shall be distributed to season ticket holders, employees, and other patrons if possible.
- A brochure, information packet, and/or web page providing full information on transit access to the stadium, similar to that currently offered at the 49ers website, shall be updated and maintained.
- The use of charter buses to the stadium shall be encouraged and expanded. A number of measures shall be considered that could be implemented at low-cost to expand the use of group charters, including reduced parking costs, publicize the groups in 49ers publications and mailings, provide priority parking, provide lounges for bus drivers and provide support services for rooter clubs.
- Residential Permit Parking Program and/or additional parking restrictions, such as time limits, during game days, particularly in the Bayview Hunters Point areas, shall be explored with residents to reduce potential for intrusion of stadium vehicles into the adjacent neighborhood during a football game or secondary event.
- The stadium operator shall implement measures to encourage carpools of 4-plus persons per vehicle.
- The stadium operator shall charge a higher parking cost for low occupancy vehicles.
- The stadium operator shall develop a separate TDM plan for employees of the stadium and concessionaires. The plan shall consider measures such as providing employees and concessionaires with free or subsidized transit passes to encourage transit use and reduce vehicular travel to the stadium. Employees shall not receive preferential parking.
- The stadium operator shall develop measures with CPSRA to ensure that game day spectators do not park in CPSRA day use parking lots. Strategies to be explored include limiting parking in CPSRA lots to a limited duration during game days (e.g., to a two-hour period), or an increase in parking fees equivalent to game day parking, and ticketing and enforcement.
- The TMP shall ensure that regular transit routes operate acceptably near the stadium. The plan should consider providing alternate routes for those transit lines that do not have exclusive right of way on game days (48-Quintara-24th Street, 44-O'Shaughnessy, 29-Sunset) onto transit-only facilities such as the BRT right of way to the south and Palou Avenue to the north (which would be a transit-only facility on game days).

Implementing this mitigation measure would likely reduce automobile travel to the stadium and encourage transit usage. However, even with implementation of Project Mitigation Measure 17, the Project's impacts on Sunday pre-game and post-game period traffic conditions would remain *significant and unavoidable.*

Project Mitigation Measure 18: Stadium 49ers Game Days Transit Service

SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area on game days. In addition, the stadium operator shall fund additional Muni shuttle service between the stadium and regional transit service, including BART (Balboa Park and/or Glen Park Station) and Caltrain (Bayshore Station). Although the specific frequencies of individual routes should be determined based on patron characteristics that may evolve over time, the increased transit service, taken as an aggregate, should generally compensate for the projected shortfall of 3,600 passengers per hour on the existing and proposed transit lines.

- Prior to opening day at the new stadium, the City and stadium operator shall determine costs associated with the increased service and determine funding sources. Examples of funding sources that shall be considered include a surcharge on game tickets or other such revenue mechanism. Implementation of increased transit service would be the responsibility of SFMTA and the stadium operator, and would be implemented when projected attendance warrants additional service.

With implementation of Project Mitigation Measure 18, the Project's impacts to transit service on Sundays during a football game could be reduced to less-than-significant levels. However, due to the traffic impacts during post-game conditions on transit operations, which could not be mitigated, the impact on transit operations would remain *significant and unavoidable.*

Project Mitigation Measure 19: Stadium Secondary Event Transportation Management Plan

The stadium operator shall develop as part of a stadium Transportation Management Plan (TMP), a strategy for coordinating with representatives of SFMTA and the SF Police Department for deploying traffic control officers in the Project vicinity to increase efficiency of pre- and post- event traffic, similar to what would be in place for football game days. The secondary event component of the stadium TMP shall be approved by SFMTA. The stadium operator shall fully fund implementation of the secondary event (i.e., non-49ers football events) measures.

Implementation of this mitigation measure would likely improve vehicle entrance and exit flows to the stadium site, maintain orderly traffic operations, and reduce intrusion onto neighborhood streets near the stadium. However, even with the implementation of Project Mitigation Measure 19 on days when special events are held at the stadium, the Project's impacts to the study roadway network would be *significant and unavoidable.*

Project Mitigation Measure 20: Stadium Secondary Event Transit Service

SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area prior to large special events. In addition, the stadium operator shall fund additional Muni shuttle service between the stadium and regional transit service, including BART (Balboa Park and/or Glen Park stations) and Caltrain (Bayshore station).

- Routes 24-Divisadero, 28L-19th Avenue Limited, and 44-O'Shaughnessey would already be operating near their maximum frequency. Therefore, this mitigation measure primarily applies to the 48-Quintara-24th Street route and the new HPX service. If each of these routes were increased to have five-minute frequencies (typically considered the maximum frequency that can be regularly maintained), the transit capacity toward the stadium would increase by 828 passengers per hour, for a total of 3,928 passengers. Even with the additional service on these two lines, there would be a shortfall of 1,797 passengers per hour in transit capacity.
- Additional express service to key regional transit destinations and regional charter express service, similar to what is offered on football game days, would offset a portion of the shortfall in transit capacity. The amount and nature of special service to special stadium events would depend on the type and size of the special event. Generally, the capacity of the express service should compensate for the shortfall of 1,797 passengers per hour for a 37,500-person event (transit supply, would of course, be designed on a case-by-case basis depending on the expected size of the secondary event).
- SFMTA and the stadium operator shall implement a stadium transportation systems plan similar to that developed for game-day operations (except that the Yosemite Slough bridge shall not be available for private automobiles), on a case-by-case basis depending on the expected size of the secondary event.

Prior to opening day at the new stadium, the City and the stadium operator shall determine costs associated with the increased service and determine funding requirements. Examples of funding sources that shall be considered include a surcharge on game tickets, parking or admission surcharge, or other such revenue mechanism. Implementation of increased transit service would be the responsibility of SFMTA and the stadium operator, and would be implemented when projected attendance warrants additional service.

With implementation of Project Mitigation Measure 20, the Project's impacts to transit service on special event days would be reduced, but not to less-than-significant levels. In addition, traffic impacts during secondary events would not be mitigated, and would impact transit operations. Therefore, the impact on transit operations would remain *significant and unavoidable.*

7.1.9 Arena

Project Mitigation Measure 21: Arena Transportation Management Plan

The arena operator shall develop a Transportation Management Plan (TMP) for coordinating with representatives of SFMTA and the SF Police Department for deploying traffic control officers in the Project vicinity to increase efficiency of pre- and post- event traffic, and for developing incentives to increase transit ridership to the arena. Implementation of this mitigation measure would likely speed vehicle entrance and exit to the arena site as well as maintain orderly traffic operations and reduce intrusion onto minor routes to and from the arena. Traffic control officers would facilitate traffic flow at the intersection of Harney/Jamestown that would operate at LOS F conditions with a sell-out arena event. The final arena TMP shall be approved by SFMTA. Preparation of the TMP Plan shall be fully funded by the arena operator, and shall be completed in time for implementation on opening day of the arena.

However, even with the implementation of Project Mitigation Measure 21, the Project's impacts to the study roadway network during a sell-out event at the arena would be *significant and unavoidable*.

7.2 PROJECT VARIANT 1

7.2.1 Traffic

Project Variant 1 Mitigation Measure 1: Implement Project Mitigation Measure 1 – TDM Plan

Project Variant 1 Mitigation Measure 2: Implement Project Mitigation Measure 6 – Harney Way Widening

Project Variant 1 Mitigation Measure 3: Implement Project Mitigation Measure 2 – Improvements at Tunnel/Blanken

Project Variant 1 Mitigation Measure 4: Implement Project Mitigation Measure 3 – Harney Interchange Project Improvements

Project Variant 1 Mitigation Measure 5: At the intersection of Crisp/Palou/Griffith, restripe the southbound approach to provide a dedicated left-turn lane and a shared through/right-turn lane. On-street parking would be prohibited on Griffith Street between Palou Avenue and Oakdale Avenue. Implementation of this improvement would be the responsibility of SFMTA and DPW, and shall be implemented as part of Hunters Point Shipyard Phase 3 roadway network improvements. The Project Applicant, in collaboration with the City, shall monitor traffic conditions at completion of Phase 2, Phase 3 and Phase 4 to determine whether the intersection operations would warrant reconfiguration and when it should be implemented. Based on the monitoring, if the City determines reconfiguration is warranted, the Project Applicant shall be required to fund the cost of reconfiguration. The SFMTA and DPW shall design and implement the measure as necessary. With implementation of Project Variant 1 Mitigation Measure 5, this intersection would operate at acceptable LOS D or better in the AM and PM peak hours, and therefore with its implementation, project-related impacts at this intersection would be *less than significant*.

Project Variant 1 Mitigation Measure 6: Implement Project Mitigation Measure 4 – Improvements at Amador/Cargo/Illinois

Project Variant 1 Mitigation Measure 7: At the intersection of Innes/Earl, install a traffic signal. Installation of a traffic signal at the intersection of Innes/Earl would improve intersection operations to LOS D or better conditions. Traffic forecasts show that this intersection would be very close to meeting peak hour traffic signal warrants with buildout of the Project Variant 1. The Project Applicant, in collaboration with the City, shall monitor traffic volumes at completion of Phase 2, Phase 3 and Phase 4 to determine whether the intersection volumes would actually warrant a traffic signal and when it should be implemented. Based on the monitoring, if the City determines a traffic signal is warranted, the Project Applicant shall be required to fund installation of a traffic signal as part of later development phases. The SFMTA and DPW shall design and implement the measure as necessary. Implementation of Project Variant 1 Mitigation Measure 7 would reduce the impacts at this intersection to *less than significant* levels.

Project Variant 1 Mitigation Measure 8: Implement Project Mitigation Measure 5 – Improvements at Bayshore/Geneva

7.2.2 Transit

Project Variant 1 Mitigation Measure 9: Implement Project Mitigation Measure 7 – Project Transit Operating Plan

Project Variant 1 Mitigation Measure 10: Implement Project Mitigation Measure 8.1 and 8.2 – 9-San Bruno Improvements

Project Variant 1 Mitigation Measure 11: Implement Project Mitigation Measure 9.1 and 9.2 – 23-Monterey, 24-Divisadero, and 44-O’Shaughnessy Improvements

Project Variant 1 Mitigation Measure 12: Implement Project Mitigation Measure 10.1 and 10.2 – 29-Sunset Improvements

Project Variant 1 Mitigation Measure 13: Implement Project Mitigation Measure 11.a and 11.2 – 48-Quintara-24th Street Improvements

Project Variant 1 Mitigation Measure 14: Implement Project Mitigation Measure 12 – 54-Felton Improvements

Project Variant 1 Mitigation Measure 15: Implement Project Mitigation Measure 13.1 and 13.2 – T-Third Improvements

Project Variant 1 Mitigation Measure 16: Implement Project Mitigation Measure 14.1 and 14.2 – 28L-19th Avenue/Geneva Limited Improvements

7.2.3 Bicycle

Project Variant 1 Mitigation Measure 17: Implement Project Mitigation Measure 15 – Bicycle Route #70 and #170 Improvements

7.2.4 Pedestrian

No significant environmental impacts have been identified; no mitigation required.

7.2.5 Parking

No significant environmental impacts have been identified; no mitigation required.

7.2.6 Loading

No significant environmental impacts have been identified; no mitigation required.

7.2.7 Construction

Project Variant 1 Mitigation Measure 18: Implement Project Mitigation Measure 16 – Construction Traffic Management Program

7.2.8 Stadium

No stadium proposed as part of Project Variant 1; no mitigation measures required.

7.2.9 Arena

Project Variant 1 Mitigation Measure 19: Implement Project Mitigation Measure 21 – Arena Transportation Management Program

Project Variant 1 Mitigation Measure 20: SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area prior to large events at the arena. Routes 29-Sunset and 28L-19th Avenue Limited would already be operating near their maximum frequency. Therefore, this mitigation measure primarily applies to Route CPX. If headways on this route were increased to five-minute frequencies in the one to two-hours prior to an event at the arena, the hourly transit capacity toward the arena would increase by 380 passengers per hour, for a total of 2,658. This would likely be adequate capacity, but may still leave some routes over-capacity and others below-capacity. Therefore, additional shuttle service to key regional transit destinations, such as BART, Caltrain, and the T-Third light rail route shall also be provided by the arena operator.

7.3 PROJECT VARIANT 2

7.3.1 Traffic

Project Variant 2 Mitigation Measure 1: Implement Project Mitigation Measure 1 – TDM Plan

Project Variant 2 Mitigation Measure 2: Implement Project Mitigation Measure 6 – Harney Way Widening

Project Variant 2 Mitigation Measure 3: Implement Project Mitigation Measure 2 – Improvements at Tunnel/Blanken

Project Variant 2 Mitigation Measure 4: Implement Project Mitigation Measure 3 – Harney Interchange Project Improvements

Project Variant 2 Mitigation Measure 5: Implement Project Mitigation Measure 4 – Improvements at Amador/Cargo/Illinois

Project Variant 2 Mitigation Measure 6: Implement Project Mitigation Measure 5 – Improvements at Bayshore/Geneva

7.3.2 Transit

Project Variant 2 Mitigation Measure 7: Implement Project Mitigation Measure 7 – Project Transit Operating Plan

Project Variant 2 Mitigation Measure 8: Implement Project Mitigation Measure 8.1 and 8.2 – 9-San Bruno Improvements

Project Variant 2 Mitigation Measure 9: Implement Project Mitigation Measure 9.1 and 9.2 – 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy Improvements

Project Variant 2 Mitigation Measure 10: Implement Project Mitigation Measure 10.1 and 10.2 – 29-Sunset Improvements

Project Variant 2 Mitigation Measure 11: Implement Project Mitigation Measure 11.a and 11.2 – 48-Quintara-24th Street Improvements

Project Variant 2 Mitigation Measure 12: Implement Project Mitigation Measure 12 – 54-Felton Improvements

Project Variant 2 Mitigation Measure 13: Implement Project Mitigation Measure 13.1 and 13.2 – T-Third Improvements

Project Variant 2 Mitigation Measure 14: Implement Project Mitigation Measure 14.1 and 14.2 – 28L-19th Avenue/Geneva Limited Improvements

7.3.3 Bicycle

Project Variant 2 Mitigation Measure 15: Implement Project Mitigation Measure 15 – Bicycle Route #70 and #170 Improvements

7.3.4 Pedestrian

No significant environmental impacts have been identified; no mitigation required.

7.3.5 Parking

No significant environmental impacts have been identified; no mitigation required.

7.3.6 Loading

No significant environmental impacts have been identified; no mitigation required.

7.3.7 Construction

Project Variant 2 Mitigation Measure 16: Implement Project Mitigation Measure 16 – Construction Traffic Management Program

7.3.8 Stadium

No stadium proposed as part of Project Variant 1; no mitigation measures required.

7.3.9 Arena

Project Variant 2 Mitigation Measure 17: Implement Project Mitigation Measure 21 – Arena Transportation Management Program

Project Variant 2 Mitigation Measure 18: SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area prior to large events at the arena. Routes 29-Sunset and 28L-19th Avenue Limited would already be operating near their maximum frequency. Therefore, this mitigation measure primarily applies to Route CPX. If headways on this route were increased to five-minute frequencies in the one to two-hours prior to an event at the arena, the hourly transit capacity toward the arena would increase by 380 passengers per hour, for a total of 2,658. This would likely be adequate capacity, but may still leave some routes over-capacity and others below-capacity. Therefore, additional shuttle service to key regional transit destinations, such as BART, Caltrain, and the T-Third light rail route shall also be provided by the arena operator.

7.4 ALTERNATIVE 1 (NO PROJECT)

No mitigation measures presented for No Project conditions. Development within Hunters Point Shipyard would be subject to the existing MMRP.

7.5 ALTERNATIVE 2 (NO BRIDGE)

7.5.1 Traffic

Alternative 2 Mitigation Measure 1: Implement Project Mitigation Measure 1 – TDM Plan

Alternative 2 Mitigation Measure 2: Implement Project Mitigation Measure 2 – Improvements at Tunnel/Blanken

Alternative 2 Mitigation Measure 3: Implement Project Mitigation Measure 3 – Harney Interchange Project Improvements

Alternative 2 Mitigation Measure 4: Implement Project Mitigation Measure 4 – Improvements at Amador/Cargo/Illinois

Alternative 2 Mitigation Measure 5: Implement Project Mitigation Measure 5 – Improvements at Bayshore/Geneva

Alternative 2 Mitigation Measure 6: Implement Project Mitigation Measure 6 – Harney Way Widening

7.5.2 Transit

Alternative 2 Mitigation Measure 7: Implement Project Mitigation Measure 7 – Project Transit Operating Plan

Alternative 2 Mitigation Measure 8: Implement Project Mitigation Measure 8.1 and 8.2 – 9-San Bruno Improvements

Alternative 2 Mitigation Measure 9: Implement Project Mitigation Measure 9.1 and 9.2 – 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy Improvements

Alternative 2 Mitigation Measure 10: Implement Project Mitigation Measure 10.1 and 10.2 – 29-Sunset Improvements

Alternative 2 Mitigation Measure 11: Implement Project Mitigation Measure 11.a and 11.2 – 48-Quintara-24th Street Improvements

Alternative 2 Mitigation Measure 12: Implement Project Mitigation Measure 12 – 54-Felton Improvements

Alternative 2 Mitigation Measure 13: Implement Project Mitigation Measure 13.1 and 13.2 – T-Third Improvements

Alternative 2 Mitigation Measure 14: Implement Project Mitigation Measure 14.1 and 14.2 – 28L-19th Avenue/Geneva Limited Improvements

7.5.3 Bicycle

Alternative 2 Mitigation Measure 15: Implement Project Mitigation Measure 15 – Bicycle Route #70 and #170 Improvements

7.5.4 Pedestrian

No significant environmental impacts have been identified; no mitigation required.

7.5.5 Parking

No significant environmental impacts have been identified; no mitigation required.

7.5.6 Loading

No significant environmental impacts have been identified; no mitigation required.

7.5.7 Construction

Alternative 2 Mitigation Measure 16: Implement Project Mitigation Measure 16 – Construction Traffic Management Program

7.5.8 Stadium

Alternative 2 Mitigation Measure 17: Implement Project Mitigation Measure 17 – Stadium 49ers Game Days Transportation Management Program

Alternative 2 Mitigation Measure 18: Implement Project Mitigation Measure 18 – Stadium 49ers Game Days Transit Service

Alternative 2 Mitigation Measure 19: Implement Project Mitigation Measure 19 – Stadium Secondary Event Transportation Management Program

Alternative 2 Mitigation Measure 20: Implement Project Mitigation Measure 20 – Stadium Secondary Event Transit Service

7.5.9 Arena

Alternative 2 Mitigation Measure 21: Implement Project Mitigation Measure 21 – Arena Transportation Management Program

7.6 ALTERNATIVE 3 (49ERS AT CANDLESTICK)

7.6.1 Traffic

Alternative 2 Mitigation Measure 1: Implement Project Mitigation Measure 1 – TDM Plan

Alternative 2 Mitigation Measure 2: Implement Project Mitigation Measure 3 – Harney Interchange Project Improvements

Alternative 2 Mitigation Measure 3: Implement Project Mitigation Measure 4 – Improvements at Amador/Cargo/Illinois

Alternative 2 Mitigation Measure 4: Implement Project Mitigation Measure 5 – Improvements at Bayshore/Geneva

Alternative 3 Mitigation Measure 5: At the intersection of Harney/Jamestown, install a traffic signal at the intersection of Harney/Jamestown. Implementation of this measure would be the responsibility of SFMTA, and should be implemented when traffic signal warrants are met. Prior to completion of Phase 1 of development, the Project Applicant shall fully fund the cost of signalization improvements. Implementation of this mitigation measure would reduce Alternative 3 traffic impacts at this intersection to *less than significant* levels.

Alternative 3 Mitigation Measure 6: At the intersection of Ingalls/Thomas, install traffic signal at the intersection of Ingalls/Thomas. Implementation of this measure would be the responsibility of SFMTA, and should be implemented when traffic signal warrants are met. Prior to completion of Phase 1 of development, the Project Applicant shall fully fund the cost of signalization improvements. Installation of a traffic signal at the intersection of Ingalls/Thomas intersection would improve intersection operations to LOS D or better conditions. Implementation of Alternative 3 Mitigation Measure 6 would reduce the impacts at this intersection to *less than significant* levels.

Alternative 3 Mitigation Measure 7: At the intersection of Arelious Walker/Gilman, install a traffic signal at the intersection of Arelious Walker/Gilman. Implementation of the new signal would be the responsibility of SFMTA, and should be implemented when traffic signal warrants are met. Since signalization was determined to be required even without the Project under 2030 No Project conditions, the Project Applicant shall contribute its fair-share toward the cost of improvements. Prior to payment of the contribution, the City shall create a mechanism to determine and receive fair share contributions from the Project Applicant. The SFMTA and DPW shall design and implement the measure as necessary. Since implementation of this mitigation measure is uncertain, traffic impacts would remain significant and unavoidable.

7.6.2 Transit

Alternative 3 Mitigation Measure 8: Implement Project Mitigation Measure 7 – Project Transit Operating Plan

Alternative 3 Mitigation Measure 9: Implement Project Mitigation Measure 8.1 and 8.2 – 9-San Bruno Improvements

Alternative 3 Mitigation Measure 10: Implement Project Mitigation Measure 9.1 and 9.2 – 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy Improvements

Alternative 3 Mitigation Measure 11: Implement Project Mitigation Measure 10.1 and 10.2 – 29-Sunset Improvements

Alternative 3 Mitigation Measure 12: Implement Project Mitigation Measure 11.a and 11.2 – 48-Quintara-24th Street Improvements

Alternative 3 Mitigation Measure 13: Implement Project Mitigation Measure 12 – 54-Felton Improvements

Alternative 3 Mitigation Measure 14: Implement Project Mitigation Measure 13.1 and 13.2 – T-Third Improvements

Alternative 3 Mitigation Measure 15: Implement Project Mitigation Measure 14.1 and 14.2 – 28L-19th Avenue/Geneva Limited Improvements

7.6.3 Bicycle

Alternative 3 Mitigation Measure 16: Implement Project Mitigation Measure 15 – Bicycle Route #70 and #170 Improvements

7.6.4 Pedestrian

No significant environmental impacts have been identified; no mitigation required.

7.6.5 Parking

No significant environmental impacts have been identified; no mitigation required.

7.6.6 Loading

No significant environmental impacts have been identified; no mitigation required.

7.6.7 Construction

Alternative 3 Mitigation Measure 17: Implement Project Mitigation Measure 16 – Construction Traffic Management Program

7.6.8 Stadium

49ers would remain at existing stadium. No stadium proposed as part of Alternative 3; no mitigation measures required.

7.6.9 Arena

No arena proposed as part of Alternative 3; no mitigation measures required.

7.7 ALTERNATIVE 4 (LESSER BUILD)

7.7.1 Traffic

Alternative 4 Mitigation Measure 1: Implement Project Mitigation Measure 1 – TDM Plan

Alternative 4 Mitigation Measure 2: Implement Project Mitigation Measure 6 – Harney Way Widening

Alternative 4 Mitigation Measure 3: Implement Project Mitigation Measure 2 – Improvements at Tunnel/Blanken

Alternative 4 Mitigation Measure 4: Implement Project Mitigation Measure 3 – Harney Interchange Project Improvements

Alternative 4 Mitigation Measure 5: Implement Project Mitigation Measure 5 – Improvements at Bayshore/Geneva

7.7.2 Transit

Alternative 4 Mitigation Measure 6: Implement Project Mitigation Measure 7 – Project Transit Operating Plan

Alternative 4 Mitigation Measure 7: Implement Project Mitigation Measure 8.1 and 8.2 – 9-San Bruno Improvements

Alternative 4 Mitigation Measure 8: Implement Project Mitigation Measure 9.1 and 9.2 – 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy Improvements

Alternative 4 Mitigation Measure 9: Implement Project Mitigation Measure 10.1 and 10.2 – 29-Sunset Improvements

Alternative 4 Mitigation Measure 10: Implement Project Mitigation Measure 11.a and 11.2 – 48-Quintara-24th Street Improvements

Alternative 4 Mitigation Measure 11: Implement Project Mitigation Measure 12 – 54-Felton Improvements

Alternative 4 Mitigation Measure 12: Implement Project Mitigation Measure 13.1 and 13.2 – T-Third Improvements

Alternative 4 Mitigation Measure 13: Implement Project Mitigation Measure 14.1 and 14.2 – 28L-19th Avenue/Geneva Limited Improvements

7.7.3 Bicycle

Alternative 4 Mitigation Measure 14: Implement Project Mitigation Measure 15 – Bicycle Route #70 and #170 Improvements

7.7.4 Pedestrian

No significant environmental impacts have been identified; no mitigation required.

7.7.5 Parking

No significant environmental impacts have been identified; no mitigation required.

7.7.6 Loading

No significant environmental impacts have been identified; no mitigation required.

7.7.7 Construction

Alternative 4 Mitigation Measure 15: Implement Project Mitigation Measure 16 – Construction Traffic Management Program

7.7.8 Stadium

No stadium proposed; no mitigation measures required.

7.7.9 Arena

Alternative 4 Mitigation Measure 16: Implement Project Mitigation Measure 21 – Arena Transportation Management Program

7.8 ALTERNATIVE 5 (NO PARK AGREEMENT)

7.8.1 Traffic

Alternative 5 Mitigation Measure 1: Implement Project Mitigation Measure 1 – TDM Plan

Alternative 5 Mitigation Measure 2: Implement Project Mitigation Measure 2 – Improvements at Tunnel/Blanken

Alternative 5 Mitigation Measure 3: Implement Project Mitigation Measure 3 – Harney Interchange Project Improvements

Alternative 5 Mitigation Measure 4: Implement Project Mitigation Measure 4 – Improvements at Amador/Cargo/Illinois

Alternative 5 Mitigation Measure 5: Implement Project Mitigation Measure 5 – Improvements at Bayshore/Geneva

Alternative 5 Mitigation Measure 6: Implement Project Mitigation Measure 6 – Harney Way Widening

7.8.2 Transit

Alternative 5 Mitigation Measure 7: Implement Project Mitigation Measure 7 – Project Transit Operating Plan

Alternative 5 Mitigation Measure 8: Implement Project Mitigation Measure 8.1 and 8.2 – 9-San Bruno Improvements

Alternative 5 Mitigation Measure 9: Implement Project Mitigation Measure 9.1 and 9.2 – 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy Improvements

Alternative 5 Mitigation Measure 10: Implement Project Mitigation Measure 10.1 and 10.2 – 29-Sunset Improvements

Alternative 5 Mitigation Measure 11: Implement Project Mitigation Measure 11.a and 11.2 – 48-Quintara-24th Street Improvements

Alternative 5 Mitigation Measure 12: Implement Project Mitigation Measure 12 – 54-Felton Improvements

Alternative 5 Mitigation Measure 13: Implement Project Mitigation Measure 13.1 and 13.2 – T-Third Improvements

Alternative 5 Mitigation Measure 14: Implement Project Mitigation Measure 14.1 and 14.2 – 28L-19th Avenue/Geneva Limited Improvements

7.8.3 Bicycle

Alternative 5 Mitigation Measure 15: Implement Project Mitigation Measure 15 – Bicycle Route #70 and #170 Improvements

7.8.4 Pedestrian

No significant environmental impacts have been identified; no mitigation required.

7.8.5 Parking

No significant environmental impacts have been identified; no mitigation required.

7.8.6 Loading

No significant environmental impacts have been identified; no mitigation required.

7.8.7 Construction

Alternative 5 Mitigation Measure 16: Implement Project Mitigation Measure 16 – Construction Traffic Management Program

7.8.8 Stadium

No stadium proposed; no mitigation measures required.

7.8.9 Arena

Alternative 5 Mitigation Measure 17: Implement Project Mitigation Measure 21 – Arena Transportation Management Program

Appendix D1 Fehr & Peers, CP-HPS Phase II Developmental Plan Transportation Study—Transit Delay Analysis Erratum, April 2010

FEHR & PEERS
TRANSPORTATION CONSULTANTS

April 26, 2010

Mr. Bill Wycko
San Francisco Planning Department, MEA
1650 Mission Street, 4th Floor
San Francisco, CA 94103

Re: CP-HPS Phase II Developmental Plan Transportation Study – Transit Delay Analysis Erratum

Dear Bill:

This letter report is an erratum to the *Candlestick Point-Hunters Point Shipyard Phase II Development Plan Transportation Study* (November 2009) to update the transit delay analysis in the original report.

Our recent work refining transit mitigation measures identified in the DEIR has led to updated calculations for transit travel time savings associated with the measures. In the course of this refinement, we identified discrepancies in the calculation of transit travel increases associated with the Proposed Project, Variants and Alternatives.

This letter report contains the revised calculations. Revisions have been made to Tables 76, 77, 82, and 83 as they appear in the Transportation Study. Rather than renumbering for this letter report, those tables have been left with their original numbering scheme.

The revised transit delay analysis includes a Project Variant that was not included in the report at the time of publication, Variant 2A. For additional background on Variant 2A and the reasons for its inclusion please see *CP-HPS Phase II Developmental Plan Transportation Study, Supplemental Memorandum – Project Variant 2A (Housing/R&D)*, LCW Consulting, March 2010.

The revisions contained herein were not found to identify any additional significant impacts to transit travel times beyond those previously identified and disclosed in the Transportation Study and DEIR. The same mitigation measures identified in those documents would continue to apply based on the information presented in this letter.

TRANSIT DELAY ANALYSIS

The transit delay analysis and impact methodologies are the same as described in Chapter 6 (Year 2030 Project Impact Analysis) of the Transportation Study and are summarized below.

Transit Delay Methodology

Transit delay is the sum of three components; traffic congestion delay, transit re-entry delay, and passenger delay. The following is a brief description of each delay component:

Traffic congestion delay – Traffic congestion associated with increases in area traffic slows down transit vehicles and results in increased transit travel times. Traffic congestion delays are calculated by summing the average vehicular delay at each intersection along the transit line's route within the study area. The increase in total route segment delay is equal to the increase in travel time associated with the project.

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Transit re-entry delay – Transit vehicles typically experience delays after stopping to pick up and drop off passengers while waiting for gaps in adjacent street traffic in order to pull out of bus stops. As traffic volumes on the adjacent street increase, re-entering the flow of traffic becomes more difficult and transit vehicles experience increased delay. Transit re-entry delay was calculated using empirical data presented in the 2000 Highway Capacity Manual (HCM). Total transit re-entry delay for each route was calculated as the sum of transit re-entry delay at each stop within the study area.

Passenger boarding delay – Although increases in transit ridership are generally viewed positively, the amount of time a transit vehicle has to stop to pick up and drop off passengers (i.e., the transit vehicle dwell time) is directly correlated to the number of passengers boarding the vehicle. If, as proposed, the project includes substantial improvements to transit service in the future (and as general transit ridership grows), vehicles would have to spend more time at stops, which may increase overall transit travel times. Passenger boarding delay was calculated assuming two seconds per passenger boarding for buses, and 0.5 seconds per passenger boarding for light rail or bus rapid transit (BRT) vehicles. Passenger boarding's within the study area were estimated by examining the increases in ridership across the study area cordons.

Although the transit routes in the study area would not be extended into the study area under existing conditions or under 2030 No Project conditions, transit delay for those scenarios was calculated as if the transit routes were extended only for purposes of comparing project impacts. Generally, the increases in travel times associated with the project are somewhat smaller than those associated with the increases expected between existing and 2030 No Project conditions.

Transit Delay Study Segments

Transit delay was calculated for the study transit routes between the project site and key destination/transfer points over the following segments:

- 9-San Bruno: Bayshore Boulevard between Sunnydale Avenue and Jerrold Avenue
- 23-Monterey: between Ingalls Street/Oakdale Avenue and the Glen Park BART Station
- 24-Divisadero: between Hunters Point Shipyard and Mission Street
- 28L-19th Avenue: between Hunters Point Shipyard and Mission Street
- 29-Sunset: between Candlestick Point and Mission Street
- 44-O'Shaughnessy: between Hunters Point Shipyard and the Glen Park BART Station
- 48-Quintara-24th St: between Hunters Point Shipyard and the 24th Street BART Station
- 54-Felton: between Jerrold Avenue/Earl Street and Mission Street
- T-Third: Third Street between Thomas Avenue and Jerrold Avenue

Transit Delay Impact Criteria

As noted in the Transportation Study and the DEIR, the Proposed Project would have a significant impact if it would increase travel times such that additional vehicles would be required to maintain the proposed headways. This was assumed to be the case if either the project's travel time increases to a particular route would be greater than ½ its proposed headway or if the number of required vehicles estimated using SFMTA's cost/scheduling model, which takes into account scheduled breaks and extra time built into schedules, increases by one or more vehicles with the addition of the project characteristics.

Revised Transit Delay Analysis – Project and Project Variants

This section describes the transit delay analysis and impacts associated with the Project and Project Variants.

Table 76 summarizes the increases in transit travel times associated with the Proposed Project and the Project Variants for each route within the study area, compared to 2030 No Project

(Alternative 1) conditions. **Table 77** identifies the number of additional vehicles that would be required to meet the proposed headways.

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Table 76
Project Increases to Transit Travel Time (minutes:seconds) [1]
Project and Project Variants – Weekday AM and PM Peak Hours

Route	Proposed Headway (min.)	Northbound/Eastbound				Southbound/Westbound			
		Project	Variant 1 (R&D)	Variant 2 (Housing)	Variant 2A (Housing/R&D)	Project	Variant 1 (R&D)	Variant 2 (Housing)	Variant 2A (Housing/R&D)
AM Peak Hour									
9-San Bruno	10	**1:09**	**1:07**	**1:19**	**0:01**	**8:04**	**8:42**	**8:09**	**7:00**
23-Monterey	15	0:41	0:41	0:38	**0:26**	3:51	3:51	3:51	**4:18**
24-Divisadero	6	**4:56**	**9:50**	**4:46**	**5:14**	**4:21**	**2:07**	**4:41**	**5:01**
28L-19th Ave Ltd	5	**4:23**	**5:28**	**4:17**	**4:29**	**10:07**	**10:04**	**9:47**	**12:47**
29-Sunset	10	**8:04**	**12:50**	**9:39**	**9:36**	**10:21**	**15:52**	**9:06**	**8:57**
44-O'Shaughnessy	6	**5:53**	**8:24**	**5:54**	**6:47**	**6:16**	**7:53**	**6:14**	**6:09**
48-Quintara-24th St	15	0:51	2:04	1:04	2:10	2:38	2:38	2:48	2:34
54-Felton [2]	20	0:56	3:23	1:39	1:55	-0:17	-3:10	-3:00	-1:59
T-Third	8	1:34	1:42	1:35	1:38	1:39	1:39	1:39	1:39
PM Peak Hour									
9-San Bruno	10	**4:03**	**4:19**	**3:55**	**3:06**	**6:49**	**6:56**	**6:49**	**6:25**
23-Monterey	15	0:56	0:58	0:58	**0:53**	1:57	2:01	1:57	**1:28**
24-Divisadero	6	**8:25**	**8:13**	**8:36**	**9:06**	**5:53**	**11:56**	**8:59**	**9:33**
28L-19th Ave Ltd	5	**8:59**	**9:42**	**8:50**	5:35	**6:03**	**6:46**	**5:54**	6:03
29-Sunset	10	**15:00**	**17:07**	**14:53**	**16:19**	**21:07**	**22:19**	**21:02**	**21:02**
44-O'Shaughnessy	6	**6:05**	**12:30**	**6:56**	**5:40**	**7:18**	**10:04**	**8:00**	**9:03**
48-Quintara-24th St	15	**8:03**	**9:02**	**8:40**	**6:57**	**3:37**	**5:21**	**3:43**	**4:48**
54-Felton [2]	20	**3:48**	**5:44**	**4:09**	**4:30**	**5:32**	**3:45**	**3:13**	**4:35**
T-Third	8	**2:57**	**3:35**	**2:50**	**3:08**	**2:33**	**2:45**	**2:32**	**2:38**

Notes:
1. Routes where the Project would increase travel times such that additional vehicles would be required highlighted in **bold**.
2. Due to roadway improvements proposed by the Project and differences between the No Project and Project land use assumptions at the Hunters Point Shipyard, there would be less traffic congestion along 54-Felton route in study area with the Project, than under 2030 No Project conditions.
Source: Fehr & Peers, 2010.

Table 77
Additional Muni Transit Vehicle Requirements
Project and Project Variants – Weekday AM and PM Peak Hours

Route	Project	Variant 1 (R&D)	Variant 2 (Housing)	Variant 2A (Housing/R&D)
AM Peak Hour				
9-San Bruno	**1**	**1**	**1**	**1**
23-Monterey	0	0	0	0
24-Divisadero	***2***	**2**	**2**	**2**
28L-19th Ave Ltd	**1**	**1**	**1**	**1**
29-Sunset	***2***	***3***	**2**	***2***
44-O'Shaughnessy	***1***	***1***	**1**	***1***
48-Quintara-24th Street	*0*	*0*	0	*0*
54-Felton	0	0	0	0
T-Third	0	0	0	0
Total	***7***	***8***	***7***	***7***
PM Peak Hour				
9-San Bruno	**1**	**1**	**1**	**1**
23-Monterey	0	0	0	0
24-Divisadero	***2***	**3**	**3**	***3***
28L-19th Ave Ltd	**1**	**1**	**1**	*0*
29-Sunset	***4***	***4***	**4**	***4***
44-O'Shaughnessy	***3***	**4**	**3**	***3***
48-Quintara-24th Street	***1***	**1**	**1**	**1**
54-Felton	**1**	**1**	**1**	**1**
T-Third	**1**	**1**	**1**	**1**
Total	***14***	***16***	***15***	***15***

Note:
Transit vehicle requirements for Project and Project Variants are in addition to those required for the 2030 No Project condition (Alternative 1, Table 83)
Italic indicates figure is different than that which appears in Transportation Study, November, 2010.
Source: Fehr & Peers, 2010.

Proposed Project: As shown on Table 77, under the Proposed Project, traffic and ridership demands would increase compared to conditions without the Proposed Project, and would result in the need for an additional 7 transit vehicles AM peak hour, and an additional 14 vehicles in the PM peak hour. During the AM peak hour, additional vehicles would be required on the 9-San Bruno (one vehicle), 24-Divisadero (two vehicles), 28L-19th Avenue Limited (one vehicle), 29-Sunset (two vehicles), and the 44-O'Shaughnessy (two vehicles) routes. These would be in addition to the 18 vehicles required to maintain 2030 No Project headways (see Table 83). In the PM peak hour, additional vehicles would be needed on the 9-San Bruno (one vehicle), 24-Divisadero (two vehicles), 28L-19th Avenue Limited (one vehicle), 29-Sunset (four vehicles), 44-O'Shaughnessy (three vehicles), 48-Quintara-24th Street (one vehicle), 54-Felton (one vehicle), and the T-Third (one train car). These would be in addition to the 16 required to maintain 2030 No Project headways.

These impacts to transit travel times were discussed in Impacts TR-21 through TR-27. Although mitigation measures were identified to reduce the severity of these impacts, the DEIR determined that their feasibility was uncertain because they would require detailed engineering feasibility studies and ultimate approval by SFMTA. Further, in some cases, even if feasibility were certain, the proposed mitigation measures would not fully mitigate the transit impacts to less than significant levels. Consequently, the DEIR concluded that the impacts would remain significant and unavoidable.

Many of the mitigation measures described in the DEIR included a series of options and/or improvements that should be considered in the feasibility study. Since the time of publication of the DEIR, feasibility studies have been conducted in collaboration with the Planning Department and SFMTA. As a result of this process, the recommended mitigation measures have been refined considerably and the mitigation measures have been made more specific. The language used to describe mitigation measures MM TR-21.1 through MM TR-27.1 has been refined as a result of this subsequent feasibility study, and will be included as staff-initiated text changes in the FEIR. Further, Master Response 18 – Traffic Mitigation Measures, has been included in the Comments and Responses portion of the FEIR, and includes a more detailed discussion of the mitigation measures, their feasibility, and their benefits to transit travel times.

However, because the mitigation measures require further approvals by the SFMTA board, and because some of them do not fully mitigate their associated impacts to less than significant levels, the conclusions of the DEIR (namely that the transit travel time impacts discussed in Impacts TR-21 through TR-27 would remain significant and unavoidable with mitigation) are unchanged.

Project Variant 1 – R&D: Under Project Variant 1, traffic and ridership demands would increase and result in the need for one additional transit vehicle (29-Sunset, one vehicle) in the AM Peak Hour and two additional vehicles (24-Divisadero, one vehicle; 44-O'Shaughnessy, one vehicle) in the PM Peak Hour in addition to those identified for the Proposed Project. The same significant impacts associated with Variant 1 identified in the Transportation Study and the DEIR would remain significant and unavoidable.

Project Variant 2 – Housing: Under Project Variant 2, traffic and ridership demands would increase and result in the need for zero additional transit vehicles in the AM Peak Hour and one additional vehicle (24-Divisadero, one vehicle) in the PM Peak Hour in addition to those identified for the Proposed Project. The same significant impacts associated with Variant 2 identified in the Transportation Study and the DEIR would remain significant and unavoidable.

Project Variant 2A – Housing/R&D: Under Project Variant 2A, traffic and ridership demands would increase and result in the need for zero additional transit vehicles in the AM Peak Hour and one additional vehicle (24-Divisadero, one vehicle) in the PM Peak Hour in addition to those identified for the Proposed Project. The same significant impacts associated with Variant 2A identified in *CP-HPS Phase II Developmental Plan Transportation Study, Supplemental Memorandum – Project Variant 2A (Housing/R&D)*, LCW Consulting, March 2010 would remain significant and unavoidable.

Revised Transit Delay Analysis – Project and Project Alternatives

This section describes the transit delay analysis and impacts associated with Project Alternatives.

Table 82 summarizes the increases in transit travel times associated with Alternatives to the Project for each route within the study area, compared to 2030 No Project (Alternative 1) conditions. Although neither Alternative 1 nor the existing conditions include extensions of transit routes into the project site, the analysis of increases to transit travel times over existing conditions associated with Alternative 1 was conducted for the same segments as the Project, to provide a meaningful comparison. **Table 83** identifies the number of additional vehicles that would be required to meet the proposed headways.

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Table 82
Project Increases to Transit Travel Time (minutes:seconds)[1]
Alternatives to the Project – Weekday AM and PM Peak Hours [2]

Route	Proposed Headway (min.)	Northbound / Eastbound			Southbound / Westbound		
		Alt. 1 No Project	Alt. 3 49ers at Candlestick	Alt. 4 Lesser Build	Alt. 1 No Project	Alt. 3 49ers at Candlestick	Alt. 4 Lesser Build
AM Peak Hour							
9-San Bruno	10	**39:52**	-1:06	**0:53**	**9:20**	0:25	**7:26**
23-Monterey	15	**8:24**	0:07	0:35	**3:33**	0:18	3:50
24-Divisadero	6	**6:35**	**12:46**	**12:16**	**7:41**	**-0:06**	**0:20**
28L-19th Ave Ltd	5	**5:20**	3:24	3:44	**7:24**	7:54	8:32
29-Sunset	10	**3:42**	**7:54**	**12:04**	**3:53**	**12:56**	**16:43**
44-O'Shaughnessy	6	**11:06**	**6:11**	4:24	**8:25**	**5:09**	4:58
48-Quintara-24th St	15	**8:03**	-0:02	-1:00	**0:14**	2:00	1:41
54-Felton [3]	20	**4:24**	-0:02	-0:54	**4:59**	-2:18	-3:05
T-Third	8	**7:01**	0:54	1:13	**5:13**	1:39	1:39
PM Peak Hour							
9-San Bruno	10	**43:53**	0:52	**3:12**	**23:02**	1:21	**6:15**
23-Monterey	15	**8:14**	0:42	0:54	**10:26**	0:34	1:44
24-Divisadero	6	**4:08**	-3:33	**-2:41**	**4:30**	6:59	**7:03**
28L-19th Ave Ltd	5	**2:26**	**10:10**	12:29	**5:20**	**3:49**	5:13
29-Sunset	10	2:36	**7:50**	**15:55**	-1:35	**13:53**	**20:22**
44-O'Shaughnessy	6	**12:57**	**4:48**	**4:01**	**10:21**	**8:06**	**5:52**
48-Quintara-24th St	15	**11:53**	-2:44	-3:26	**6:30**	5:03	3:30
54-Felton [3]	20	**13:31**	**3:28**	**3:28**	**6:56**	**2:43**	**3:15**
T-Third	8	**4:16**	**1:54**	**2:17**	**5:13**	**1:07**	**1:58**

Notes:
1. Routes where project would increase travel times such that additional vehicles would be required highlighted in **bold**.
2. Travel times for Alternative 2 same as for Project, and travel times for Alternative 5 same as Project Variant 2, as presented on Table 76. The exception is the 28L-19th Avenue Limited, were travel times in each direction would increase by five minutes per direction as neither Alternative 2 nor Alternative 5 would include the Yosemite Slough bridge.
3. Due to roadway improvements proposed by the Project and differences between the No Project and Project land use assumptions in the Hunters Point Shipyard, there would be less traffic congestion along 54-Felton route in the study area with the Project, than under 2030 No Project conditions.
Source: Fehr & Peers, 2010.

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Table 83
Additional Muni Transit Vehicle Requirements
Alternatives to the Project – Weekday AM and PM Peak Hours

Route	Alternative 1 No Project	Alternative 2 No Bridge	Alternative 3 49ers at Candlestick	Alternative 4 Lesser Build	Alternative 5 No Park Agreement
AM Peak Hour					
9-San Bruno	***6***	**1**	0	**1**	**1**
23-Monterey	**1**	0	0	0	0
24-Divisadero	***3***	***2***	***2***	**1**	**2**
28L-19th Ave Ltd	**1**	**1**	0	0	**1**
29-Sunset	**1**	***2***	***2***	***3***	***2***
44-O'Shaughnessy	***2***	**2**	***1***	*0*	***1***
48-Quintara-24th St	**1**	*0*	*0*	*0*	*0*
54-Felton	**1**	0	0	0	0
T-Third	**2**	0	0	0	0
Total	***18***	***8***	***5***	***5***	***7***
PM Peak Hour					
9-San Bruno	**7**	**1**	0	**1**	**1**
23-Monterey	**1**	0	0	0	0
24-Divisadero	*2*	*2*	*0*	*1*	***3***
28L-19th Ave Ltd	**1**	**1**	**1**	**0**	**1**
29-Sunset	**0**	***4***	*2*	***4***	***4***
44-O'Shaughnessy	**4**	***3***	**2**	**2**	***3***
48-Quintara-24th St	**1**	*1*	*0*	*0*	**1**
54-Felton	**1**	**1**	**1**	**1**	**1**
T-Third	**1**	**1**	*1*	**1**	**1**
Total	***18***	***14***	***7***	***10***	***15***

Note:
Transit vehicle requirements for Alternatives 2 through 5 are in addition to those required for the 2030 No Project condition (Alternative 1).
Italic indicates figure is different than that which appears in Transportation Study, November, 2010.
Source: Fehr & Peers, 2010.

Alternative 1 – No Project: As shown on Table 83, under Alternative 1 - No Project, traffic and ridership demands would increase and result in the need for an additional 18 transit vehicles in the AM peak hour, and an additional 18 vehicles in the PM peak hour. During the AM peak hour, additional vehicles would be required on the 9-San Bruno (six vehicles), 23-Monterey (one vehicle), 24-Divisadero (three vehicles), 28L-19th Avenue Limited (one vehicle), 29-Sunset (one vehicle), 44-O'Shaughnessy (two vehicles), the 48-Quintara-24th Street (one vehicle), the 54-Felton (one vehicle) and the T-Third (two train cars). In the PM peak hour, additional vehicles would be needed on the 9-San Bruno (seven vehicles), 23-Monterey (one vehicle), 24-Divisadero (two vehicles), 28L-19th Avenue Limited (one vehicle), 44-O'Shaughnessy (four vehicles), 48-Quintara-24th Street (one vehicle), 54-Felton (one vehicle), and the T-Third (one train car).

Alternative 2 – No Bridge: Under Alternative 2, traffic and ridership demands would increase and result in the need for 8 additional transit vehicles in the AM Peak Hour and 14 additional vehicles in the PM Peak Hour in addition to those identified to maintain 2030 No Project conditions (18 vehicles in the AM peak hour, and 18 vehicles in the PM peak hour). The same significant impacts associated with Alternative 2 identified in the Transportation Study and the DEIR would remain significant and unavoidable.

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Alternative 3 – 49ers at Candlestick: Under Alternative 3, traffic and ridership demands would increase and result in the need for 5 additional transit vehicles in the AM Peak Hour and 7 additional vehicles in the PM Peak Hour in addition to those identified to maintain 2030 No Project conditions (18 vehicles in the AM peak hour, and 18 vehicles in the PM peak hour). The same significant impacts associated with Alternative 3 identified in the Transportation Study and the DEIR would remain significant and unavoidable.

Alternative 4 – Lesser Build: Under Alternative 4, traffic and ridership demands would increase and result in the need for 5 additional transit vehicles in the AM Peak Hour and 10 additional vehicles in the PM Peak Hour in addition to those identified to maintain 2030 No Project conditions (18 vehicles in the AM peak hour, and 18 vehicles in the PM peak hour). The same significant impacts associated with Alternative 4 identified in the Transportation Study and the DEIR would remain significant and unavoidable.

Alternative 5 – No Park Agreement: Since the land use program and transit operating plan for Alternative 5 would be the same as for Project Variant 2. The same significant impacts associated with Alternative 5 identified in the Transportation Study and the DEIR would remain significant and unavoidable.

SUMMARY

The revisions described herein to the transit delay analysis presented in the Transportation Study and DEIR did not identify any additional significant impacts to transit travel times beyond those previously identified and disclosed in the Transportation Study and DEIR. The same mitigation measures identified in those documents would continue to apply based on the information presented in this letter. However, as discussed above and further described in Master Response 18 in the Comments and Responses to the DEIR, additional feasibility studies of transit-related mitigation measures have been performed since publication of the DEIR. This has resulted in more detailed information regarding feasible improvements. As a result, the text of mitigation measures MM TR-21 through MM TR-27 has been revised to incorporate this subsequent feasibility study.

We hope you find this information useful. Please do not hesitate to call for clarifications or additional information.

Sincerely,

FEHR & PEERS

Eric Womeldorff
Senior Transportation Engineer

SF08-0407

Appendix E There is no appendix associated with Section III.E

Appendix F There is no appendix associated with Section III.F

Appendix G Cermak Peterka Petersen Pedestrian Wind Assessment, March 10, 2008

CPP
CERMAK
PETERKA
PETERSEN

Monday, March 10, 2008

Stuart Jones
IBI Group
700 – 1285 W. Pender St.
Vancouver, BC
V6E 4B1

Re: Preliminary Pedestrian Wind Assessment: Response to Comments
Candlestick Point and Hunter's Point Developments, CPP Project 4139,
Addendum 1.

Dear Stuart:

This letter report addresses three issues related to the Preliminary Pedestrian Wind Assessment Final Report issued by CPP in June of 2007.

The first issue concerns changes to some of the tower locations. In some cases, the movement of the tower is expected to improve wind conditions, while in other cases, ground level winds will increase. However, the basic merits of the original layout are maintained, which is that the random layout of the towers (see Figures 1 and 2) is an excellent design feature in terms of mitigating a number of wind effects (when compared to closely grouped towers which can effectively form a wall for certain wind directions).

The second issue concerns the effects of Bayview Hill and Hunter's Point Hill on the wind conditions in the proposed developments. Both hills are directly upwind of the developments for the prevailing westerly winds. As stated in the final report, the hills will:

1. accelerate the wind,
2. change the direction slightly, and
3. cause additional turbulence or gustiness.

1. Accelerated wind flows around hills are most pronounced at the crests and near the sides. For the dominant west winds, the primary location of concern for wind acceleration is at the south end of the hill. As most of the development lies to the west of the hill, acceleration is not considered a major concern.

2. Around San Francisco Bay, high winds are most common in the late afternoon between March and October. During these times, the atmosphere is often quite stable, with a thermal inversion between 1000 ft and 3000 ft above sea level. The lower the temperature inversion, the more wind is forced around the hills, rather than flowing over the top of the hills. This is particularly pronounced for hills which are as high as, or higher than, the inversion level. On days with a particularly low inversion, winds would be expected to be channeled along the direction of the hill, which would produce more of a west-northwest wind at the development site. This possibility is addressed in Figure 11 of the final report. Given that the streets are required to

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follow a grid pattern (staggered or meandering streets would further reduce the likelihood of high wind speeds at street level), the streets are well aligned to minimize the likelihood of high pedestrian winds for both the prevailing W and W winds.

3. The full effects of the hills on local wind patterns are difficult to predict. However, one effect which is certain is that much of the Candlestick development will be in the wake of the Bayview hill most afternoons and evenings from spring through autumn. As noted in the final report, wakes tend to feature lower mean wind speeds, but higher turbulence or gustiness. A wind tunnel study of Candlestick Park performed by Jack Cermak at Colorado State University shortly after the stadium was built revealed that it is the turbulence from Bayview Hill which caused wind gusting problems at the Park, making field goals and fly balls more difficult. The wake effect (more gusts, lower average speeds) will diminish with distance from the hill. The wake effect behind Hunter's Point Hill will be much less pronounced that at Candlestick, as the hill is much lower.

Hunter's Point and Candlestick Point are known to be windy locations. Both the proposed arrangement of the streets (at angles to the dominant winds) and the proposed locations of the towers (spread about the development) are well designed to avoid exacerbating wind conditions for pedestrians. Nonetheless, it is likely that mitigation will be desirable in many locations. Potential mitigation measures include

a. Winding or staggered streets (rather than a clean grid pattern) would keep with winds from sweeping along the streets from end to end, thus helping to keep the faster winds above building height.

b. Narrow streets would also help to keep high winds above the low-rise buildings and therefore above street level.

c. Taller buildings will channel high winds from their upper floors down to street level. This phenomenon is called "downwash". It can be mitigated using podium setbacks and street level awnings; for effective mitigation the setback and awnings would have to be of the order of 15 ft. As the winds are highly directional, setbacks may only be needed for buildings faces exposed to the west. Note however that San Francisco Bay does occasionally see strong winds from the south during the winter months. The benefit provided by setbacks can be quantified with a wind tunnel study.

d. Trees, trellises and porous fences are all common mitigation techniques for locations with higher than desirable pedestrian winds. The benefits of these measures can also be quantified by a wind tunnel study.

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Pedestrian level wind conditions around the site are expected to be acceptable for use as a main public accessway, but amelioration techniques as discussed above are likely to be required at specific sites, particularly to ensure the retail areas are fit for purpose and where outdoor dining is being considered. Additional advice on these matters can be given once the detailed design has commenced. Please do not hesitate to contact me with questions or comments.

Sincerely,

David Banks
Sr. Associate

CPP, Inc.
Wind Engineering and Air Quality Consultants

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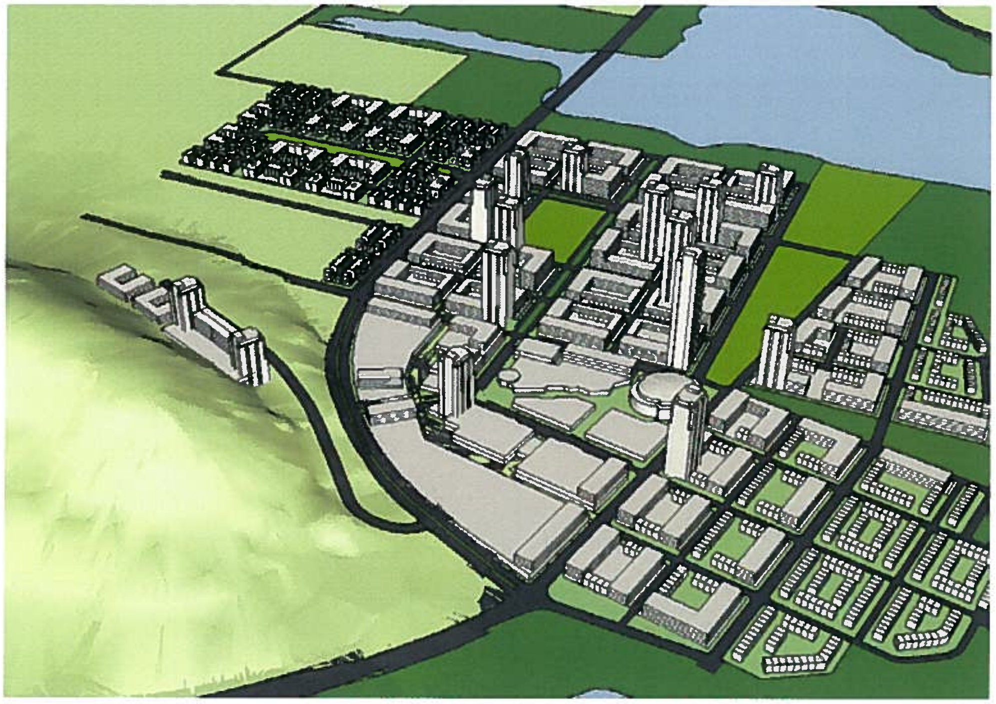

Figure 1: Proposed development at Candlestick Point

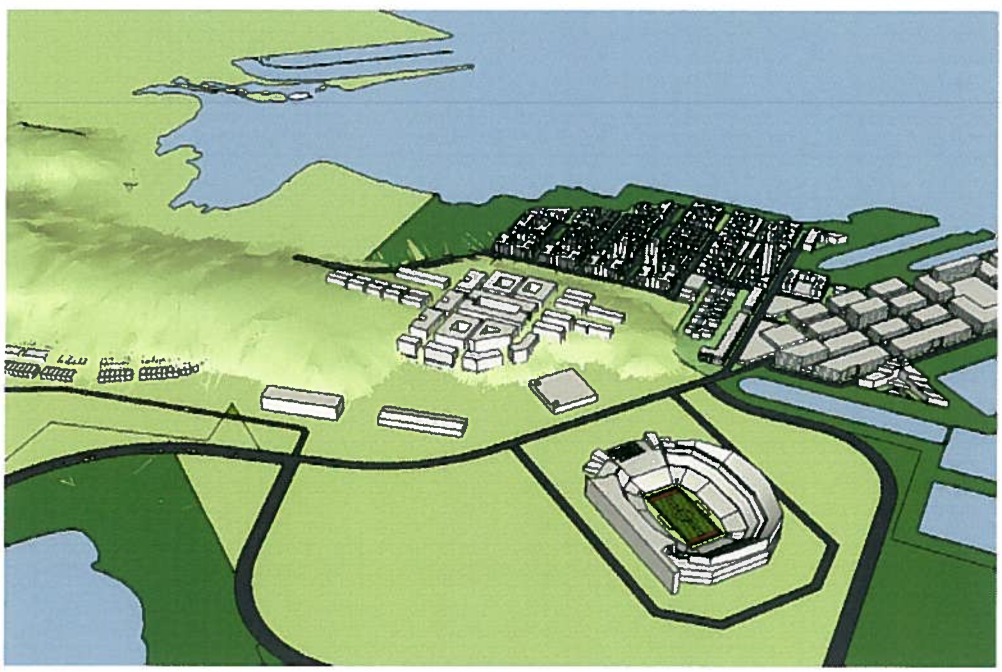

Figure 2: Proposed development at Hunter's Point

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FINAL REPORT

PRELIMINARY PEDESTRIAN WIND ASSESSMENT
CANDLESTICK POINT AND HUNTERS POINT DEVELOPMENTS
San Francisco, California

CPP Project 07-4129

June 2007

Prepared by:

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EXECUTIVE SUMMARY

An assessment has been made of the likely environmental wind conditions around the proposed Candlestick and Hunters Point developments, San Francisco. This report follows on from a study of the local wind climate, architectural sketch drawings, and discussion with the client. The purpose of the report is to offer advice on the orientation of the development with regard to the likely wind conditions.

Pedestrian level wind conditions around the site are expected to be acceptable for use as a main public accessway, but amelioration techniques are suggested to ensure the retail areas are fit for purpose. No change in the orientation of the roads is recommended.

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1. INTRODUCTION

It is generally accepted that wind speed and the rate of change of wind velocity are the primary parameters that should be used in the assessment of how wind affects pedestrians. Local wind effects can be assessed with respect to a number of environmental wind speed criteria established by various researchers. Despite the apparent differences in numerical values and assumptions made in their development, it has been found that when these are compared on a probabilistic basis, there is remarkably good agreement. Because pedestrians will tolerate higher wind speeds for a smaller period of time than for lower wind speeds, these criteria provide a means of evaluating the overall acceptability of a pedestrian location. Also, a location can be evaluated for its intended use, such as for an outdoor café or a sidewalk. One of the most widely accepted set of criteria was developed by Lawson (1990).

Lawson's criteria have categories for discomfort, based on wind speeds exceeded 5% of the time. The criteria also include a distress rating, for safety assessment, which is based on occasional (once or twice per year) wind speeds. In both cases, the wind speed used the larger of a mean or gust-equivalent-mean (GEM) wind speed. The criteria based on the mean wind speeds define when the steady component of the wind causes discomfort, whereas the GEM wind speeds define when the wind gusts cause discomfort. For this report only the mean wind speeds for distress are discussed. The wind speed categories are listed in Table 1.

A detailed assessment of the acceptability of the pedestrian-wind environment is often desirable (and is required in windier cities such as Boston or San Francisco) during the project design phase so that mitigation measures (typically changes to the landscaping) can be made, if necessary, to improve areas found to be excessively windy. Such an assessment is carried out using scaled-models in a boundary layer wind tunnel, as analytical methods such as computational fluid dynamics (CFD) are not capable at this time, except in very simple geometries, to estimate wind pressures, frame loads, or windiness in pedestrian areas.

In some situations, however, the massing of the buildings presents adverse wind conditions which cannot be easily remedied through local mitigation. A good example of this is Candlestick Park, which was studied by Dr. Jack Cermak at Colorado State University, in a pioneering wind tunnel test in 1963 (see Figure 1). This study revealed that many of the wind problems experienced in the stadium could have been avoided if the stadium and the parking lot locations had been reversed.

It is the goal of this report to make preliminary assessment of the potential for pedestrian wind problems at the Hunter's Point and Candlestick Point developments. In a detailed assessment, the wind speeds at several points around the site would be measured for 16 wind directions, and the results would be compared to the Lawson criteria at each location. For this preliminary assessment, the criteria of Lawson will serve primarily as a guidelines for the discussion, as we discuss the wind conditions necessary for ratings of suitable for sitting, standing, walking, or business walking.

The proposed developments are depicted in Figure 2 and Figure 3. In the plan view of Figure 2, difference section of the developments are identified:

A. Residential, primarily townhomes. There is a retail strip along the main road running along the NW border of the section, which is expected to have café's and outdoor seating. The street orientation is section A is set by the planners.

B. Retail, with a parking garage on the western edge. Two residential towers are visible to the west of section B. These towers are on the side of the 400 ft-tall hill located to the west of the site.

C. Residential, including several high-rise towers. As with section A, there is a retail corridor along some of the perimeter roads. The street orientation is section C is designed to match that of the existing streets to the northwest of the section.

D. Residential, a mix of 4-story wood frame and three towers. The street orientation is designed to match an existing street grid.

E. Office space and parking structures. The street grid orientation is set by the planners.

F. A residential space which includes many existing buildings.

Note that a proposed football stadium for the San Francisco 49ers is shown at the southern end of the Hunters Point images.

2. WIND CLIMATE

Wind climatology for the everyday winds that affect pedestrians was defined using wind statistics from nearby anemometers. The locations of these anemometers relative to the proposed developments sites are shown in Figure 4. For wind engineering analysis along the San Francisco peninsula, it is customary to use data from San Francisco International Airport (SFO).

The wind roses of Figure 5 indicate the direction and strength of winds at a height of 10m at this airport. The wind roses are simply stacked bar charts arranged in a circle– the longer the bar, the more often the winds originate from that direction. For example, we see in Figure 5a that the dominant wind direction is the West-Northwest, with winds coming out of this direction 23% of the time. Of these winds, winds exceeding 12 mph account for 14%, or nearly two thirds of these winds. Winds come from the neighboring wind directions (West and Northwest) 13% of the time each, so that these three wind directions account for roughly half of the winds.

To get some sense what these winds speeds entail, the Beaufort wind scale is provided in Table 2. Sir Francis Beaufort established the earliest quantitative description of wind effects in 1806, for use at sea. It is still in use today (Penwarden and Wise 1975). The Beaufort scale is based on *mean* velocity only, and includes qualitative descriptions of wind effects. Table 2 suggests that mean wind speeds below 12 mph are of minor concern and that mean wind speeds above 24 mph are definitely inconvenient.

A closer examination of the wind patterns in San Francisco reveals that the winds change markedly during the winter months (Figure 5c), becoming milder and less dominated by the west-northwesterly winds. Figure 6 indicates that the winds also change significantly during the day, typically intensifying from late morning until reaching an average peak of 20 knots (23 mph) in the late afternoon, then diminishing in the evening. As it is the highest 5% of the wind speeds which dictate the pedestrian wind rating system of Table 1, this report will focus on the potential impact of these summer afternoon winds, shown in Figure 5b. Locations which are susceptible to these directions can be expected to experience higher speeds more often, and will develop reputations as windy places. The high exceedance of the wind speed governing the criteria for long term stationary activities, Table 1, means that any outdoor eating areas will have to be carefully located to ensure acceptable conditions and profitable tenancies.

Figure 7a illustrate one of the ways in which a location can be susceptible to winds. When strong winds are aligned with a street grid, then the winds tend to sweep along the streets. Conversely, if the winds and the street are at angles to each other, then the wind tends to pass over the streets, as shown in Figure 7b. This issue is further addressed in the Discussion section below. However, in order to avoid aligning the streets with the dominant wind direction, it is important to identify this wind direction accurately. Figure 8 plots the fraction of the time that a given wind direction was measured at SFO for three different time periods, which represent different anemometer locations. Prior to 1995, the dominant wind direction was 300° (270° is winds from the west; 315° is winds from the NW). After the anemometer was moved in 1995, the dominant wind direction is now reported as 290°.

Given the sensitivity of street orientation to wind direction, CPP pursued additional wind data closer to the sites. Reliable wind data was located for three years from a downtown anemometer, and this data is overlayed with the SFO data in Figure 8. This data indicates less of a shift to the west than had been expected, and that winds from the NW are less of a concern than winds from the west.

CPP has also determined that reliable wind data from a well sited anemometer was recorded at the Hunters Point Naval Shipyard as part of the Superfund Site monitoring. Only 16 months of data from this anemometer are available. To avoid seasonal bias, one full calendar year from Hunters Point is presented in Figure 8 and Figure 9a. This data indicates a clear dominance of westerly winds; strong winds outside a band from 240° to 300° are quite rare.

This shift between the airport and downtown is not unexpected. The dominant wind direction is know to shifts with locations around the bay. Figure 9b shows wind data taken from an anemometer across the bay in Oakland, indicating that winds generally come more from the west (270°). Figure 10 shows data taken from around the bay area. We see that on this summer afternoon, winds at SFO are out of the west, but out of the west-southwest at Golden Gate. Wind direction is affected by local topography.

The Candlestick Point development will be influenced by the relatively large hill to the west, which will tend to accelerate the wind and may change the direction from west towards west-north-west. It is the turbulence from this hill which causes wind gusting problems at Candlestick Park.

3. DISCUSSION

3.1 Street Orientation

As mentioned above, when looking at the overall orientation of the scheme it is important to ensure that the streets do not align with the strong prevailing summer afternoon winds, otherwise the wind will be funneled along these streets causing uncomfortable conditions. The funneling of wind will occur along any street when there is a continuous street front with buildings in the order of 4 storeys or taller.

Figure 11 illustrates the street alignment when compared to the prevailing wind directions. None of the streets are vulnerable to west winds. The sections in which the street plan is based upon the existing street plan are vulnerable as the winds shift towards the NW, but these winds are outside the dominant range at Hunters Point.

The streets in each of the sections are aligned in a manner to encourage the wind to flow over the top of the buildings reducing the wind speed at ground level. This becomes more important the wider the street, which may be of importance for the park areas in embedded in the residential areas. Wide streets bordered by tall buildings are especially vulnerable to this so-called "wind tunnel" funneling phenomenon.

Winding streets that do not follow a grid, such as those in section B, can keep high winds above the buildings as well. The impact of wind funneling can be reduced by planting tall, bushy trees along these streets to force the winds to stay above the street level.

3.2 Retail Areas

Candlestick Point has a retail block, and two retail strips; the primary one running south-west to north-east which is understood to contain outdoor eating areas, and the secondary running north-west to south east. The retail block (section B), with its irregular street pattern, is ideal for minimising adverse wind conditions. While the gridded street plans of sections A and C are well aligned to minimize the adverse effects of the dominant winds, the street orientations will nonetheless occasionally tend to encourage wind to be funneled to the retail crossroads, particularly if the local topography shifts the wind directions to align with the nearby hill. The full effects of the hill are difficult to predict. It is likely that much of the candlestick development will be in the wake of the hill much of the time. Wakes tend to feature lower mean wind speeds, but higher turbulence or gustiness.

Wind conditions at the main crossroads are likely to be gusty and outdoor eating should not be located on this corner (see red highlighted region in Figure 11a). It is best to locate the outdoor eating areas towards the centre of the blocks. Awnings along the street front will give additional protection not only from wind, but also rain, thereby encouraging patrons to come even in inclement weather.

While the street alignments are close to ideal, the potential need to mitigate remains considerable in the face of such a strong dominant afternoon winds. Mitigation measures to counteract pedestrian wind problems could include awnings along the retail strip, combined with local screening and roadside tree planting.

3.3 General Guidelines

Corners: It is best to locate entrances at least 5 m away from the corners of buildings, as these are typically the windiest locations.

Balconies: Any balconies on the high-rise towers should be located away from the building corners, otherwise they will only be usable for a short period of the year. Balconies facing into the prevailing wind direction will be equally uncomfortable for a large portion of the year and can cause issues with building operations due to internal pressurisation.

Towers:

1. By setting the tower on a podium with about a 5 m setback from the street edge, the downwash is forced into the street away from the pedestrian areas. The current scheme typically has the tall towers on the street edge and it would be preferable to mount these on podiums, alternatively include awnings along all frontages in the vicinity of the towers.
2. The random layout of the towers is an excellent design feature in terms of mitigating a number of wind effects. The only tower that causes slight concern is the one on the corner of the main retail streets as this has the potential to cause problems along the main retail strip. It would be better if this tower could be located away from this corner.

3.4 Conclusion

This area of San Francisco is known to be windy, especially in summer afternoons when winds from the west quadrant dominate the wind climate. Based on the Hunters Point wind data, the street alignments are close to ideal to reducing the effects of winds. In spite of this, it is likely that some locations will be too windy for certain uses, simply because of how windy the site is.

Pedestrian level wind conditions around the site are expected to be acceptable for use as a main public accessway, but amelioration techniques as discussed above will be required to ensure the retail areas are fit for purpose, particularly where outdoor dining is being considered.

Additional advice on these matters can be given once the detailed design has commenced.

REFERENCES

Hunt, J.C.R., Poulton, E.C., and Mumford, J.C. (1976), "The Effects of Wind on People; New Criteria Based on Wind Tunnel Experiments," *Building and Environment*, Vol. II, pp. 15 – 28.

Isyumov, N., and Davenport, A.G. (1976), "The Ground Level Wind Environment in Built-Up Areas," *Proceedings of the Fourth International Conference on Wind Effects on Buildings and Structures*, Cambridge University Press, United Kingdom, pp. 403 – 422.

Lawson, T.V., and Penwarden, A.D. (1976), "The Effects of Wind on People in the Vicinity of Buildings," *Proceedings of the Fourth International Conference on Wind Effects on Buildings and Structures*, Cambridge University Press, United Kingdom, pp. 605 – 622.

Penwarden, A.D., and Wise, A.F.E. (1975), "Wind Environment Around Buildings," *Building Research Establishment Report*, HMSO.

FIGURES

Figure 1 Original Candlestick Park wind tunnel test model

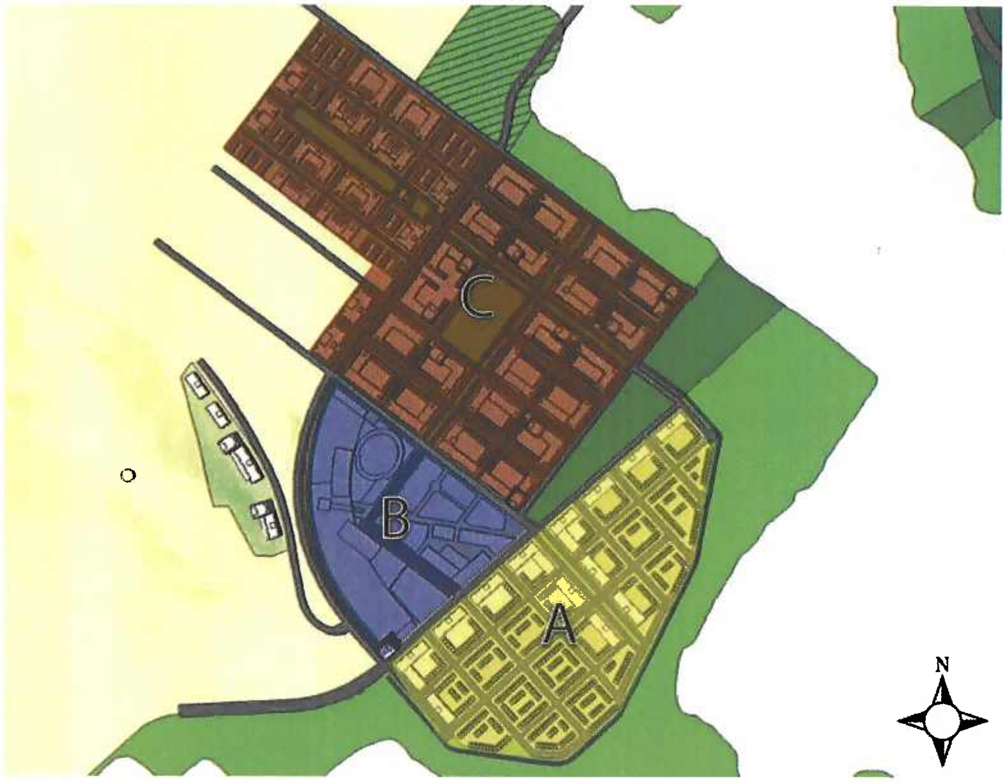


Figure 2a Proposed development at Candlestick Point

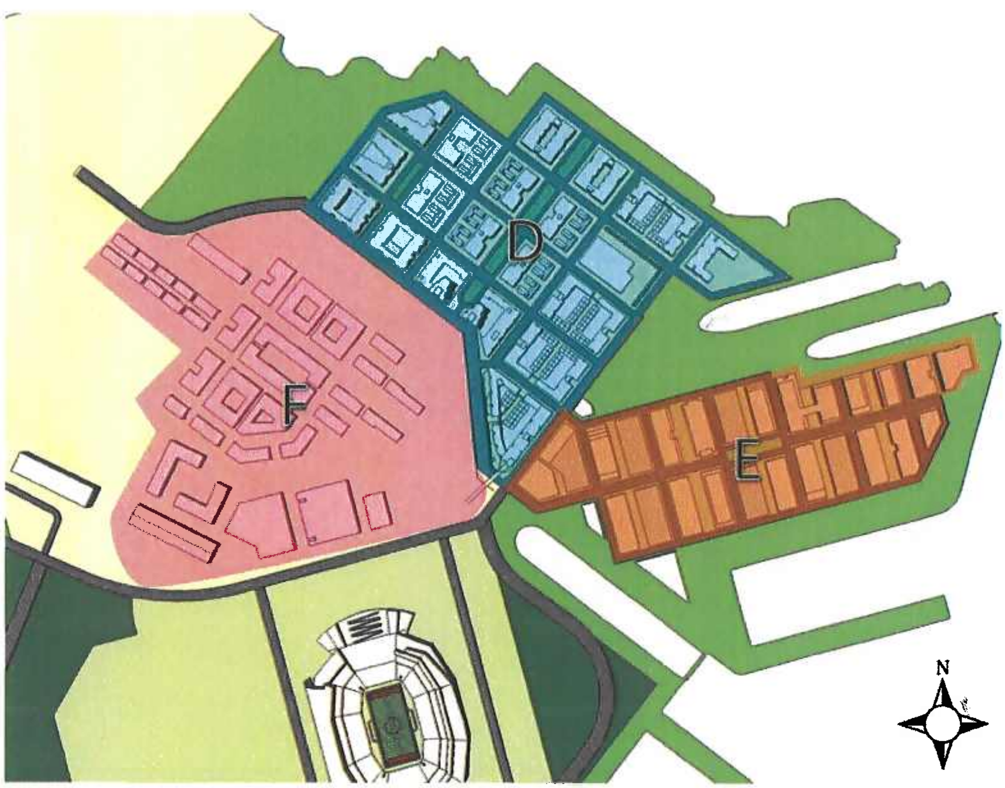


Figure 2b Proposed development at Hunters Point

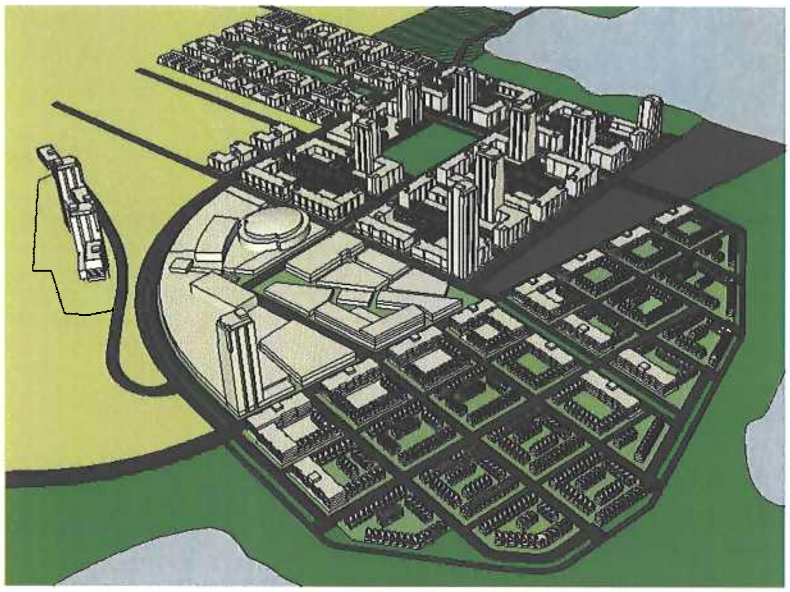


Figure 3a Proposed development at Candlestick Point

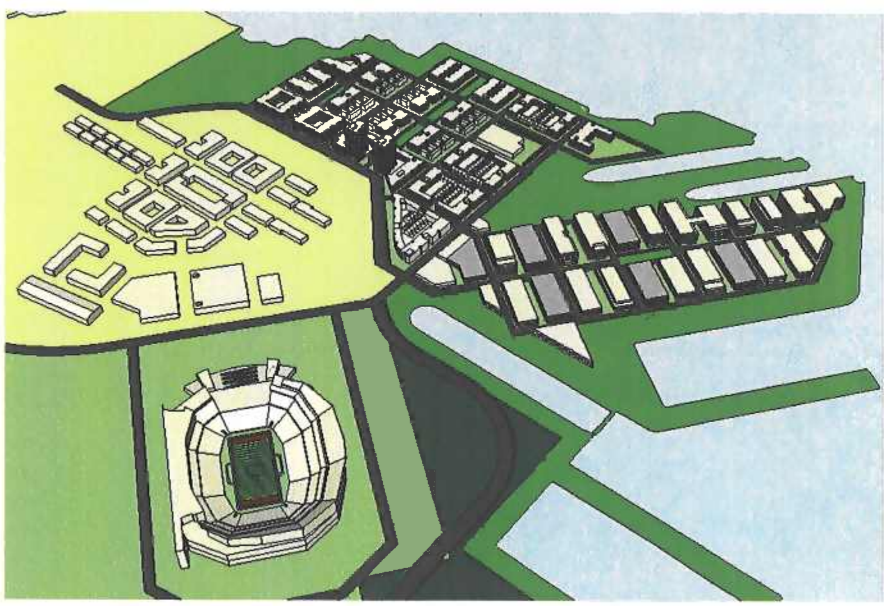


Figure 3b Proposed development at Hunters Point

BayAnemometersP

Figure 4. Project location.

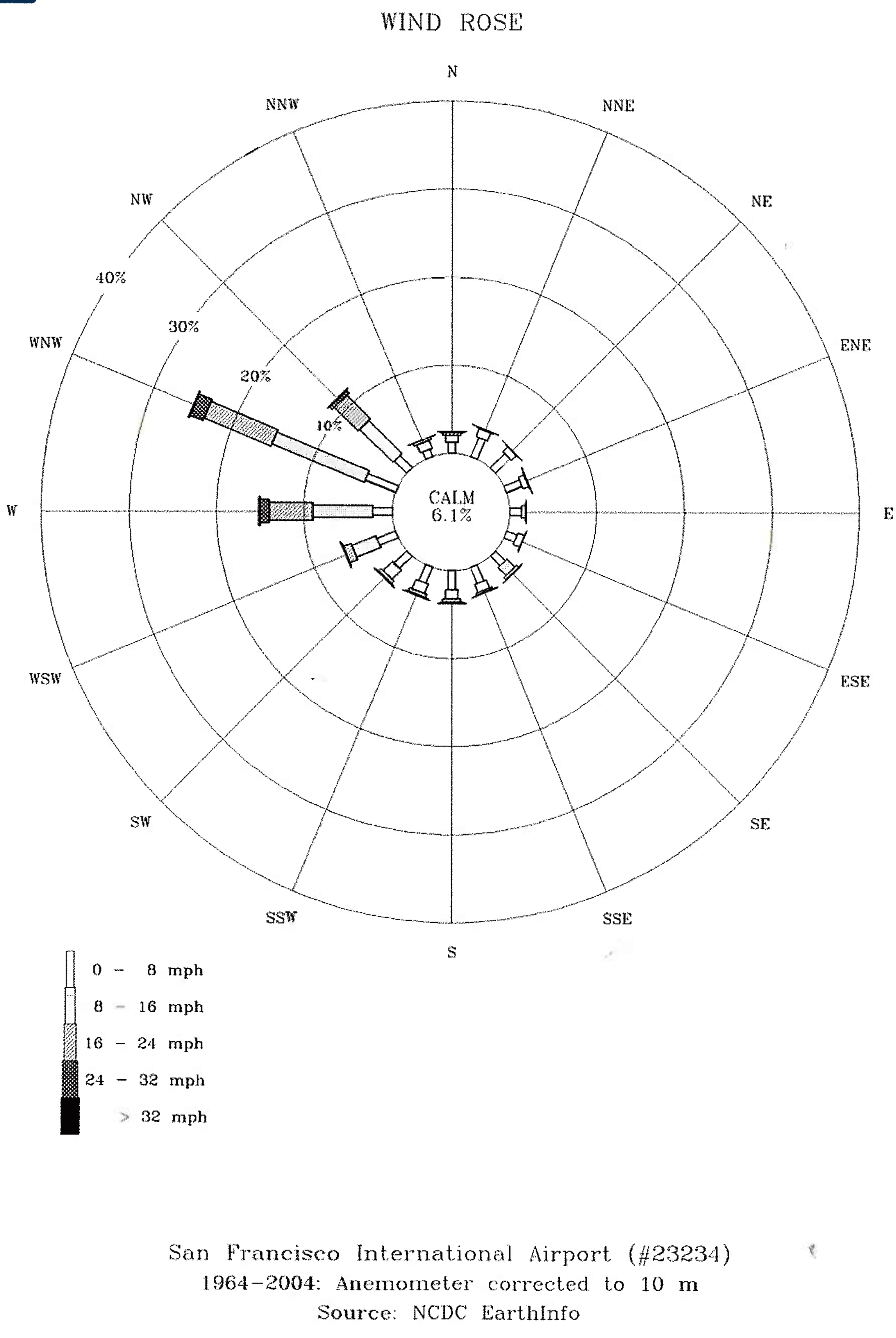
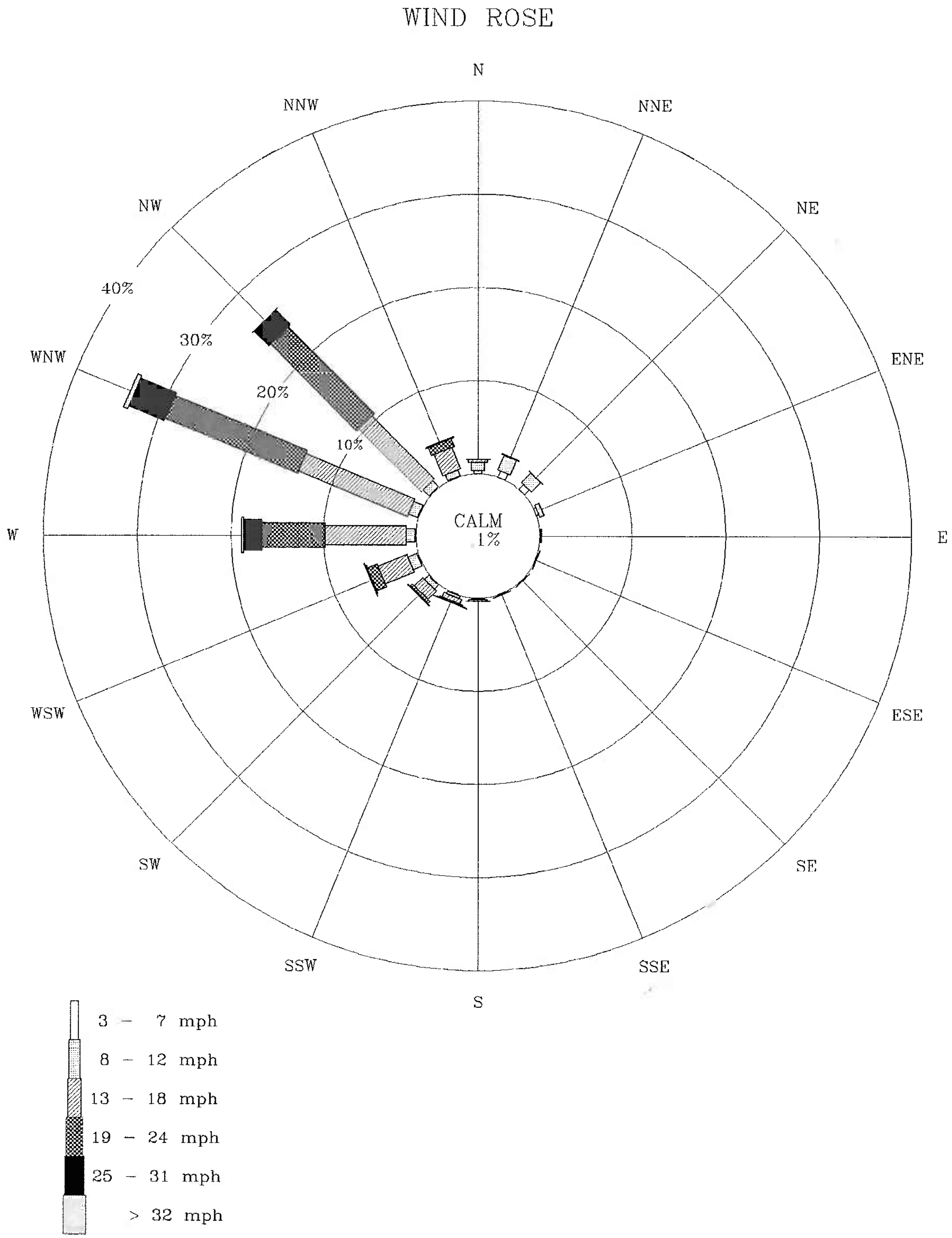


Figure 5a. San Francisco International Airport wind rose (all year, all hours).



San Francisco International Airport – June–August, noon–8pm
1981–1995: 10 m Anemometer
Source: Earth Info CD

Figure 5b. San Francisco International Airport wind rose, summer afternoons.

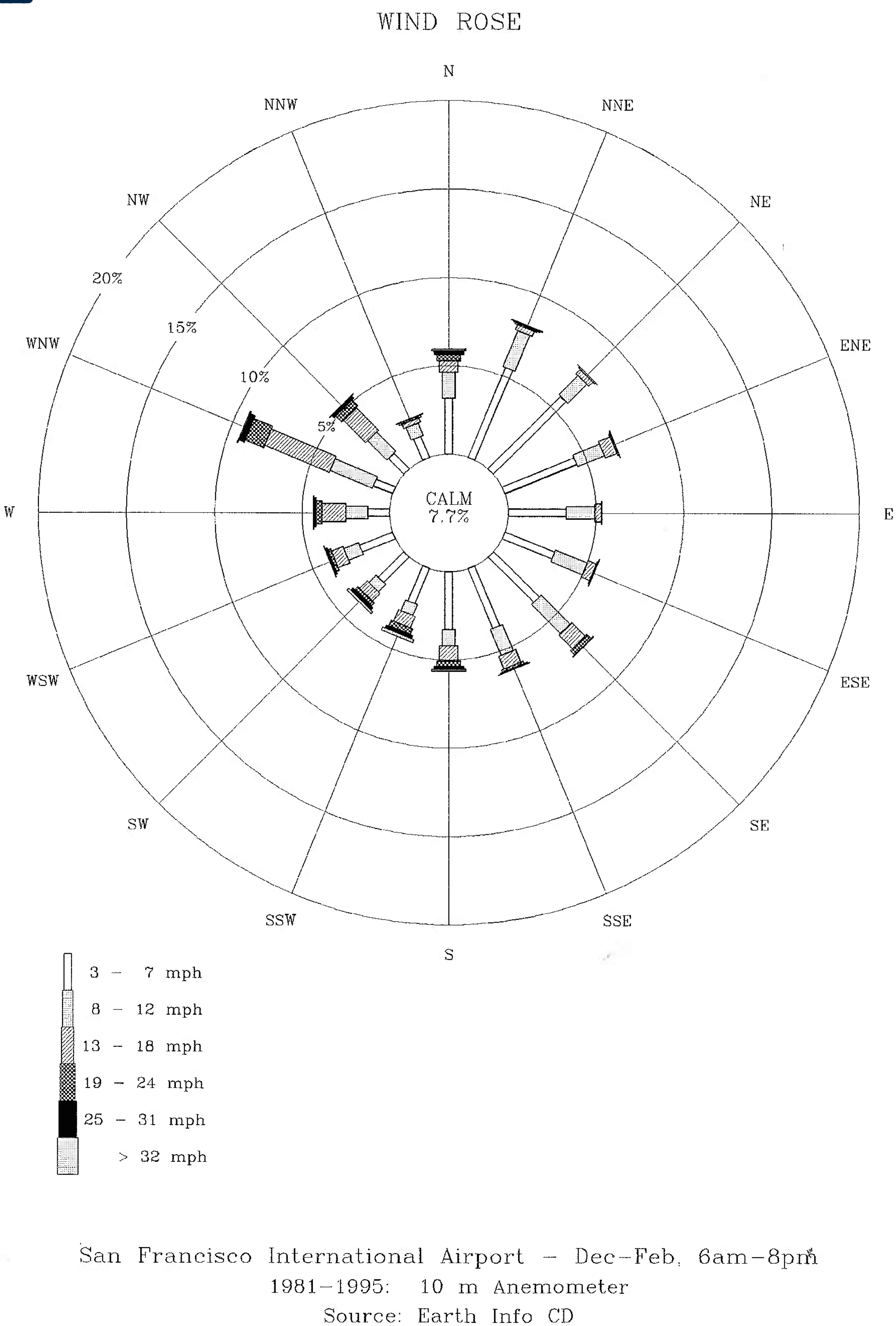


Figure 5c. San Francisco International Airport wind rose, winter daytime.

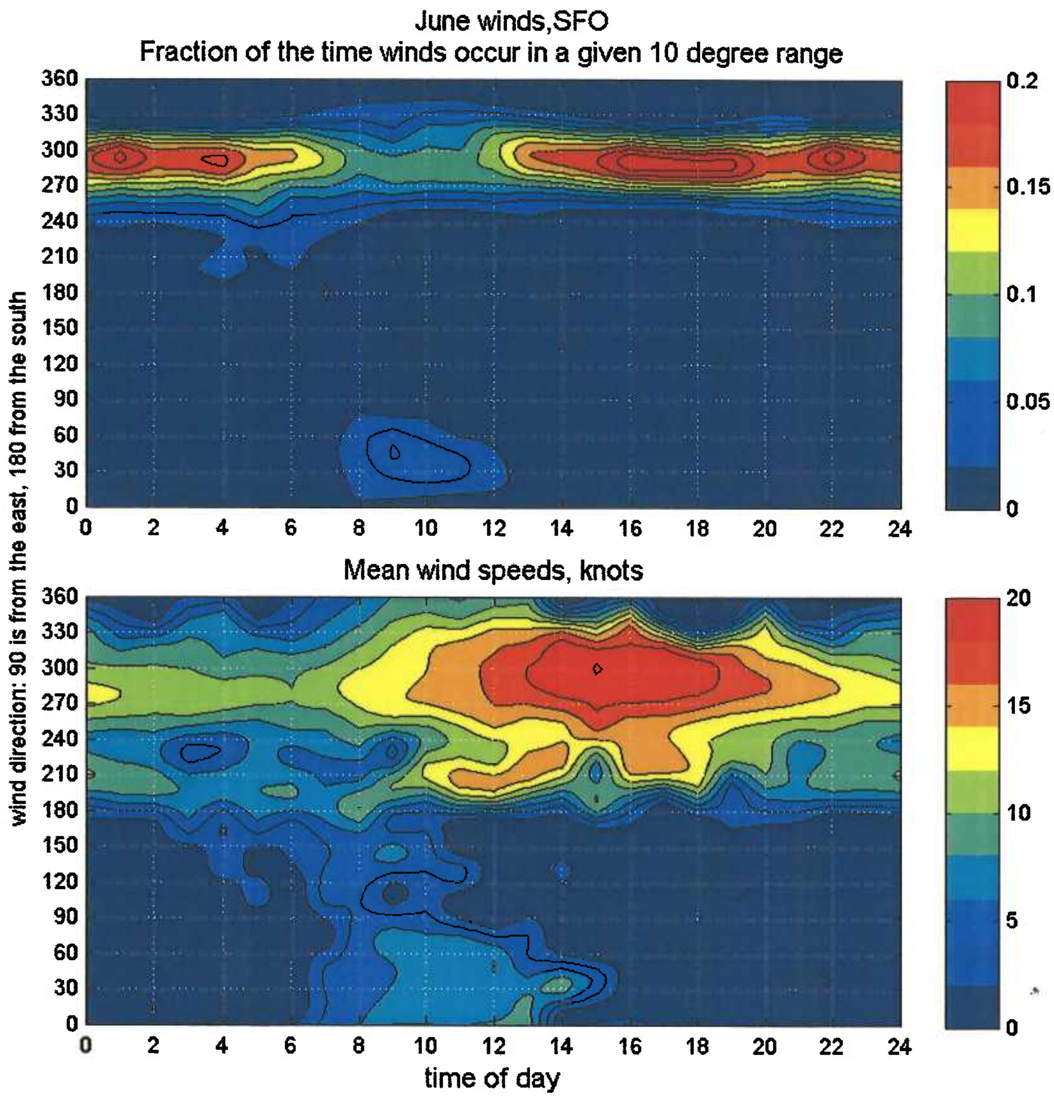


Figure 6 San Francisco International Airport wind speed and direction contours vs. time of day.

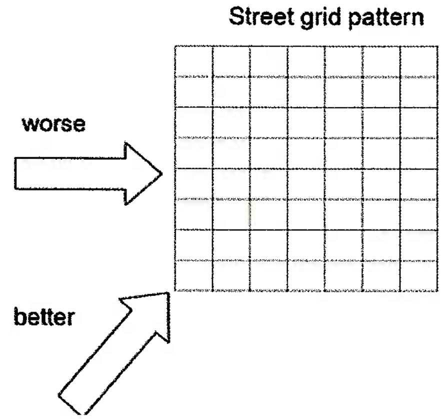


Figure 7a Winds which are not aligned with the direction of the street typically reduce wind speeds at street level.

Figure 7b Illustration of recirculating flows in a street canyon

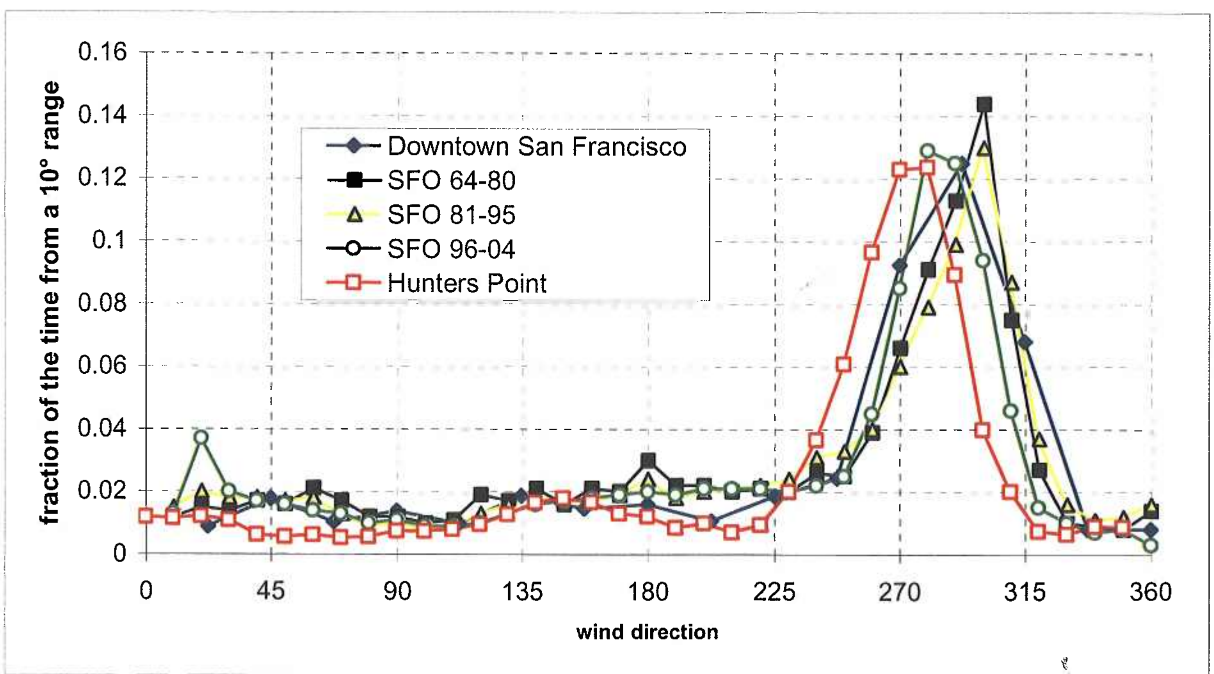


Figure 8 Uncertainty in the dominant wind direction related to anemometer position.

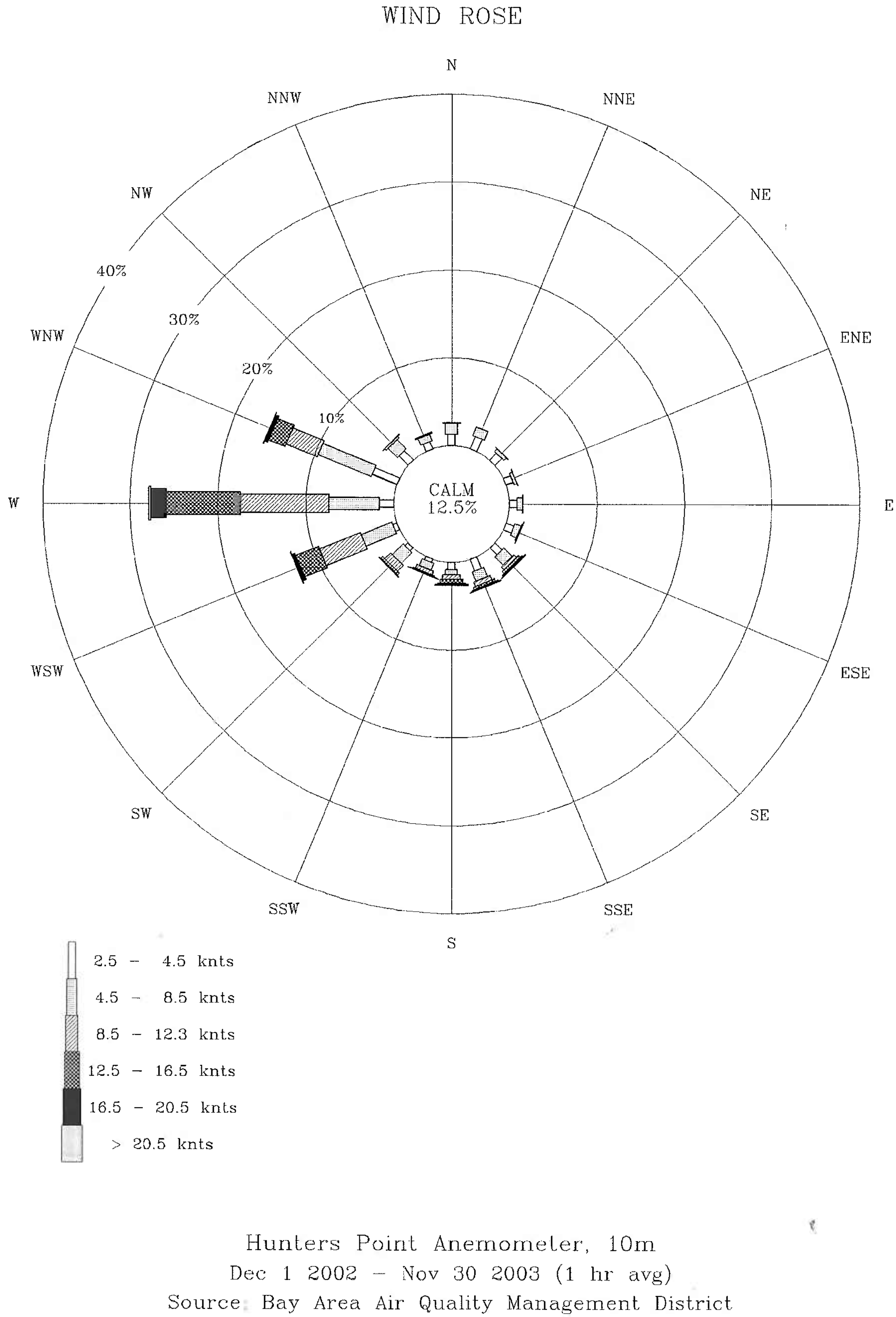


Figure 9 Hunters Points naval shipyard anemometer. 7 knots = 8 mph.

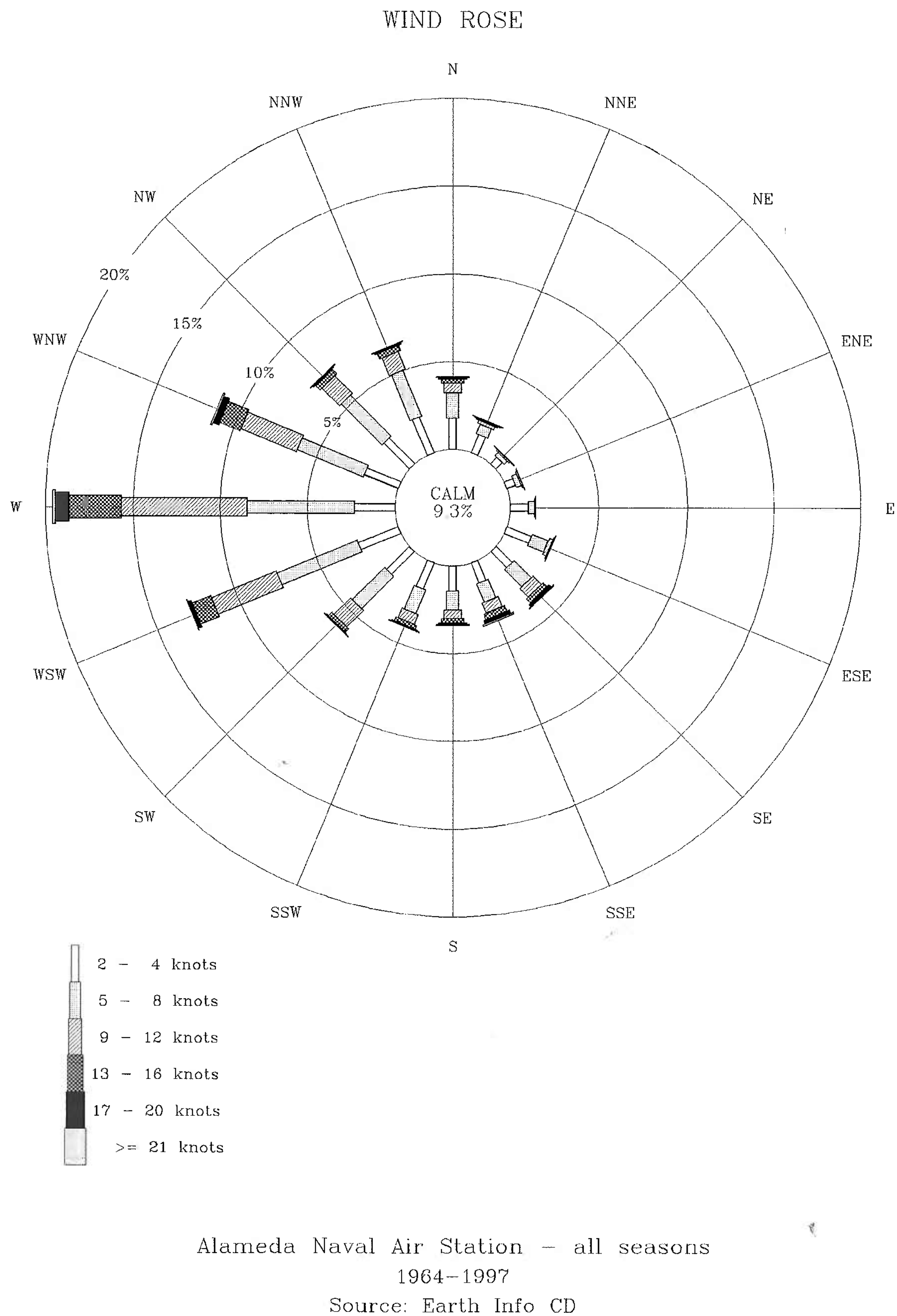


Figure 9 Oakland Alameda Naval Air Station wind rose. 7 knots = 8 mph.

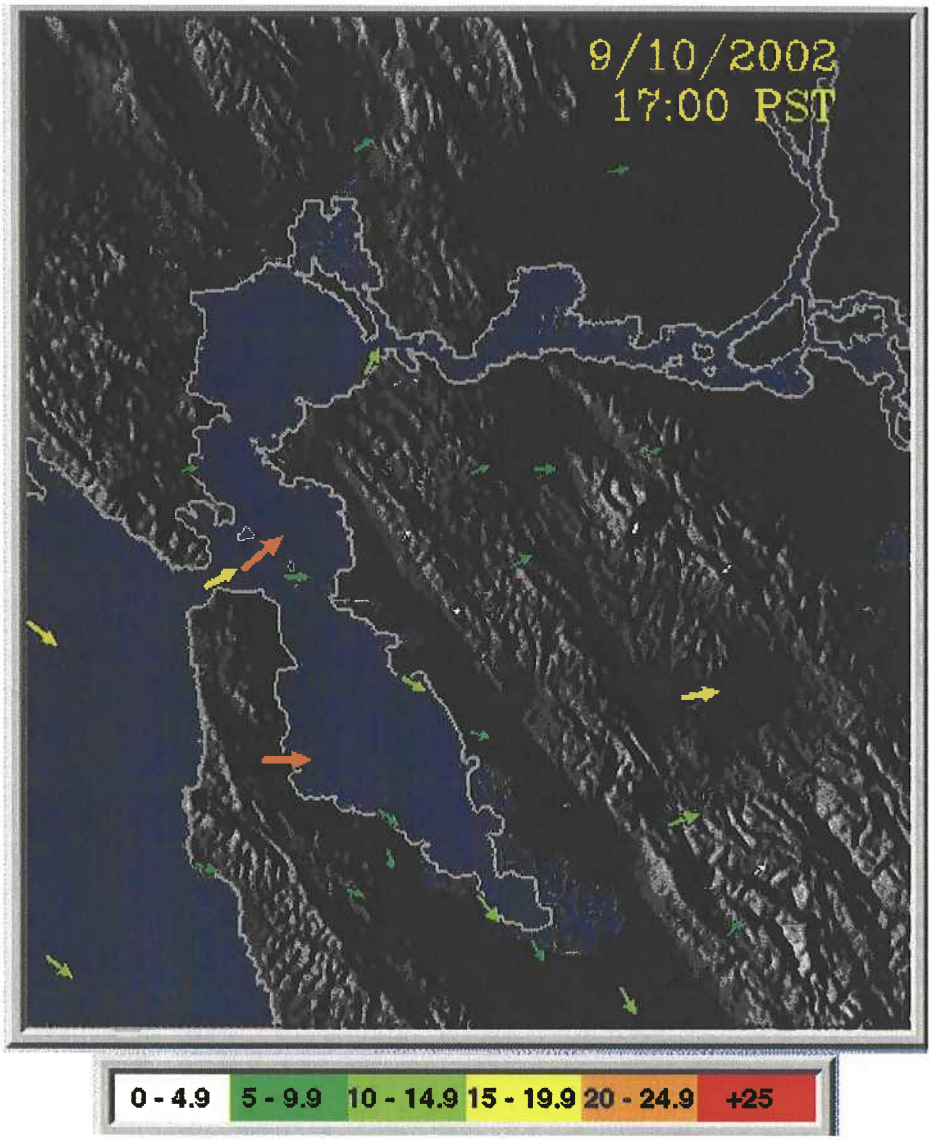
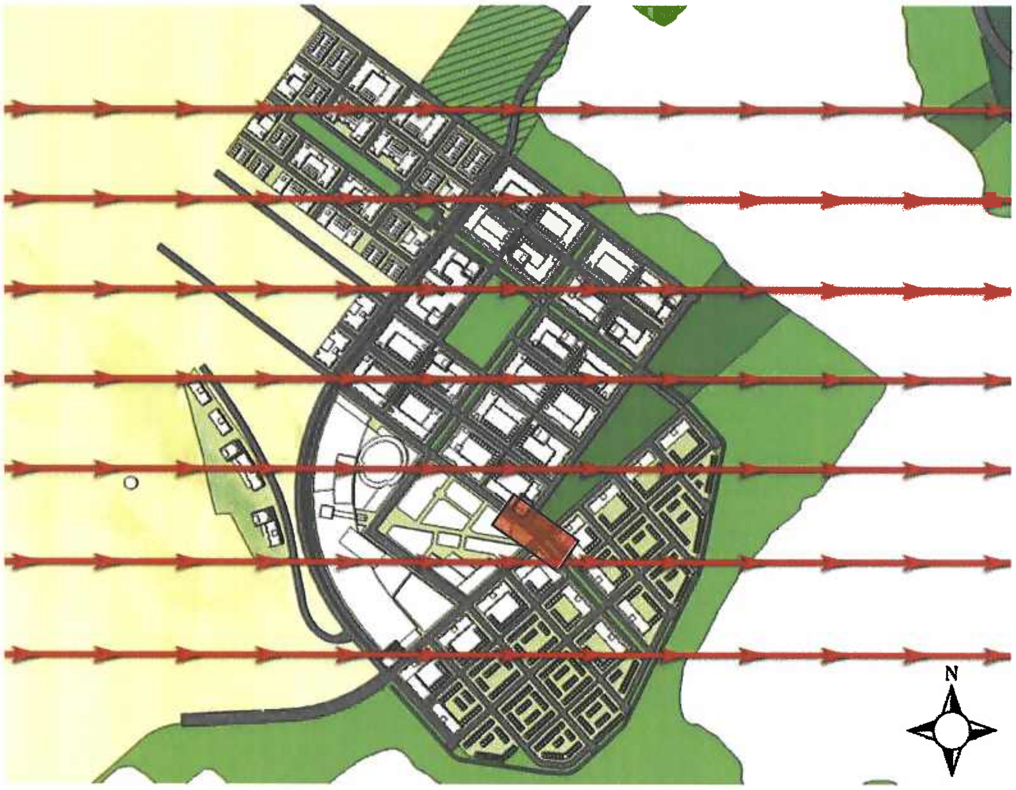


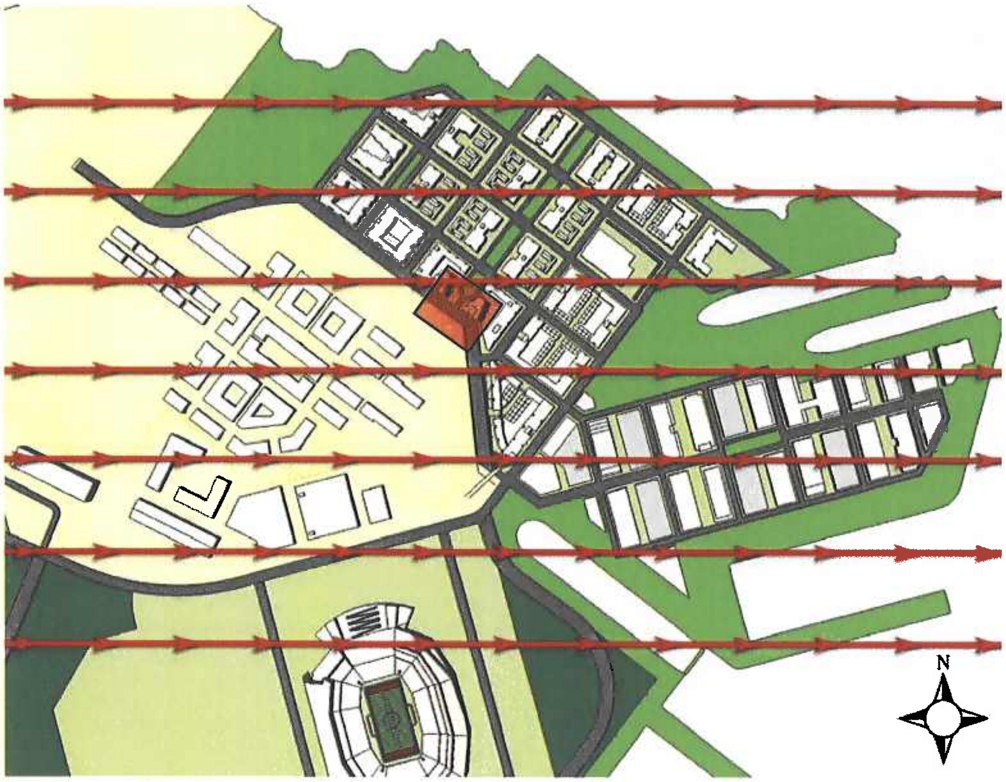
Figure 10: San Francisco Bay anemometer readings for 5 pm, Sept 10, 2002
(from http://sfports.wr.usgs.gov/cgi-bin/wind/windbin.cgi)



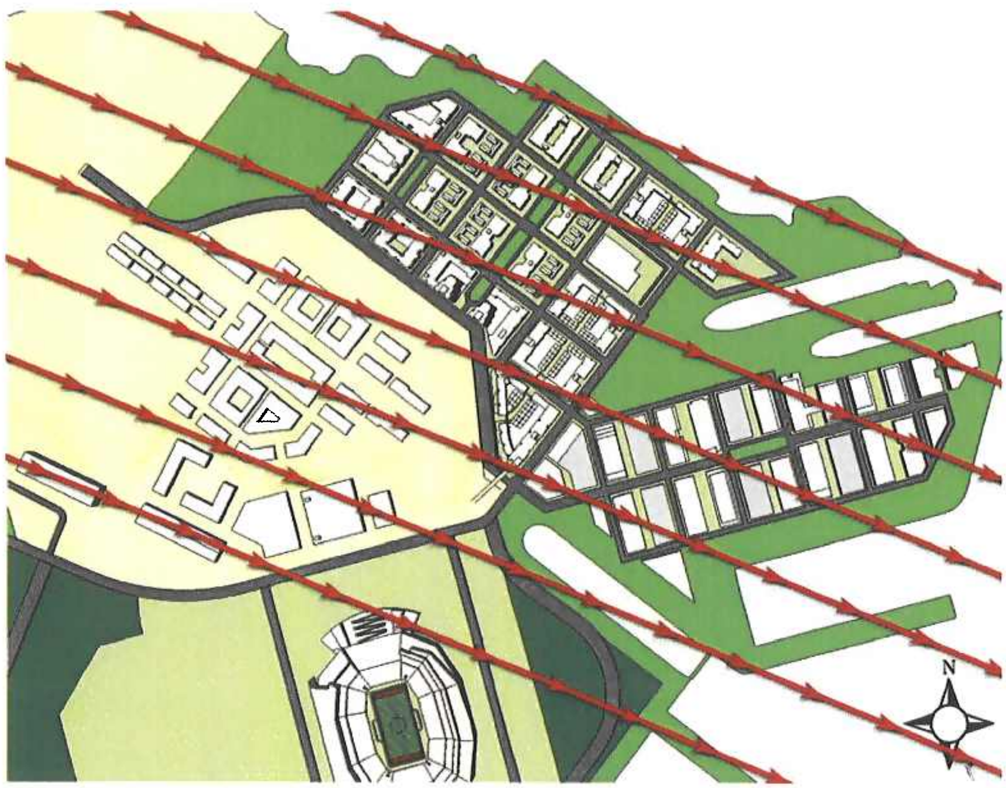
Westerly

WNW

Figure 11a. Plan view of Candlestick showing comparing street alignment with dominant wind directions. Red highlighted boxes indicate areas of concern.



Westerly



WNW

Figure 11b. Plan view of Hunters Point comparing street alignment with dominant wind directions.

TABLES

TABLE 2
SUMMARY OF LAWSON CRITERIA

Comfort (maximum of mean or gust-equivalent-mean (GEM[1]) wind speed exceeded 5% of the time)		
< 4 m/s	< 9 mph	Pedestrian Sitting (considered to be of long duration)
4 - 6 m/s	9 - 13 mph	Pedestrian Standing (or sitting for a short time or exposure)
6 - 8 m/s	13 - 18 mph	Pedestrian Walking
8 - 10 m/s	18- 22 mph	Business Walking (objective walking from A to B or for cycling)
> 10 m/s	> 22 mph	Uncomfortable
Distress (for safety assessment)		
15 m/s	34 mph	not to be exceeded more than two times per year (or one time per season)

Note:

1. The gust-equivalent-mean (GEM) is the peak gust wind speed divided by 1.85.

TABLE 2

SUMMARY OF WIND EFFECTS ON PEOPLE

Description	Beaufort Number	Mean Speed (mph)	Mean Speed (m/s)	Effects
Calm, light air	0, 1	0–3	0–2	Calm, no noticeable wind.
Light breeze	2	4–7	2–3	Wind felt on face.
Gentle breeze	3	8–12	3–5	Wind extends light flag. Hair is disturbed. Clothing flaps
Moderate breeze	4	13–18	5–8	Raises dust, dry soil, and loose paper. Hair disarranged.
Fresh breeze	5	19–24	8–11	Force of wind felt on body. Drifting snow becomes airborne. Limit of agreeable wind on land.
Strong breeze	6	25–31	11–14	Umbrellas used with difficulty. Hair blown straight. Difficult to walk steadily. Wind noise on ears unpleasant. Windborne snow above head height (blizzard).
Near gale	7	32–38	14–17	Inconvenience felt when walking.
Gale	8	39–46	17–21	Generally impedes progress. Great difficulty with balance in gusts.
Strong gale	9	47–54	21–24	People blown over by gusts.

Note: Table from Penwarden and Wise [1975].

Appendix H1 PBS&J Air Quality Model Input/Output, July 2009

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview CP Variant 1.urb924

Project Name: Bayview Waterfront CP Varaint 1

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	449.11	69.91	43.36	0.00	0.16	0.16	88,301.51

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	241.34	217.11	2,372.22	6.42	1,143.23	215.11	639,585.25

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	690.45	287.02	2,415.58	6.42	1,143.39	215.27	727,886.76

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	5.34	69.79	34.09	0.00	0.13	0.13	88,284.66
Hearth - No Summer Emissions							
Landscape	0.74	0.12	9.27	0.00	0.03	0.03	16.85
Consumer Products	384.05						
Architectural Coatings	58.98						
TOTALS (lbs/day, unmitigated)	449.11	69.91	43.36	0.00	0.16	0.16	88,301.51

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

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Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	151.23	125.36	1,394.32	3.73	661.83	124.62	371,698.27
Racquetball/health	3.93	4.00	42.71	0.12	21.01	3.95	11,694.44
Hotel	4.99	4.37	46.62	0.13	22.94	4.31	12,766.23
Regnl shop. center	63.66	65.77	699.47	1.92	344.96	64.84	191,878.61
Strip mall	12.53	12.95	137.69	0.38	67.91	12.76	37,771.38
Office park	5.00	4.66	51.41	0.14	24.58	4.63	13,776.32
TOTALS (lbs/day, unmitigated)	241.34	217.11	2,372.22	6.42	1,143.23	215.11	639,585.25

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	206.58	5.76	dwelling units	7,850.00	45,216.00	386,583.26
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Hotel		8.17	rooms	220.00	1,797.40	13,404.11
Regnl shop. center		42.94	1000 sq ft	635.00	27,266.90	201,584.18
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93

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Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	150.00	1,713.00	14,358.37
					83,007.30	667,890.62

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Regnl shop. center				2.0	1.0	97.0
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview CP Variant 1.urb924

Project Name: Bayview Waterfront CP Varaint 1

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	450.91	113.20	52.56	0.28	3.64	3.60	143,696.42

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	243.97	312.71	2,478.29	5.46	1,143.23	215.11	550,544.24

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	694.88	425.91	2,530.85	5.74	1,146.87	218.71	694,240.66

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	5.34	69.79	34.09	0.00	0.13	0.13	88,284.66
Hearth	2.54	43.41	18.47	0.28	3.51	3.47	55,411.76
Landscaping - No Winter Emissions							
Consumer Products	384.05						
Architectural Coatings	58.98						
TOTALS (lbs/day, unmitigated)	450.91	113.20	52.56	0.28	3.64	3.60	143,696.42

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

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Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	140.94	180.69	1,444.82	3.18	661.83	124.62	320,160.25
Racquetball/health	4.50	5.76	45.11	0.10	21.01	3.95	10,057.48
Hotel	4.91	6.29	49.25	0.11	22.94	4.31	10,979.23
Regnl shop. center	73.89	94.62	740.29	1.63	344.96	64.84	165,004.06
Strip mall	14.54	18.63	145.73	0.32	67.91	12.76	32,481.11
Office park	5.19	6.72	53.09	0.12	24.58	4.63	11,862.11
TOTALS (lbs/day, unmitigated)	243.97	312.71	2,478.29	5.46	1,143.23	215.11	550,544.24

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	206.58	5.76	dwelling units	7,850.00	45,216.00	386,583.26
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Hotel		8.17	rooms	220.00	1,797.40	13,404.11
Regnl shop. center		42.94	1000 sq ft	635.00	27,266.90	201,584.18
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93

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Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	150.00	1,713.00	14,358.37
					83,007.30	667,890.62

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Regnl shop. center				2.0	1.0	97.0
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview CP Variant 2.urb924

Project Name: Bayview Waterfront CP Varaint 2

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	373.21	59.73	39.03	0.00	0.14	0.14	75,304.25

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	215.33	195.55	2,132.43	5.78	1,029.41	193.68	575,662.62

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	588.54	255.28	2,171.46	5.78	1,029.55	193.82	650,966.87

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	4.55	59.61	29.76	0.00	0.11	0.11	75,287.40
Hearth - No Summer Emissions							
Landscape	0.74	0.12	9.27	0.00	0.03	0.03	16.85
Consumer Products	318.00						
Architectural Coatings	49.92						
TOTALS (lbs/day, unmitigated)	373.21	59.73	39.03	0.00	0.14	0.14	75,304.25

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

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Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	125.22	103.80	1,154.53	3.09	548.01	103.19	307,775.64
Racquetball/health	3.93	4.00	42.71	0.12	21.01	3.95	11,694.44
Hotel	4.99	4.37	46.62	0.13	22.94	4.31	12,766.23
Regnl shop. center	63.66	65.77	699.47	1.92	344.96	64.84	191,878.61
Strip mall	12.53	12.95	137.69	0.38	67.91	12.76	37,771.38
Office park	5.00	4.66	51.41	0.14	24.58	4.63	13,776.32
TOTALS (lbs/day, unmitigated)	215.33	195.55	2,132.43	5.78	1,029.41	193.68	575,662.62

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	171.05	5.76	dwelling units	6,500.00	37,440.00	320,100.79
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Hotel		8.17	rooms	220.00	1,797.40	13,404.11
Regnl shop. center		42.94	1000 sq ft	635.00	27,266.90	201,584.18
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93

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Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	150.00	1,713.00	14,358.37
					75,231.30	601,408.15

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Regnl shop. center				2.0	1.0	97.0
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview CP Variant 2.urb924

Project Name: Bayview Waterfront CP Varaint 2

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	374.57	95.55	45.05	0.23	3.02	2.99	121,169.75

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	219.73	281.63	2,229.82	4.91	1,029.41	193.68	495,484.83

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	594.30	377.18	2,274.87	5.14	1,032.43	196.67	616,654.58

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	4.55	59.61	29.76	0.00	0.11	0.11	75,287.40
Hearth	2.10	35.94	15.29	0.23	2.91	2.88	45,882.35
Landscaping - No Winter Emissions							
Consumer Products	318.00						
Architectural Coatings	49.92						
TOTALS (lbs/day, unmitigated)	374.57	95.55	45.05	0.23	3.02	2.99	121,169.75

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

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Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	116.70	149.61	1,196.35	2.63	548.01	103.19	265,100.84
Racquetball/health	4.50	5.76	45.11	0.10	21.01	3.95	10,057.48
Hotel	4.91	6.29	49.25	0.11	22.94	4.31	10,979.23
Regnl shop. center	73.89	94.62	740.29	1.63	344.96	64.84	165,004.06
Strip mall	14.54	18.63	145.73	0.32	67.91	12.76	32,481.11
Office park	5.19	6.72	53.09	0.12	24.58	4.63	11,862.11
TOTALS (lbs/day, unmitigated)	219.73	281.63	2,229.82	4.91	1,029.41	193.68	495,484.83

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	171.05	5.76	dwelling units	6,500.00	37,440.00	320,100.79
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Hotel		8.17	rooms	220.00	1,797.40	13,404.11
Regnl shop. center		42.94	1000 sq ft	635.00	27,266.90	201,584.18
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93

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Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	150.00	1,713.00	14,358.37
					75,231.30	601,408.15

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Regnl shop. center				2.0	1.0	97.0
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview HPS Phase 4.urb924

Project Name: Bayview Waterfront HPS End Phase 4

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	166.47	38.42	30.11	0.00	0.09	0.09	47,554.38

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	150.78	136.93	1,508.00	4.07	722.00	135.89	404,548.94

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	317.25	175.35	1,538.11	4.07	722.09	135.98	452,103.32

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	2.88	38.34	23.93	0.00	0.07	0.07	47,543.14
Hearth - No Summer Emissions							
Landscape	0.49	0.08	6.18	0.00	0.02	0.02	11.24
Consumer Products	129.65						
Architectural Coatings	33.45						
TOTALS (lbs/day, unmitigated)	166.47	38.42	30.11	0.00	0.09	0.09	47,554.38

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	51.05	42.32	470.69	1.26	223.42	42.07	125,477.76
Racquetball/health	3.93	4.00	42.71	0.12	21.01	3.95	11,694.44
Strip mall	12.53	12.95	137.69	0.38	67.91	12.76	37,771.38
Office park	83.27	77.66	856.91	2.31	409.66	77.11	229,605.36
TOTALS (lbs/day, unmitigated)	150.78	136.93	1,508.00	4.07	722.00	135.89	404,548.94

Operational Settings:

Does not include correction for passby trips

7/8/2009 10:04:08 AM

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	69.74	5.76	dwelling units	2,650.00	15,264.00	130,502.63
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93
Office park		11.42	1000 sq ft	2,500.00	28,550.00	239,306.10
					50,828.00	421,769.43

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview HPS Phase 4.urb924

Project Name: Bayview Waterfront HPS End Phase 4

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	541.23	70.64	1,399.02	4.05	217.14	209.01	91,861.49

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	153.06	197.31	1,563.49	3.45	722.00	135.89	348,320.01

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	694.29	267.95	2,962.51	7.50	939.14	344.90	440,181.50

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	2.88	38.34	23.93	0.00	0.07	0.07	47,543.14
Hearth	375.25	32.30	1,375.09	4.05	217.07	208.94	44,318.35
Landscaping - No Winter Emissions							
Consumer Products	129.65						
Architectural Coatings	33.45						
TOTALS (lbs/day, unmitigated)	541.23	70.64	1,399.02	4.05	217.14	209.01	91,861.49

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	47.58	61.00	487.74	1.07	223.42	42.07	108,079.57
Racquetball/health	4.50	5.76	45.11	0.10	21.01	3.95	10,057.48
Strip mall	14.54	18.63	145.73	0.32	67.91	12.76	32,481.11
Office park	86.44	111.92	884.91	1.96	409.66	77.11	197,701.85
TOTALS (lbs/day, unmitigated)	153.06	197.31	1,563.49	3.45	722.00	135.89	348,320.01

Operational Settings:

Does not include correction for passby trips

7/8/2009 10:04:41 AM

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	69.74	5.76	dwelling units	2,650.00	15,264.00	130,502.63
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93
Office park		11.42	1000 sq ft	2,500.00	28,550.00	239,306.10
					50,828.00	421,769.43

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview HPS Variant 1.urb924

Project Name: Bayview Waterfront HPS Variant 1

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	182.32	55.09	44.11	0.00	0.12	0.12	67,554.38

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	234.05	214.59	2,364.91	6.37	1,131.65	213.00	634,154.31

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	416.37	269.68	2,409.02	6.37	1,131.77	213.12	701,708.69

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	4.09	55.01	37.93	0.00	0.10	0.10	67,543.14
Hearth - No Summer Emissions							
Landscape	0.49	0.08	6.18	0.00	0.02	0.02	11.24
Consumer Products	129.65						
Architectural Coatings	48.09						
TOTALS (lbs/day, unmitigated)	182.32	55.09	44.11	0.00	0.12	0.12	67,554.38

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	51.05	42.32	470.69	1.26	223.42	42.07	125,477.76
Racquetball/health	3.93	4.00	42.71	0.12	21.01	3.95	11,694.44
Strip mall	12.53	12.95	137.69	0.38	67.91	12.76	37,771.38
Office park	166.54	155.32	1,713.82	4.61	819.31	154.22	459,210.73
TOTALS (lbs/day, unmitigated)	234.05	214.59	2,364.91	6.37	1,131.65	213.00	634,154.31

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	69.74	5.76	dwelling units	2,650.00	15,264.00	130,502.63
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93
Office park		11.42	1000 sq ft	5,000.00	57,100.00	478,612.20
					79,378.00	661,075.53

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview HPS Variant 1.urb924

Project Name: Bayview Waterfront HPS Variant 1

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	182.69	69.66	44.17	0.09	1.28	1.27	86,249.02

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	239.50	309.24	2,448.39	5.41	1,131.65	213.00	546,021.86

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	422.19	378.90	2,492.56	5.50	1,132.93	214.27	632,270.88

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	4.09	55.01	37.93	0.00	0.10	0.10	67,543.14
Hearth	0.86	14.65	6.24	0.09	1.18	1.17	18,705.88
Landscaping - No Winter Emissions							
Consumer Products	129.65						
Architectural Coatings	48.09						
TOTALS (lbs/day, unmitigated)	182.69	69.66	44.17	0.09	1.28	1.27	86,249.02

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	47.58	61.00	487.74	1.07	223.42	42.07	108,079.57
Racquetball/health	4.50	5.76	45.11	0.10	21.01	3.95	10,057.48
Strip mall	14.54	18.63	145.73	0.32	67.91	12.76	32,481.11
Office park	172.88	223.85	1,769.81	3.92	819.31	154.22	395,403.70
TOTALS (lbs/day, unmitigated)	239.50	309.24	2,448.39	5.41	1,131.65	213.00	546,021.86

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	69.74	5.76	dwelling units	2,650.00	15,264.00	130,502.63
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93
Office park		11.42	1000 sq ft	5,000.00	57,100.00	478,612.20
					79,378.00	661,075.53

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview HPS Variant 2.urb924

Project Name: Bayview Waterfront HPS Variant 2

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	242.36	48.60	34.44	0.00	0.11	0.11	60,551.64

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	176.79	158.49	1,747.79	4.71	835.82	157.32	468,471.57

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	419.15	207.09	1,782.23	4.71	835.93	157.43	529,023.21

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	3.66	48.52	28.26	0.00	0.09	0.09	60,540.40
Hearth - No Summer Emissions							
Landscape	0.49	0.08	6.18	0.00	0.02	0.02	11.24
Consumer Products	195.69						
Architectural Coatings	42.52						
TOTALS (lbs/day, unmitigated)	242.36	48.60	34.44	0.00	0.11	0.11	60,551.64

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	77.06	63.88	710.48	1.90	337.24	63.50	189,400.39
Racquetball/health	3.93	4.00	42.71	0.12	21.01	3.95	11,694.44
Strip mall	12.53	12.95	137.69	0.38	67.91	12.76	37,771.38
Office park	83.27	77.66	856.91	2.31	409.66	77.11	229,605.36
TOTALS (lbs/day, unmitigated)	176.79	158.49	1,747.79	4.71	835.82	157.32	468,471.57

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	105.26	5.76	dwelling units	4,000.00	23,040.00	196,985.10
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93
Office park		11.42	1000 sq ft	2,500.00	28,550.00	239,306.10
					58,604.00	488,251.90

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview HPS Variant 2.urb924

Project Name: Bayview Waterfront HPS Variant 2

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	243.16	70.64	37.67	0.14	1.88	1.86	88,775.69

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	177.30	228.38	1,811.96	4.00	835.82	157.32	403,379.42

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	420.46	299.02	1,849.63	4.14	837.70	159.18	492,155.11

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	3.66	48.52	28.26	0.00	0.09	0.09	60,540.40
Hearth	1.29	22.12	9.41	0.14	1.79	1.77	28,235.29
Landscaping - No Winter Emissions							
Consumer Products	195.69						
Architectural Coatings	42.52						
TOTALS (lbs/day, unmitigated)	243.16	70.64	37.67	0.14	1.88	1.86	88,775.69

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	71.82	92.07	736.21	1.62	337.24	63.50	163,138.98
Racquetball/health	4.50	5.76	45.11	0.10	21.01	3.95	10,057.48
Strip mall	14.54	18.63	145.73	0.32	67.91	12.76	32,481.11
Office park	86.44	111.92	884.91	1.96	409.66	77.11	197,701.85
TOTALS (lbs/day, unmitigated)	177.30	228.38	1,811.96	4.00	835.82	157.32	403,379.42

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	105.26	5.76	dwelling units	4,000.00	23,040.00	196,985.10
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93
Office park		11.42	1000 sq ft	2,500.00	28,550.00	239,306.10
					58,604.00	488,251.90

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview IB Variant 1.urb924

Project Name: Bayview Waterfront IB Variant 1

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	79.38	19.48	17.08	0.00	0.06	0.06	24,026.65

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	79.39	72.56	798.27	2.15	382.53	72.00	214,295.75

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	158.77	92.04	815.35	2.15	382.59	72.06	238,322.40

7/20/2009 10:31:26 AM

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	1.45	19.42	12.44	0.00	0.04	0.04	24,018.22
Hearth - No Summer Emissions							
Landscape	0.37	0.06	4.64	0.00	0.02	0.02	8.43
Consumer Products	60.66						
Architectural Coatings	16.90						
TOTALS (lbs/day, unmitigated)	79.38	19.48	17.08	0.00	0.06	0.06	24,026.65

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	23.89	19.80	220.25	0.59	104.54	19.69	58,714.12
Strip mall	10.03	10.36	110.15	0.30	54.32	10.21	30,217.10
Office park	45.47	42.40	467.87	1.26	223.67	42.10	125,364.53
TOTALS (lbs/day, unmitigated)	79.39	72.56	798.27	2.15	382.53	72.00	214,295.75

Operational Settings:

7/20/2009 10:31:26 AM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	32.63	5.76	dwelling units	1,240.00	7,142.40	61,065.38
Strip mall		42.94	1000 sq ft	100.00	4,294.00	31,745.54
Office park		11.42	1000 sq ft	1,365.00	15,588.30	130,661.13
					27,024.70	223,472.05

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

7/20/2009 10:32:05 AM

Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview IB Variant 1.urb924

Project Name: Bayview Waterfront IB Variant 1

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	79.41	26.28	15.36	0.04	0.59	0.59	32,771.16

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	81.10	104.55	827.97	1.83	382.53	72.00	184,503.18

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	160.51	130.83	843.33	1.87	383.12	72.59	217,274.34

7/20/2009 10:32:05 AM

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	1.45	19.42	12.44	0.00	0.04	0.04	24,018.22
Hearth	0.40	6.86	2.92	0.04	0.55	0.55	8,752.94
Landscaping - No Winter Emissions							
Consumer Products	60.66						
Architectural Coatings	16.90						
TOTALS (lbs/day, unmitigated)	79.41	26.28	15.36	0.04	0.59	0.59	32,771.16

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	22.26	28.54	228.23	0.50	104.54	19.69	50,573.08
Strip mall	11.64	14.90	116.58	0.26	54.32	10.21	25,984.89
Office park	47.20	61.11	483.16	1.07	223.67	42.10	107,945.21
TOTALS (lbs/day, unmitigated)	81.10	104.55	827.97	1.83	382.53	72.00	184,503.18

Operational Settings:

7/20/2009 10:32:05 AM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	32.63	5.76	dwelling units	1,240.00	7,142.40	61,065.38
Strip mall		42.94	1000 sq ft	100.00	4,294.00	31,745.54
Office park		11.42	1000 sq ft	1,365.00	15,588.30	130,661.13
					27,024.70	223,472.05

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name:

Project Name: Bayview Proposed Project BAU

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	572.16	561.60	6,132.71	16.90	3,018.22	567.37	1,682,188.03

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	572.16	561.60	6,132.71	16.90	3,018.22	567.37	1,682,188.03

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Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Office park	572.16	561.60	6,132.71	16.90	3,018.22	567.37	1,682,188.03
TOTALS (lbs/day, unmitigated)	572.16	561.60	6,132.71	16.90	3,018.22	567.37	1,682,188.03

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	14,169.00	161,809.98	1,763,728.73
					161,809.98	1,763,728.73

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.9	10.9	10.9	10.9	10.9	10.9
Rural Trip Length (miles)	10.9	10.9	10.9	10.9	10.9	10.9
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Office park				48.0	24.0	28.0

7/15/2009 1:40:35 PM

Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name:

Project Name: Bayview Proposed Project BAU

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	613.65	810.35	6,237.35	14.36	3,018.22	567.37	1,447,053.43

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	613.65	810.35	6,237.35	14.36	3,018.22	567.37	1,447,053.43

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Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Office park	613.65	810.35	6,237.35	14.36	3,018.22	567.37	1,447,053.43
TOTALS (lbs/day, unmitigated)	613.65	810.35	6,237.35	14.36	3,018.22	567.37	1,447,053.43

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	14,169.00	161,809.98	1,763,728.73
					161,809.98	1,763,728.73

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.9	10.9	10.9	10.9	10.9	10.9
Rural Trip Length (miles)	10.9	10.9	10.9	10.9	10.9	10.9
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Office park				48.0	24.0	28.0

7/15/2009 1:12:20 PM

Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name:

Project Name: Bayview Proposed Project Internal Trips

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	27.84	12.45	165.34	0.27	41.50	8.14	27,374.29

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	27.84	12.45	165.34	0.27	41.50	8.14	27,374.29

7/15/2009 1:12:20 PM

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Office park	27.84	12.45	165.34	0.27	41.50	8.14	27,374.29
TOTALS (lbs/day, unmitigated)	27.84	12.45	165.34	0.27	41.50	8.14	27,374.29

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	2,100.00	23,982.00	23,982.00
					23,982.00	23,982.00

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	1.0	1.0	1.0	1.0	1.0	1.0
Rural Trip Length (miles)	1.0	1.0	1.0	1.0	1.0	1.0
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Office park				48.0	24.0	28.0

7/15/2009 1:13:24 PM

Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name:

Project Name: Bayview Proposed Project Internal Trips

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	22.79	17.54	212.33	0.24	41.50	8.14	24,177.08

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	22.79	17.54	212.33	0.24	41.50	8.14	24,177.08

7/15/2009 1:13:24 PM

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Office park	22.79	17.54	212.33	0.24	41.50	8.14	24,177.08
TOTALS (lbs/day, unmitigated)	22.79	17.54	212.33	0.24	41.50	8.14	24,177.08

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	2,100.00	23,982.00	23,982.00
					23,982.00	23,982.00

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0

7/15/2009 1:13:24 PM

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	1.0	1.0	1.0	1.0	1.0	1.0
Rural Trip Length (miles)	1.0	1.0	1.0	1.0	1.0	1.0
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Office park				48.0	24.0	28.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Baview CP Phase 4.urb924

Project Name: Bayview Waterfront CP End Phase 4

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	449.11	69.91	43.36	0.00	0.16	0.16	88,301.51

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	241.34	217.11	2,372.22	6.42	1,143.23	215.11	639,585.25

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	690.45	287.02	2,415.58	6.42	1,143.39	215.27	727,886.76

7/15/2009 2:48:57 PM

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	5.34	69.79	34.09	0.00	0.13	0.13	88,284.66
Hearth - No Summer Emissions							
Landscape	0.74	0.12	9.27	0.00	0.03	0.03	16.85
Consumer Products	384.05						
Architectural Coatings	58.98						
TOTALS (lbs/day, unmitigated)	449.11	69.91	43.36	0.00	0.16	0.16	88,301.51

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

7/15/2009 2:48:57 PM

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	151.23	125.36	1,394.32	3.73	661.83	124.62	371,698.27
Racquetball/health	3.93	4.00	42.71	0.12	21.01	3.95	11,694.44
Hotel	4.99	4.37	46.62	0.13	22.94	4.31	12,766.23
Regnl shop. center	63.66	65.77	699.47	1.92	344.96	64.84	191,878.61
Strip mall	12.53	12.95	137.69	0.38	67.91	12.76	37,771.38
Office park	5.00	4.66	51.41	0.14	24.58	4.63	13,776.32
TOTALS (lbs/day, unmitigated)	241.34	217.11	2,372.22	6.42	1,143.23	215.11	639,585.25

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	206.58	5.76	dwelling units	7,850.00	45,216.00	386,583.26
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Hotel		8.17	rooms	220.00	1,797.40	13,404.11
Regnl shop. center		42.94	1000 sq ft	635.00	27,266.90	201,584.18
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93

7/15/2009 2:48:57 PM

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	150.00	1,713.00	14,358.37
					83,007.30	667,890.62

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Regnl shop. center				2.0	1.0	97.0
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

7/15/2009 2:50:02 PM

Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Baview CP Phase 4.urb924

Project Name: Bayview Waterfront CP End Phase 4

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	450.91	113.20	52.56	0.28	3.64	3.60	143,696.42

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	243.97	312.71	2,478.29	5.46	1,143.23	215.11	550,544.24

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	694.88	425.91	2,530.85	5.74	1,146.87	218.71	694,240.66

7/15/2009 2:50:02 PM

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	5.34	69.79	34.09	0.00	0.13	0.13	88,284.66
Hearth	2.54	43.41	18.47	0.28	3.51	3.47	55,411.76
Landscaping - No Winter Emissions							
Consumer Products	384.05						
Architectural Coatings	58.98						
TOTALS (lbs/day, unmitigated)	450.91	113.20	52.56	0.28	3.64	3.60	143,696.42

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

7/15/2009 2:50:02 PM

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	140.94	180.69	1,444.82	3.18	661.83	124.62	320,160.25
Racquetball/health	4.50	5.76	45.11	0.10	21.01	3.95	10,057.48
Hotel	4.91	6.29	49.25	0.11	22.94	4.31	10,979.23
Regnl shop. center	73.89	94.62	740.29	1.63	344.96	64.84	165,004.06
Strip mall	14.54	18.63	145.73	0.32	67.91	12.76	32,481.11
Office park	5.19	6.72	53.09	0.12	24.58	4.63	11,862.11
TOTALS (lbs/day, unmitigated)	243.97	312.71	2,478.29	5.46	1,143.23	215.11	550,544.24

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	206.58	5.76	dwelling units	7,850.00	45,216.00	386,583.26
Racquetball/health		32.93	1000 sq ft	50.00	1,646.50	12,278.77
Hotel		8.17	rooms	220.00	1,797.40	13,404.11
Regnl shop. center		42.94	1000 sq ft	635.00	27,266.90	201,584.18
Strip mall		42.94	1000 sq ft	125.00	5,367.50	39,681.93

7/15/2009 2:50:02 PM

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Office park		11.42	1000 sq ft	150.00	1,713.00	14,358.37
					83,007.30	667,890.62

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4

7/15/2009 2:50:02 PM

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Regnl shop. center				2.0	1.0	97.0
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

7/15/2009 4:01:12 PM

Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview IB Phase 4.urb924

Project Name: Bayview Waterfront IB End Phase 4

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	79.38	19.48	17.08	0.00	0.06	0.06	24,026.65

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	79.39	72.56	798.27	2.15	382.53	72.00	214,295.75

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	158.77	92.04	815.35	2.15	382.59	72.06	238,322.40

7/15/2009 4:01:12 PM

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	1.45	19.42	12.44	0.00	0.04	0.04	24,018.22
Hearth - No Summer Emissions							
Landscape	0.37	0.06	4.64	0.00	0.02	0.02	8.43
Consumer Products	60.66						
Architectural Coatings	16.90						
TOTALS (lbs/day, unmitigated)	79.38	19.48	17.08	0.00	0.06	0.06	24,026.65

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	23.89	19.80	220.25	0.59	104.54	19.69	58,714.12
Strip mall	10.03	10.36	110.15	0.30	54.32	10.21	30,217.10
Office park	45.47	42.40	467.87	1.26	223.67	42.10	125,364.53
TOTALS (lbs/day, unmitigated)	79.39	72.56	798.27	2.15	382.53	72.00	214,295.75

Operational Settings:

7/15/2009 4:01:12 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	32.63	5.76	dwelling units	1,240.00	7,142.40	61,065.38
Strip mall		42.94	1000 sq ft	100.00	4,294.00	31,745.54
Office park		11.42	1000 sq ft	1,365.00	15,588.30	130,661.13
					27,024.70	223,472.05

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

7/15/2009 4:01:49 PM

Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\21478\Application Data\Urbemis\Version9a\Projects\Bayview IB Phase 4.urb924

Project Name: Bayview Waterfront IB End Phase 4

Project Location: San Francisco County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	79.41	26.28	15.36	0.04	0.59	0.59	32,771.16

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	81.10	104.55	827.97	1.83	382.53	72.00	184,503.18

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	160.51	130.83	843.33	1.87	383.12	72.59	217,274.34

7/15/2009 4:01:49 PM

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	1.45	19.42	12.44	0.00	0.04	0.04	24,018.22
Hearth	0.40	6.86	2.92	0.04	0.55	0.55	8,752.94
Landscaping - No Winter Emissions							
Consumer Products	60.66						
Architectural Coatings	16.90						
TOTALS (lbs/day, unmitigated)	79.41	26.28	15.36	0.04	0.59	0.59	32,771.16

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments mid rise	22.26	28.54	228.23	0.50	104.54	19.69	50,573.08
Strip mall	11.64	14.90	116.58	0.26	54.32	10.21	25,984.89
Office park	47.20	61.11	483.16	1.07	223.67	42.10	107,945.21
TOTALS (lbs/day, unmitigated)	81.10	104.55	827.97	1.83	382.53	72.00	184,503.18

Operational Settings:

7/15/2009 4:01:49 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2030 Temperature (F): 40 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments mid rise	32.63	5.76	dwelling units	1,240.00	7,142.40	61,065.38
Strip mall		42.94	1000 sq ft	100.00	4,294.00	31,745.54
Office park		11.42	1000 sq ft	1,365.00	15,588.30	130,661.13
					27,024.70	223,472.05

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	61.0	0.0	100.0	0.0
Light Truck < 3750 lbs	10.9	0.0	100.0	0.0
Light Truck 3751-5750 lbs	16.4	0.0	100.0	0.0
Med Truck 5751-8500 lbs	4.7	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.5	0.0	80.0	20.0
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	1.7	0.0	17.6	82.4
Heavy-Heavy Truck 33,001-60,000 lbs	0.1	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.3	0.0	0.0	100.0
Motorcycle	3.5	34.3	65.7	0.0

7/15/2009 4:01:49 PM

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.2	0.0	100.0	0.0

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Strip mall				2.0	1.0	97.0
Office park				48.0	24.0	28.0

Candlestick Point-Hunters Point Shipyard Project
Proposed Project Trip Generation Summary

		Person Trips					Vehicle Trips		
	Net New	**auto**	**transit**	**bicycle**	**internal**	**total**	**Total**	**Work**	**Non Work**
Hunters Point Shipyard									
residential	2650units	13,668	3,403	528	7,037	24,637	8,543	2,819	5,723
retail	125ksf	8,529	1,622	314	4,185	14,650	5,331	213	5,117
R&D	2500ksf	12,475	3,186	484	6,456	22,602	7,797	2,807	4,990
park	238acres	494	110	19	249	870	308	62	247
stadium/artists	--	638	163	25	330	1,155	399	143	255
community services	50ksf	696	173	27	358	1,254	435	87	348
	subtotal	**36,499**	**8,657**	**1,397**	**18,615**	**65,168**	**22,812**	**External**	
	mode split %	56%	13%	2%	29%	**Internal**	**247,213**	**<VMT**	
	mode split of external trips %	78%	19%	3%	**5,817**	**<VMT**			
Candlestick									
residential	7594units	39,443	9,821	1,524	19,807	70,595	24,652	8,135	16,517
retail	760ksf	44,603	8,482	1,642	21,343	76,070	27,877	1,115	26,762
hotel	220rooms	1,478	304	55	716	2,554	924	111	813
office/arena	150ksf	2,031	519	79	1,025	3,654	1,270	457	813
park	147acres	203	45	8	100	355	127	25	101
community services	50ksf	716	159	27	352	1,254	448	90	358
	subtotal	**88,475**	**19,330**	**3,334**	**43,344**	**154,483**	**55,297**	**External**	
	mode split %	57%	13%	2%	28%	**Internal**	**599,254**	**<VMT**	
	mode split of external trips %	80%	17%	3%	**13,545**	**<VMT**			
India Basin									
residential									
retail									
office									
	subtotal	**0**	**0**	**0**	**0**	**0**	**0**	**External**	
	mode split %					**Internal**	**0**	**<VMT**	
	mode split of external trips %				**0**	**<VMT**			
Total CP_HPS									
residential							33,195		
retail							33,208		
office							0		
R&D							7,797		
hotel							924		
office/arena							1,270		
stadium/artists							399		
park							435		
community services							883		
	TOTAL CP_HPS	**124,974**	**27,987**	**4,731**	**61,959**	**219,651**	**78,109**	**External**	
	mode split %	57%	13%	2%	28%	**Internal**	**846,468**	**<VMT**	
	mode split of external trips only%	79%	18%	3%	**19,362**	**<VMT**			

Example External Modal Split

	95.500%	4%		0.50%	
Auto		Med. Truck	H. Truck	MC	Transit (person trips)
	8158	228	114	43	3,403

ode split (HP to CP, CP to HP, etc treated as external) goal is 50% non-auto (walk/bike)

From F&P

Vehicle Trip Production (Residential)

% HBW	% HBO	% NHB
0.32	0.47	0.21

* 2030 MTC Model

Vehicle Trip Attraction (Non Residential)

% HBW	% HBO	% NHB
0.26	0.48	0.27

Vehicle Trips

	All	HBW	HBO	NHB
Residential	33,195	10,622	15,601	6,971
Retail	33,208	8,472	15,827	8,909
Other NonRes	11,707	2,987	5,579	3,141
Total	78,109	22,081	37,007	19,021

Vehicle Trip Length

HBW	HBO	NHB
14.9	9.1	9.5

Vehicle Miles Traveled

	All	HBW	HBO	NHB
Residential	366,469	158,272	141,973	66,223
Retail	354,891	126,233	144,021	84,637
Other NonRes	125,108	44,500	50,771	29,836
Total	846,468	329,005	336,766	180,697

Average Vehicle Trip Length **10.84**

Candlestick Point-Hunters Point Shipyard Project
Proposed Project Variant 1 Trip Generation Summary

		Person Trips					Vehicle Trips		
	Net New	**auto**	**transit**	**bicycle**	**internal**	**total**	**Total**	**Work**	**Non Work**
Hunters Point Shipyard									
residential	2650units	14,904	3,711	576	5,446	24,637	9,315	3,074	6,241
retail	125ksf	9,300	1,769	342	3,238	14,650	5,813	233	5,580
R&D	5000ksf	24,015	6,134	932	8,820	39,901	15,009	5,403	9,606
park	238acres	538	119	20	192	870	336	67	269
stadium/artists	30ksf	299	76	12	110	496	187	67	119
community services	50ksf	696	173	27	358	1,254	435	87	348
subtotal		**49,751**	**11,982**	**1,909**	**18,165**	**81,808**	**31,095**	**External**	
mode split %		61%	15%	2%	22%	**Internal**	**336,625**	**<VMT**	
mode split of external trips %		78%	19%	3%	**5,677**	**<VMT**			
Candlestick									
residential	7594units	39,443	9,821	1,524	19,807	70,595	24,652	8,135	16,517
retail	760ksf	44,603	8,482	1,642	21,343	76,070	27,877	1,115	26,762
hotel	220rooms	1,478	304	55	716	2,554	924	111	813
office/arena	150ksf	2,031	519	79	1,025	3,654	1,270	457	813
park	147acres	203	45	8	100	355	127	25	101
community services	50ksf	716	159	27	352	1,254	448	90	358
subtotal		**88,475**	**19,330**	**3,334**	**43,344**	**154,483**	**55,297**	**External**	
mode split %		57%	13%	2%	28%	**Internal**	**598,633**	**<VMT**	
mode split of external trips %		80%	17%	3%	**13,545**	**<VMT**			
India Basin									
residential									
retail									
office									
subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**External**	
mode split %						**Internal**	**0**	**<VMT**	
mode split of external trips %					**0**	**<VMT**			
Total CP_HPS									
residential							33,967		
retail							33,690		
office							0		
R&D							15,009		
hotel							924		
office/arena							1,270		
stadium/artists							187		
park							463		
community services							883		
Total CP_HPS		**138,227**	**31,313**	**5,243**	**61,509**	**236,291**	**86,392**	**External**	
mode split %		58%	13%	2%	26%	**Internal**	**935,258**	**<VMT**	
mode split of external trips only%		79%	18%	3%	**19,221**	**<VMT**			

Example External Modal Split

	95.500%	4%		0.50%	
Auto		Med. Trucl	H. Truck	MC	Transit (person trips)
	8896	248	124	47	3,711

From F&P

Vehicle Trip Production (Residential)

% HBW	% HBO	% NHB
0.32	0.47	0.21

* 2030 MTC Model

Vehicle Trip Attraction (Non Residential)

% HBW	% HBO	% NHB
0.26	0.48	0.27

Vehicle Trips

	All	HBW	HBO	NHB
Residential	33,967	10,869	15,965	7,133
Retail	33,690	8,595	16,056	9,038
Other NonRes	18,735	4,780	8,929	5,026
Total	86,392	24,244	40,950	21,198

Vehicle Trip Length

HBW	HBO	NHB
14.9	9.1	9.5

Vehicle Miles Traveled

	All	HBW	HBO	NHB
Residential	374,997	161,955	145,277	67,764
Retail	360,043	128,066	146,112	85,865
Other NonRes	200,219	71,217	81,253	47,749
Total	935,258	361,237	372,642	201,379
Average Vehicle Trip Length		**10.83**		

Candlestick Point-Hunters Point Shipyard Project
Proposed Project Variant 2 Trip Generation Summary

		Person Trips					Vehicle Trips		
	Net New	**auto**	**transit**	**bicycle**	**internal**	**total**	**Total**	**Work**	**Non Work**
Hunters Point Shipyard									
residential	4000units	19,065	4,747	736	12,636	37,184	11,915	3,932	7,983
retail	125ksf	7,882	1,499	290	4,978	14,650	4,926	197	4,729
R&D	2500ksf	11,529	2,945	448	7,680	22,602	7,206	2,594	4,612
park	238acres	456	101	17	296	870	285	57	228
stadium/artists	30ksf	253	65	10	169	496	158	57	101
community services	50ksf	696	173	27	358	1,254	435	87	348
subtotal		**39,881**	**9,530**	**1,528**	**26,117**	**77,056**	**24,926**	**External**	
mode split %		52%	12%	2%	34%	**Internal**	**270,106**	**<VMT**	
mode split of external trips %		78%	19%	3%	**8,162**	**<VMT**			
Candlestick									
residential	6244units	34,488	8,587	1,332	13,638	58,045	21,555	7,113	14,442
retail	760ksf	47,432	9,020	1,746	17,873	76,070	29,645	1,186	28,459
hotel	220rooms	1,572	323	59	600	2,554	982	118	864
office/arena	150ksf	2,160	552	84	859	3,654	1,350	486	864
park	147acres	216	48	8	83	355	135	27	108
community services	50ksf	716	159	27	352	1,254	448	90	358
subtotal		**86,583**	**18,689**	**3,256**	**33,404**	**141,933**	**54,115**	**External**	
mode split %		61%	13%	2%	24%	**Internal**	**586,413**	**<VMT**	
mode split of external trips %		80%	17%	3%	**10,439**	**<VMT**			
India Basin									
residential									
retail									
office									
subtotal		**0**	**0**	**0**	**0**	**0**	**0**	**External**	
mode split %						**Internal**	**0**	**<VMT**	
mode split of external trips %					**0**	**<VMT**			
Total CP_HPS									
residential							33,470		
retail							34,571		
office							0		
R&D							7,206		
hotel							982		
office/arena							1,350		
stadium/artists							158		
park							420		
community services							883		
Total CP_HPS		**126,464**	**28,219**	**4,784**	**59,521**	**218,989**	**79,040**	**External**	
mode split %		58%	13%	2%	27%	**Internal**	**856,519**	**<VMT**	
mode split of external trips only%		79%	18%	3%	**18,600**	**<VMT**			

Example External Modal Split

	95.500%	4%		0.50%	
Auto		Med. Truck	H. Truck	MC	Transit (person trips)
	11379	318	159	60	4,747

From F&P

Vehicle Trip Production (Residential)

% HBW	% HBO	% NHB
0.32	0.47	0.21

* 2030 MTC Model

Vehicle Trip Attraction (Non Residential)

% HBW	% HBO	% NHB
0.26	0.48	0.27

Vehicle Trips

	All	HBW	HBO	NHB
Residential	33,470	10,710	15,731	7,029
Retail	34,571	8,820	16,476	9,275
Other NonRes	10,999	2,806	5,242	2,951
Total	79,040	22,336	37,449	19,254

Vehicle Trip Length

HBW	HBO	NHB
14.9	9.1	9.5

Vehicle Miles Traveled

	All	HBW	HBO	NHB
Residential	369,512	159,586	143,152	66,773
Retail	369,464	131,417	149,935	88,112
Other NonRes	117,543	41,809	47,701	28,032
Total	856,519	332,812	340,789	182,918
Average Vehicle Trip Length			**10.84**	

Table X.X-X1

Operational Criteria Pollutant Emissions - Proposed Project (Year 2030)

Scenario/Emission Source	ROG (lbs/day)	NOx (lbs/day)	CO (lbs/day)	PM_{10} (lbs/day)	$PM_{2.5}$ (lbs/day)
Hunters Point Shipyard					
Area*	166	38	30	1	1
Motor Vehicles (External Unadjusted)	151	137	1,563	722	136
Motor Vehicles (External)	88	80	916	423	80
Subtotal	255	119	947	424	81
Candlestick Point					
Area*	449	70	53	4	4
Motor Vehicles (External Unadjusted)	241	217	2,478	1,143	215
Motor Vehicles (External)	217	195	2,224	1,026	193
Subtotal	666	265	2,276	1,029	197
India Basin Shoreline					
Area*	0	0	0	0	0
Motor Vehicles (External Unadjusted)	0	0	0	0	0
Motor Vehicles (External)	0	0	0	0	0
Subtotal	0	0	0	0	0
All Development Sites (Proposed Project)					
Area*	616	108	83	5	5
Motor Vehicles (External)	305	275	3,140	1,449	273
Motor Vehicles (Internal)	24	11	184	36	7
All Sources (Proposed Project)	**945**	**394**	**3,406**	**1,490**	**285**
Project Comparison to Business as Usual	**86%**	**67%**	**63%**	**58%**	**50%**
Project Reduction from Business as Usual	**-14%**	**-33%**	**-37%**	**-42%**	**-50%**
BAAQMD Significance Threshold	**54**	**54**	**None**	**82**	**54**
Project Exceeds BAAQMD Threshold?	**Yes**	**Yes**	**----**	**Yes**	**Yes**
All Development Sites (Business as Usual)					
Area*	616	108	83	5	5
Motor Vehicles	485	476	5,292	2,561	567
All Sources (Business as Usual)	**1,101**	**585**	**5,375**	**2,566**	**572**
BAU Comparison to Proposed Project	**117%**	**148%**	**158%**	**172%**	**201%**

Source: PBS&J, 2009. Based on URBEMIS 2007 Version 9.2.4.

* Area emissions are from sources located on the project site, such as natural gas combustion for heating/cooling, maintenance equipment, consumer product use, etc.

Daily emissions of ROG and NOx were calculated under Summer conditions when ambient ozone concentrations are highest. Daily emissions of CO, PM10 and PM2.5 were calculated under winter conditions when associated ambient concentrations are highest.

URBEMIS VMT	External Project VMT		
421,769	247,213		

URBEMIS VMT	External Project VMT	**HPS + CP VMT**	**HPS + CP**
667,891	599,254	846,468	External
		19,362	Internal
		865,830	Total

URBEMIS VMT	External Project VMT	**IB VMT**	**IB**
223,472	0	130,559	External
		4,616	Internal
		135,175	Total

Total VMT	**Total**
977,026	External
23,978	Internal
1,001,005	Total

161,810	**BAU ADT**	**HPS + CP+IS**
137,282	**BAU ADT**	**HPS + CP**
84.8%	**Ratio**	

Table X.X-X1

Operational Criteria Pollutant Emissions - Variant #1 (Year 2030)

Scenario/Emission Source	ROG (lbs/day)	NOx (lbs/day)	CO (lbs/day)	PM_{10} (lbs/day)	$PM_{2.5}$ (lbs/day)				
Hunters Point Shipyard									
Area*	182	55	44	1	1		External		
Motor Vehicles (External Unadjusted)	234	215	2,448	1,132	213	URBEMIS VMT	Variant VMT		
						661,075	336,625		
Motor Vehicles (External)	119	109	1,247	576	108				
Subtotal	302	164	1,291	578	110				
Candlestick Point									
Area*	449	70	53	4	4		External	**HPS + CP**	
Motor Vehicles (External Unadjusted)	241	217	2,478	1,143	215	URBEMIS VMT	Variant VMT	**VMT**	**HPS + CP**
						667,891	598,633	935,258	External
Motor Vehicles (External)	216	195	2,221	1,025	193			19,222	Internal
Subtotal	665	265	2,274	1,028	196			954,480	Total
India Basin Shoreline									
Area*	0	0	0	0	0		External	**IB**	
Motor Vehicles (External Unadjusted)	0	0	0	0	0	URBEMIS VMT	Variant VMT	**VMT**	**IB**
						223,472	0	130,559	External
Motor Vehicles (External)	0	0	0	0	0			4,616	Internal
Subtotal	0	0	0	0	0			135,175	Total
All Development Sites									
Area*	631	125	97	5	5	URMEMIS		**Total**	
Motor Vehicles (External)	335	304	3,468	1,601	301	Internal	Internal	**VMT**	**Total**
						Variant VMT	Variant VMT	1,065,817	External
						23,838	19,222	23,838	Internal
Motor Vehicles (Internal)	30	13	228	45	9			1,089,656	Total
All Sources (Variant 1)	**997**	**442**	**3,793**	**1,650**	**315**				
Comparison to Proposed Project	**106%**	**112%**	**111%**	**111%**	**111%**				
Change from Proposed Project	**6%**	**12%**	**11%**	**11%**	**11%**				
Comparison to Business as Usual	**89%**	**74%**	**70%**	**64%**	**65%**				
Reduction from Business as Usual	**-11%**	**-26%**	**-30%**	**-36%**	**-35%**				
All Development Sites (Business as Usual)									
Area*	631	125	97	5	5		161,810	**BAU ADT**	**HPS + CP+IS**
Motor Vehicles	485	476	5,292	2,561	481		137,282	**BAU ADT**	**HPS + CP**
All Sources (Business as Usual)	**1,117**	**601**	**5,389**	**2,566**	**486**		**84.8%**	**Ratio**	
Comparison to Variant 1	**112%**	**136%**	**142%**	**155%**	**154%**				

Source: PBS&J, 2009. Based on URBEMIS 2007 Version 9.2.4.

* Area emissions are from sources located on the project site, such as natural gas combustion for heating/cooling, maintenance equipment, consumer product use, etc.

Daily emissions of ROG and NOx were calculated under Summer conditions when ambient ozone concentrations are highest. Daily emissions of CO, PM10 and PM2.5 were calculated under winter conditions when associated ambient concentrations are highest.

Table X.X-X1
Operational Criteria Pollutant Emissions - Variant #2 (Year 2030)

Scenario/Emission Source	ROG (lbs/day)	NOx (lbs/day)	CO (lbs/day)	PM_{10} (lbs/day)	$PM_{2.5}$ (lbs/day)
Hunters Point Shipyard					
Area*	242	49	38	2	2
Motor Vehicles (External Unadjusted)	177	158	1,812	836	157
Motor Vehicles (External)	98	88	1,002	462	87
Subtotal	340	136	1,040	464	89
Candlestick Point					
Area*	373	60	45	3	3
Motor Vehicles (External Unadjusted)	215	196	2,230	1,029	194
Motor Vehicles (External)	210	191	2,174	1,004	189
Subtotal	583	250	2,219	1,007	192
India Basin Shoreline					
Area*	0	0	0	0	0
Motor Vehicles (External Unadjusted)	0	0	0	0	0
Motor Vehicles (External)	0	0	0	0	0
Subtotal	0	0	0	0	0
All Development Sites					
Area*	616	108	83	5	5
Motor Vehicles (External)	308	278	3,177	1,466	276
Motor Vehicles (Internal)	30	13	229	45	9
All Sources (Variant 2)	**953**	**400**	**3,489**	**1,516**	**290**
Comparison to Proposed Project	**101%**	**102%**	**102%**	**102%**	**102%**
Change from Proposed Project	**1%**	**2%**	**2%**	**2%**	**2%**
Comparison to Business as Usual	**87%**	**68%**	**65%**	**59%**	**60%**
Reduction from Business as Usual	**-13%**	**-32%**	**-35%**	**-41%**	**-40%**
All Development Sites (Business as Usual)					
Area*	616	108	83	5	5
Motor Vehicles	485	476	5,292	2,561	481
All Sources (Business as Usual)	**1,101**	**585**	**5,375**	**2,566**	**486**
Comparison to Project Variant 2	**115%**	**146%**	**154%**	**169%**	**168%**

Source: PBS&J, 2009. Based on URBEMIS 2007 Version 9.2.4.
* Area emissions are from sources located on the project site, such as natural gas combustion for heating/cooling, maintenance equipment, consumer product use, etc.
Daily emissions of ROG and NOx were calculated under Summer conditions when ambient ozone concentrations are highest. Daily emissions of CO, PM10 and PM2.5 were calculated under winter conditions when associated ambient concentrations are highest.

	External		
URBEMIS VMT	Variant VMT		
488,252	270,106		
	External	**HPS + CP**	
URBEMIS VMT	Variant VMT	**VMT**	**HPS + CP**
601,408	586,413	856,519	External
		18,601	Internal
		875,120	Total
	External	**IB**	
URBEMIS VMT	Variant VMT	**VMT**	**IB**
223,472	0	130,559	External
		4,616	Internal
		135,175	Total
URMEMIS		**Total**	
Internal	Internal	**VMT**	**Total**
Variant VMT	Variant VMT	987,077	External
23,217	18,601	23,217	Internal
		1,010,295	Total
	161,810	**BAU ADT**	**HPS + CP+IS**
	137,282	**BAU ADT**	**HPS + CP**
	84.8%	**Ratio**	

Table A Eight-Hour CO Levels At CPHPS Intersections

Recep. #	Address	Total Concentration Exist 2009	FNP 2030	FP 2030		
1	Walker Gilman	1.6	1.7	2.0	1.6	1.6
2	Third_Gilman	2.0	1.9	2.1	1.6	1.6
3	Griffin Palou	1.7	1.7	1.8	1.6	1.6
4	Evans Jennings	1.9	2.0	2.0	1.6	1.6
5		0.0	0.0	0.0	0.0	0.0
6		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0

CO Background (Highest at SF)

	1-hour	8-hour
2006	2.7	2.1
2007	**2.5**	**1.6**
2008	5.7	2.3
	3.6	2.0

2nd highest of past 2 years

		CALINE4 Model Values Exist 2009	FNP 2030	FP 2030			Background 2009	2030	2030	Total Concentration Exist 2009	FNP 2030	FP 2030		
1	Walker Gilman	0.0	0.1	0.4	0.0	0.0	1.6	1.6	1.6	1.6	1.7	2.0	1.6	1.6
2	Third_Gilman	0.4	0.3	0.5	0.0	0.0	1.6	1.6	1.6	2.0	1.9	2.1	1.6	1.6
3	Griffin Palou	0.1	0.1	0.2	0.0	0.0	1.6	1.6	1.6	1.7	1.7	1.8	1.6	1.6
4	Evans Jennings	0.3	0.4	0.4	0.0	0.0	1.6	1.6	1.6	1.9	2.0	2.0	1.6	1.6
5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table A One-Hour CO Levels At CPHPS Intersections

		Total Concentration				
Recep. #	**Address**	**Exist 2009**	**FNP 2030**	**FP 2030**		
1	Walker Gilman	2.5	2.7	3.1	2.5	2.5
2	Third_Gilman	3.1	2.9	3.2	2.5	2.5
3	Griffin Palou	2.7	2.7	2.8	2.5	2.5
4	Evans Jennings	2.9	3.0	3.0	2.5	2.5
5		0.0	0.0	0.0	0.0	0.0
6		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0

CO Background (Highest at SF)

	1-hour	8-hour
2006	2.7	2.1
2007	**2.5**	**1.6**
2008	5.7	2.3
	3.6	2.0

2nd highest of past 2 years

		CALINE4 Model Values					Background			Total Concentration				
		Exist 2009	**FNP 2030**	**FP 2030**			**2009**	**2030**	**2030**	**Exist 2009**	**FNP 2030**	**FP 2030**	**CUM 2020**	**CUMP 2020**
1	Walker Gilman	0.0	0.2	0.6	0.0	0.0	2.5	2.5	2.5	2.5	2.7	3.1	2.5	2.5
2	Third_Gilman	0.6	0.4	0.7	0.0	0.0	2.5	2.5	2.5	3.1	2.9	3.2	2.5	2.5
3	Griffin Palou	0.2	0.2	0.3	0.0	0.0	2.5	2.5	2.5	2.7	2.7	2.8	2.5	2.5
4	Evans Jennings	0.4	0.5	0.5	0.0	0.0	2.5	2.5	2.5	2.9	3.0	3.0	2.5	2.5
5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

::

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Third_Gilman Project
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

```
     U=   1.0 M/S            Z0= 100. CM          ALT=     0. (M)
   BRG= WORST CASE           VD=   .0 CM/S
  CLAS=     6 (F)            VS=   .0 CM/S
  MIXH= 1000. M             AMB=   .0 PPM
 SIGTH=   10. DEGREES      TEMP=  5.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Gillman E	0	0	300	0	AG	2710	1.8	.0	16.8
B. Gillman W	0	0	-300	0	AG	2610	1.8	.0	16.8
C. Third N	0	0	0	300	AG	3280	1.8	.0	27.6
D. Third S	0	0	0	-300	AG	2740	1.8	.0	27.6

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. Recpt 1	14	8	.5
2. Recpt 2	-14	8	.5
3. Recpt 3	-14	-8	.5
4. Recpt 4	14	-8	.5

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D
1. Recpt 1	262.	.7	.1	.3	.2	.0
2. Recpt 2	98.	.7	.3	.1	.2	.0
3. Recpt 3	8.	.6	.0	.2	.4	.0
4. Recpt 4	352.	.6	.2	.0	.4	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Third_Gilman No Project
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 1.0 M/S	Z0= 100. CM	ALT= 0. (M)
BRG= WORST CASE	VD= .0 CM/S	
CLAS= 6 (F)	VS= .0 CM/S	
MIXH= 1000. M	AMB= .0 PPM	
SIGTH= 10. DEGREES	TEMP= 5.0 DEGREE (C)	

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Gillman E	0	0	300	0	AG	910	1.8	.0	16.8
B. Gillman W	0	0	-300	0	AG	1220	1.8	.0	16.8
C. Third N	0	0	0	300	AG	2710	1.8	.0	27.6
D. Third S	0	0	0	-300	AG	2500	1.8	.0	27.6

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. Recpt 1	14	8	.5
2. Recpt 2	-14	8	.5
3. Recpt 3	-14	-8	.5
4. Recpt 4	14	-8	.5

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D
1. Recpt 1	188.	.4	.0	.0	.0	.3
2. Recpt 2	172.	.4	.0	.1	.0	.3
3. Recpt 3	8.	.4	.0	.1	.3	.0
4. Recpt 4	352.	.4	.0	.0	.3	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Third_Gilman Exist
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

```
     U=   1.0 M/S            Z0= 100. CM           ALT=     0. (M)
   BRG= WORST CASE           VD=   .0 CM/S
  CLAS=     6 (F)            VS=   .0 CM/S
  MIXH= 1000. M             AMB=   .0 PPM
 SIGTH=   10. DEGREES      TEMP=  5.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
	LINK COORDINATES (M)								
A. Gillman E	0	0	300	0	AG	431	5.3	.0	16.8
B. Gillman W	0	0	-300	0	AG	507	5.3	.0	16.8
C. Third N	0	0	0	300	AG	1202	5.3	.0	27.6
D. Third S	0	0	0	-300	AG	1044	5.3	.0	27.6

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
	COORDINATES (M)		
1. Recpt 1	14	8	.5
2. Recpt 2	-14	8	.5
3. Recpt 3	-14	-8	.5
4. Recpt 4	14	-8	.5

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	A	B	C	D
			CONC/LINK (PPM)			
1. Recpt 1	188.	.5	.1	.0	.0	.4
2. Recpt 2	172.	.6	.0	.1	.0	.4
3. Recpt 3	8.	.6	.0	.1	.4	.0
4. Recpt 4	352.	.6	.1	.0	.4	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Griffin_Palou Project
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 1.0 M/S	Z0= 100. CM	ALT= 0. (M)
BRG= WORST CASE	VD= .0 CM/S	
CLAS= 6 (F)	VS= .0 CM/S	
MIXH= 1000. M	AMB= .0 PPM	
SIGTH= 10. DEGREES	TEMP= 5.0 DEGREE (C)	

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Palou E	0	0	300	0	AG	1470	1.5	.0	13.2
B. Palou W	0	0	-300	0	AG	1080	1.5	.0	13.2
C. Griffin N	0	0	0	300	AG	620	1.5	.0	13.2
D. Griffin S	0	0	0	-300	AG	1010	1.5	.0	13.2

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. Recpt 1	7	7	.5
2. Recpt 2	-7	7	.5
3. Recpt 3	-7	-7	.5
4. Recpt 4	7	-7	.5

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D
1. Recpt 1	187.	.3	.1	.0	.0	.1
2. Recpt 2	97.	.3	.2	.0	.0	.0
3. Recpt 3	83.	.3	.2	.0	.0	.0
4. Recpt 4	278.	.3	.0	.1	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Griffin_Palou No Project
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	1.0 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	6 (F)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	10. DEGREES	TEMP=	5.0 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Palou E	0	0	300	0	AG	1060	1.5	.0	13.2
B. Palou W	0	0	-300	0	AG	910	1.5	.0	13.2
C. Griffin N	0	0	0	300	AG	620	1.5	.0	13.2
D. Griffin S	0	0	0	-300	AG	770	1.5	.0	13.2

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. Recpt 1	7	7	.5
2. Recpt 2	-7	7	.5
3. Recpt 3	-7	-7	.5
4. Recpt 4	7	-7	.5

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D
1. Recpt 1	187.	.2	.0	.0	.0	.1
2. Recpt 2	97.	.2	.1	.0	.0	.0
3. Recpt 3	83.	.2	.1	.0	.0	.0
4. Recpt 4	277.	.2	.0	.1	.0	.0

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   1

     JOB: Bayview Griffin_Palou Exist
     RUN: Hour 1           (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

I. SITE VARIABLES

```
    U=   1.0 M/S            Z0= 100. CM           ALT=     0. (M)
  BRG= WORST CASE           VD=   .0 CM/S
 CLAS=     6 (F)            VS=   .0 CM/S
 MIXH= 1000. M             AMB=   .0 PPM
SIGTH=   10. DEGREES      TEMP=  5.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Palou E	0	0	300	0	AG	133	4.6	.0	13.2
B. Palou W	0	0	-300	0	AG	190	4.6	.0	13.2
C. Griffin N	0	0	0	300	AG	305	4.6	.0	13.2
D. Griffin S	0	0	0	-300	AG	270	4.6	.0	13.2

(LINK COORDINATES (M))

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. Recpt 1	7	7	.5
2. Recpt 2	-7	7	.5
3. Recpt 3	-7	-7	.5
4. Recpt 4	7	-7	.5

(COORDINATES (M))

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D
1. Recpt 1	187.	.2	.0	.0	.0	.1
2. Recpt 2	173.	.2	.0	.0	.0	.1
3. Recpt 3	7.	.2	.0	.0	.1	.0
4. Recpt 4	353.	.2	.0	.0	.1	.0

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

              JOB: Bayview Evans_Jennings Project
              RUN: Hour 1           (WORST CASE ANGLE)
        POLLUTANT: Carbon Monoxide


   I.  SITE VARIABLES

        U=   1.0 M/S             Z0= 100. CM            ALT=     0. (M)
      BRG= WORST CASE            VD=   .0 CM/S
     CLAS=     6 (F)             VS=   .0 CM/S
     MIXH= 1000. M              AMB=   .0 PPM
    SIGTH=   10. DEGREES       TEMP=  5.0 DEGREE (C)


  II.  LINK VARIABLES

      LINK      *  LINK COORDINATES (M)   *                 EF     H     W
   DESCRIPTION  *   X1    Y1    X2    Y2  * TYPE  VPH  (G/MI)  (M)   (M)
 ---------------*-------------------------*-----------------------------
 A. Jennings E  *     0     0   300     0 *  AG   3070   1.5     .0  13.2
 B. Jennings W  *     0     0  -300     0 *  AG   2750   1.5     .0  13.2
 C. Evans N     *     0     0     0   300 *  AG   1280   1.5     .0  20.4
 D. Evans S     *     0     0     0  -300 *  AG    800   1.5     .0  20.4


 III.  RECEPTOR LOCATIONS

             *    COORDINATES (M)
   RECEPTOR  *    X      Y      Z
 ------------*---------------------
 1. Recpt 1  *     10      7    .5
 2. Recpt 2  *    -10      7    .5
 3. Recpt 3  *    -10     -7    .5
 4. Recpt 4  *     10     -7    .5


  IV.  MODEL RESULTS (WORST CASE WIND ANGLE )

             *       * PRED  *      CONC/LINK
             *  BRG  * CONC  *        (PPM)
  RECEPTOR   * (DEG) * (PPM) *   A    B    C    D
 ------------*-------*-------*--------------------
 1. Recpt 1  *  262. *    .5 *   .1   .3   .0   .0
 2. Recpt 2  *   98. *    .5 *   .3   .1   .0   .0
 3. Recpt 3  *   82. *    .5 *   .3   .1   .0   .0
 4. Recpt 4  *  278. *    .5 *   .1   .3   .0   .0
```

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Evans_Jennings No Project
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 1.0 M/S	Z0= 100. CM	ALT= 0. (M)
BRG= WORST CASE	VD= .0 CM/S	
CLAS= 6 (F)	VS= .0 CM/S	
MIXH= 1000. M	AMB= .0 PPM	
SIGTH= 10. DEGREES	TEMP= 5.0 DEGREE (C)	

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Jennings E	0	0	300	0	AG	3150	1.5	.0	13.2
B. Jennings W	0	0	-300	0	AG	2820	1.5	.0	13.2
C. Evans N	0	0	0	300	AG	1290	1.5	.0	20.4
D. Evans S	0	0	0	-300	AG	800	1.5	.0	20.4

(LINK COORDINATES (M): X1, Y1, X2, Y2)

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. Recpt 1	10	7	.5
2. Recpt 2	-10	7	.5
3. Recpt 3	-10	-7	.5
4. Recpt 4	10	-7	.5

(COORDINATES (M))

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	A	B	C	D
1. Recpt 1	262.	.5	.1	.3	.0	.0
2. Recpt 2	98.	.5	.3	.1	.0	.0
3. Recpt 3	82.	.5	.3	.1	.0	.0
4. Recpt 4	278.	.5	.1	.3	.0	.0

(CONC/LINK (PPM): A, B, C, D)

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Evans_Jennings Exist
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

```
     U=   1.0 M/S            Z0= 100. CM            ALT=     0. (M)
   BRG= WORST CASE           VD=   .0 CM/S
  CLAS=     6 (F)            VS=   .0 CM/S
  MIXH= 1000. M             AMB=   .0 PPM
 SIGTH=   10. DEGREES      TEMP=  5.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Jennings E	0	0	300	0	AG	670	4.1	.0	13.2
B. Jennings W	0	0	-300	0	AG	776	4.1	.0	13.2
C. Evans N	0	0	0	300	AG	165	4.1	.0	20.4
D. Evans S	0	0	0	-300	AG	149	4.1	.0	20.4

(LINK COORDINATES (M))

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. Recpt 1	10	7	.5
2. Recpt 2	-10	7	.5
3. Recpt 3	-10	-7	.5
4. Recpt 4	10	-7	.5

(COORDINATES (M))

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D
1. Recpt 1	263.	.4	.0	.3	.0	.0
2. Recpt 2	263.	.4	.0	.4	.0	.0
3. Recpt 3	277.	.4	.0	.4	.0	.0
4. Recpt 4	277.	.4	.0	.3	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Waker_Gilman Project
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 1.0 M/S ZO= 100. CM ALT= 0. (M)
BRG= WORST CASE VD= .0 CM/S
CLAS= 6 (F) VS= .0 CM/S
MIXH= 1000. M AMB= .0 PPM
SIGTH= 10. DEGREES TEMP= 5.0 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
	LINK COORDINATES (M)								
A. Gilman E	0	0	300	0	AG	410	1.5	.0	13.2
B. Gilman W	0	0	-300	0	AG	2370	1.5	.0	13.2
C. Carroll N	0	0	0	300	AG	2140	1.5	.0	13.2
D. Carroll S	0	0	0	-300	AG	2700	1.5	.0	13.2

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. Recpt 1	7	7	.5
2. Recpt 2	-7	7	.5
3. Recpt 3	-7	-7	.5
4. Recpt 4	7	-7	.5

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D
1. Recpt 1	263.	.5	.0	.3	.2	.0
2. Recpt 2	172.	.6	.0	.2	.0	.3
3. Recpt 3	8.	.5	.0	.2	.3	.0
4. Recpt 4	277.	.5	.0	.3	.0	.2

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Walker_Gilman No Project
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

```
   U=   1.0 M/S             Z0= 100. CM           ALT=     0. (M)
 BRG= WORST CASE            VD=   .0 CM/S
CLAS=     6 (F)             VS=   .0 CM/S
MIXH= 1000. M              AMB=   .0 PPM
SIGTH=  10. DEGREES       TEMP=  5.0 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Gilman E	0	0	300	0	AG	160	1.3	.0	13.2
B. Gilman W	0	0	-300	0	AG	580	1.3	.0	13.2
C. Carroll N	0	0	0	300	AG	870	1.3	.0	13.2
D. Carroll S	0	0	0	-300	AG	990	1.3	.0	13.2

(LINK COORDINATES (M): X1, Y1, X2, Y2)

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. Recpt 1	7	7	.5
2. Recpt 2	-7	7	.5
3. Recpt 3	-7	-7	.5
4. Recpt 4	7	-7	.5

(COORDINATES (M))

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	A	B	C	D
1. Recpt 1	187.	.1	.0	.0	.0	.1
2. Recpt 2	173.	.2	.0	.0	.0	.1
3. Recpt 3	7.	.2	.0	.0	.1	.0
4. Recpt 4	277.	.1	.0	.0	.0	.0

(CONC/LINK (PPM): A, B, C, D)

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Bayview Walker_Gilman Exist
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= 1.0 M/S	Z0= 100. CM	ALT= 0. (M)
BRG= WORST CASE	VD= .0 CM/S	
CLAS= 6 (F)	VS= .0 CM/S	
MIXH= 1000. M	AMB= .0 PPM	
SIGTH= 10. DEGREES	TEMP= 5.0 DEGREE (C)	

II. LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Gilman E	0	0	300	0	AG	141	4.1	.0	13.2
B. Gilman W	0	0	-300	0	AG	69	4.1	.0	13.2
C. Carroll N	0	0	0	300	AG	98	4.1	.0	13.2
D. Carroll S	0	0	0	-300	AG	1	4.1	.0	13.2

III. RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. Recpt 1	7	7	.5
2. Recpt 2	-7	7	.5
3. Recpt 3	-7	-7	.5
4. Recpt 4	7	-7	.5

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D
1. Recpt 1	97.	.0	.0	.0	.0	.0
2. Recpt 2	96.	.0	.0	.0	.0	.0
3. Recpt 3	84.	.0	.0	.0	.0	.0
4. Recpt 4	354.	.0	.0	.0	.0	.0

Appendix H2 MACTEC Construction Workers and Equipment Resources, October 1, 2009

Draft: Bayview Waterfront Project - Construction Workers and Equipment for 2017 Stadium delivery by Construction Phase (Revision 7, 10-01-09)
Prepared by MACTEC for EIR analysis

Construction Phase	Yearly Average Duration (months)	Daily Construction Workers Max. Number of workers	Avg. Number of workers	Daily Construction Truck Trips [1] Max. Number of truck trips	Avg. Number of truck trips	Number of on site equipment	Construction Equipment [3] Full Time	Construction Equipment [3] 1/2 Time	Construction Equipment [3] 1/4 Time
Hunters Point Shipyard									
2010 Site Preparation									
Abatement (HP-01, 03, 04)	6	15	12	16	8	6	(3) Man Lifts, (1)Loader, (1) Rough Terrain Fork lift	(1) Water Truck	
Demolition (HP-01, 03, 04)	5	25	20	24	16	10	(2) Man Lifts, (2)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (2)Water Trucks, (1) Crane		
2011 Site Preparation									
Demolition (HP-01, 03, 04)	5	25	20	24	16	10	(2) Man Lifts, (2)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (2)Water Trucks, (1) Crane		
Grading & Infrastructure (HP-01, 03, 04)	8	38	30	160	128	15	(3)Excavators, (2)Loaders, (1)Bobcat, (2)Compactors, (1)Water Truck, (1) Scraper, (3) Off Road Dump Trucks, (1) Dozer		(1) Barge
2012 Site Preparation									
Abatement (HP-07, 10, 06)	7	30	24	32	8	12	(6) Man Lifts, (2)Loader, (2) Rough Terrain Fork lift	(2) Water Truck	
Demolition (HP-07, 10, 06)	6	50	40	48	16	20	(4) Man Lifts, (4)Excavators,(2) Off Road Dump Truck, (2)Loaders, (2)Dozer, (4)Water Trucks, (2) Crane		
Grading & Infrastructure (HP-01, 02, 03 and 04)	7	68	54	240	216	27	(4)Excavators, (2)Loaders, (2)Bobcat, (2)Compactors, (2)Water Truck, (2) Off Road Dump Truck, (1) Dozer		(2) Grader, (2) Asphalt Layer, (2) Soil stabilizer, (2) Roller, (2) Dozers, (1) Barge
2013 Site Preparation									
Demolition (HP-07, 10, 06)	7	50	40	48	32	20	(4) Man Lifts, (4)Excavators,(2) Off Road Dump Truck, (2)Loaders, (2)Dozer, (4)Water Trucks, (2) Crane		
Grading & Infrastructure (HP-03, 06, 07 and 10)	8	90	72	408	352	36	(6)Excavators, (4)Loaders, (2)Bobcat, (4)Compactors, (3)Water Truck, (6) Off Road Dump Truck, (2) Scrapers, (2) Dozers		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers, (2) Barge
2013 Building Construction									
Foundation Piles/Structure/Rough In (HP-01)	6	20	16	16	8	8	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift		
Interior and Exterior Finishes (HP-01)	7	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2014 Site Preparation									
Abatement (HP-08)	7	15	12	16	8	6	(3) Man Lifts, (1)Loader, (1) Rough Terrain Fork lift	(1) Water Truck	
Grading & Infrastructure (HP-04, 05, 06, 7 and 10)	8	145	116	424	360	58	(9)Excavators, (5)Loaders, (5)Compactors, (4) Bobcats, (4)Water Trucks, (6) Off Road Dump Trucks, (1) Scraper, (3) Dozers		(4) Grader, (4) Asphalt Layer, (4) Soil stabilizer, (4) Roller, (4) Dozers, (1) Barge
2014 Building Construction									
Foundation Piles/Structure/Rough In (HP-03)	4	13	10	16	8	5	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift		
Interior and Exterior Finishes (HP-01)	4	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2015 - Site Preparation									
Abatement (HP-11)	1	13	10	16	8	5		(2) Man Lifts, (1)Loader, (1) Rough Terrain Fork lift	(1) Water Truck
Demolition (HP-08)	6	25	20	24	16	10	(2) Man Lifts, (2)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (2)Water Trucks, (1) Crane		
Grading & Infrastructure (HP-07, and 08)	10	63	50	176	152	25	(3)Excavators, (2)Loaders, (2)Bobcat, (2)Compactors, (2)Water Truck, (2) Off Road Dump Truck, (1) Dozer		(2) Grader, (2) Asphalt Layer, (2) Soil Stabilizer, (2) Roller, (2) Dozers, (1) Barge
2015 - Building Construction									
Foundation Piles/Structure/Rough In (HP-04 and 06)	7	60	48	32	16	24	(3)Excavators, (4)Loaders,(3)Water Trucks, (5)Cranes, (3) Man Lift		
Interior and Exterior Finishes (HP-03)	10	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2016 - Site Preparation									
Demolition (HP-11)	1	20	16	16	8	8	(2) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks	(1) Crane	
Grading & Infrastructure (HP- 08, 09 and 10)	8	85	68	256	224	34	(3)Excavators, (3)Loaders, (3)Bobcat, (3)Compactors, (3)Water Truck, (3) Off Road Dump Truck		(3) Grader, (3) Asphalt Layer, (3) Soil stabilizer, (3) Roller, (3) Dozers,
2016-Building Construction									
Foundation Piles/Structure/Rough In (HP-07)	10	33	26	32	16	13	(2)Excavators, (2)Loaders,(2)Water Trucks, (2)Cranes, (2) Man Lift		
Interior and Exterior Finishes(HP-04, 06 and 07)	9	60	48	64	32	24	(5)Loader, (6) Man Lift, (5) Sweeper, (7) Rough Terrain Fork Lift, (1) Crane		
2017-Site Preparation									
Grading & Infrastructure (HP-11)	9	33	26	240	224	13	(1)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (2) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2017-Building Construction									
Foundation Piles/Structure/Rough In (HP-07, 10 and 11)	4	68	54	64	32	27	(4)Excavators, (4)Loaders,(4)Water Trucks, (3)Cranes, (4) Man Lift		
Interior and Exterior Finishes (HP-07 and 08)	6	30	24	48	24	12	(3)Loader, (3) Man Lift, (3) Sweeper, (3) Rough Terrain Fork Lift		
2018- Building Construction									
Interior and Exterior Finishes (HP-10 and 11)	8	38	30	32	16	15	(4) Man Lift, (2) Sweeper, (2) Rough Terrain Fork Lift, (1)Loader	(1)Loader, (1) Off Road Dump Truck	(4) Onsite Field Trucks
Yosemite Slough Bridge / Access Road 2015	9	78	62	32	24	31	(1)Excavators, (2)Loaders, (2) Off Road Dump Truck, (1) Dozer, (4) Barges, (4) Cranes, (1) Drill Rig, (1)Water Truck	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck, (1) Pile Driver	(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers, (2) Pump Trucks
Yosemite Slough Bridge / Access Road 2016	9	78	62	32	24	31	(1)Excavators, (2)Loaders, (2) Off Road Dump Truck, (1) Dozer, (4) Barges, (4) Cranes, (1) Drill Rig, (1)Water Truck	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck, (1) Pile Driver	(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers, (2) Pump Trucks
Off-Site Roadway Improvements 2013	8	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Palou									
Off-Site Roadway Improvements 2014	6	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Palou									
Off-Site Roadway Improvements 2015	10	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Innes									
Off-Site Roadway Improvements 2016	6	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Innes									
Field Management 2010	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2011	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2012	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2013	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2014	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2015	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2016	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2017	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	

Construction Phase	Yearly Average Duration (months)	Daily Construction Workers: Max. Number of workers	Daily Construction Workers: Avg. Number of workers	Daily Construction Truck Trips[1]: Max. Number of truck trips	Daily Construction Truck Trips[1]: Avg. Number of truck trips	Daily Construction Truck Trips[1]: Number of on site equipment	Construction Equipment[3] Full Time	Construction Equipment[3] 1/2 Time	Construction Equipment[3] 1/4 Time
Candlestick Point									
Site Preparation 2011									
Grading & Infrastructure (CP-01 and 02)	5	20	16	144	120	8	(1)Excavators, (1)Loaders, (1)Compactors, (1)Water Truck, (1) Scraper, (2) Off Road Dump Trucks, (1) Dozer		
2012 Site Preparation									
Grading & Infrastructure (CP-01)	3	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2012 Building Construction									
Structure/Rough In (CP-01)	3	18	14	16	8	7	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	
2013 Site Preparation									
Abatement (CP-03)	2	13	10	16	8	5	(2) Man Lifts, (1)Loader, (1) Rough Terrain Fork lift	(1) Water Truck	
Grading & Infrastructure (CP-02)	2	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2013 Building Construction									
Structure/Rough In (CP-02)	2	18	14	16	8	7	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift		(1) Cement Truck, (1) Pump Truck
Interior and Exterior Finishes (CP-01)	8	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2014 Site Preparation									
Abatement (CP-04)	2	13	10	16	8	5	(2) Man Lifts, (1)Loader, (1) Rough Terrain Fork lift	(1) Water Truck	
Demolition (CP-03)	2	20	16	24	16	8	(2) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks, (1) Crane		
Grading & Infrastructure (CP-03)	3	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2014 Building Construction									
Interior and Exterior Finishes (CP-02)	5	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2015 Site Preparation									
Abatement (CP-05)	2	13	10	16	8	5	(2) Man Lifts, (1)Loader, (1) Rough Terrain Fork lift	(1) Water Truck	
Demolition (CP-04)	2	20	16	24	16	8	(2) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks, (1) Crane		
Grading & Infrastructure (CP-04)	5	33	26	16	8	13	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck	(1) Scraper	(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2015 Building Construction									
Structure/Rough In (CP-03)	3	18	14	16	8	7	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	
2016 Site Preparation									
Abatement (CP-06)	2	13	10	16	8	5	(2) Man Lifts, (1)Loader, (1) Rough Terrain Fork lift	(1) Water Truck	
Demolition (CP-05 and 06)	2	40	32	48	32	16	(4) Man Lifts, (2)Excavators,(2) Off Road Dump Truck, (2)Loaders, (2)Dozer, (2) Crane, (2)Water Trucks		
Grading & Infrastructure (CP-05)	5	33	26	16	8	13	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (2) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2016 Building Construction									
Foundation Piles/Structure/Rough In (CP-04)	5	18	14	16	8	7	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	
Interior and Exterior Finishes (CP-03)	8	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2017 Site Preparation									
Abatement (CP-07)	3	13	10	3	24	5	(2) Man Lifts, (1)Loader, (1) Rough Terrain Fork lift	(1) Water Truck	
Demolition (CP-07)	11	40	32	48	40	16	(4) Man Lifts, (2)Excavators,(2) Off Road Dump Truck, (2)Loaders, (2)Dozer, (2)Water Trucks, (2) Crane		
Grading & Infrastructure (CP-06)	5	33	26	16	8	13	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (2) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Grading & Infrastructure (CP-07)	10	33	26	16	8	13	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (2) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2017 Building Construction									
Foundation Piles/Structure/Rough In (CP-05)	4	18	14	16	8	7	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	
Interior and Exterior Finishes (CP-04)	10	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2018 Site Preparation									
Grading & Infrastructure (CP-07)	10	60	48	16	8	24	(4)Excavators, (2)Loaders, (2)Bobcat, (2)Compactors, (2)Water Truck, (2) Off Road Dump Truck		(2) Grader, (2) Asphalt Layer, (2) Soil stabilizer, (2) Roller, (2) Dozers
2018 Building Construction									
Structure/Rough In (CP-06)	3	18	14	16	8	7	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	
Interior and Exterior Finishes (CP-05)	8	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2019 Site Preparation									
Demolition (CP-08)	1	15	12	24	16	6		(1) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks	
Grading & Infrastructure (CP-08)	8	30	24	24	16	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2019 Building Construction									
Foundation Piles/Structure/Rough In (CP-07)	10	20	16	16	8	8	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	(1) Pile Driver
Interior and Exterior Finishes (CP-06)	8	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
Interior and Exterior Finishes (CP-07)	9	20	16	16	8	8	(2)Loader, (2) Man Lift, (2) Sweeper, (2) Rough Terrain Fork Lift		
2020 Site Preparation									
Demolition (CP-09)	1	20	16	24	16	8		(2) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks, (1) Crane	
Grading & Infrastructure (CP-09)	4	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2020 Building Construction									
Foundation Piles/Structure/Rough In (CP-07 and 08)	9	40	32	32	16	16	(2)Excavators, (2)Loaders,(2)Water Trucks, (2)Cranes, (2) Man Lift	(2) Cement Truck, (2) Pump Truck	(2) Pile Driver
Interior and Exterior Finishes (CP-07 and 08)	9	30	24	32	16	12	(3)Loader, (3) Man Lift, (3) Sweeper, (3) Rough Terrain Fork Lift		
2021 Site Preparation									
Demolition (CP-10)	1	20	16	24	16	8		(2) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks, (1) Crane	
Grading & Infrastructure (CP-10)	10	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2021 Building Construction									
Foundation Piles/Structure/Rough In (CP-09)	3	20	16	16	8	8	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	(1) Pile Driver
Interior and Exterior Finishes (CP-08)	8	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2022 Site Preparation									
Demolition (CP-11)	1	15	12	24	16	6		(1) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks	
Grading & Infrastructure (CP-11)	6	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
2022 Building Construction									
Foundation Piles/Structure/Rough In (CP-10)	8	20	16	16	8	8	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	(1) Pile Driver
Interior and Exterior Finishes (CP-09)	7	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2023 Site Preparation									
Demolition (CP-12)	1	15	12	24	16	6		(1) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks	
Grading & Infrastructure (CP-12)	10	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers

Construction Phase	Yearly Average Duration (months)	Daily Construction Workers Max. Number of workers	Avg. Number of workers	Daily Construction Truck Trips[1] Max. Number of truck trips	Avg. Number of truck trips	Number of on site equipment	Construction Equipment[3] Full Time	Construction Equipment[3] 1/2 Time	Construction Equipment[3] 1/4 Time
2023 Building Construction									
Foundation Piles/Structure/Rough In (CP-11)	5	20	16	16	8	8	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	(1) Pile Driver
Interior and Exterior Finishes (CP-10)	9	20	16	16	8	8	(2)Loader, (2) Man Lift, (2) Sweeper, (2) Rough Terrain Fork Lift		
2024 Site Preparation									
Demolition (CP-13)	2	20	16	24	16	8	(2) Man Lifts, (1)Excavators,(1) Off Road Dump Truck, (1)Loaders, (1)Dozer, (1)Water Trucks, (1) Crane		
Grading & Infrastructure (CP-13)	8	63	50	16	8	25	(3)Excavators, (2)Loaders, (2)Bobcat, (2)Compactors, (2)Water Truck, (4) Off Road Dump Truck		(2) Grader, (2) Asphalt Layer, (2) Soil stabilizer, (2) Roller, (2) Dozers
2024 Building Construction									
Foundation Piles/Structure/Rough In (CP-12)	8	13	10	16	8	5	(1)Excavators, (1)Loaders,(1)Water Trucks, (1)Cranes, (1) Man Lift	(1) Cement Truck, (1) Pump Truck	(1) Pile Driver
Interior and Exterior Finishes (CP-11)	10	10	8	16	8	4	(1)Loader, (1) Man Lift, (1) Sweeper, (1) Rough Terrain Fork Lift		
2025 Building Construction									
Foundation Piles/Structure/Rough In (CP-13)	10	38	30	16	8	15	(2)Excavators, (2)Loaders,(2)Water Trucks, (2)Cranes, (2) Man Lift	(2) Cement Truck, (2) Pump Truck	(1) Pile Driver
Interior and Exterior Finishes (CP-12)	7	20	16	16	8	8	(2)Loader, (2) Man Lift, (2) Sweeper, (2) Rough Terrain Fork Lift		
2026 Building Construction									
Interior and Exterior Finishes (CP-13)	10	20	16	16	8	8	(2)Loader, (2) Man Lift, (2) Sweeper, (2) Rough Terrain Fork Lift		
Off-Site Roadway Improvements 2013	9	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Gilman (Southeast), Carroll									
Off-Site Roadway Improvements 2015	10	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Gilman(Northwest), Thomas, Griffith									
Off-Site Roadway Improvements 2016	10	30	24	16	8	12	(2)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Harney									
Off-Site Roadway Improvements 2020	6	28	22	16	8	11	(1)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Ingerson									
Off-Site Roadway Improvements 2021	6	28	22	16	8	11	(1)Excavators, (1)Loaders, (1)Bobcat, (1)Compactors, (1)Water Truck, (1) Off Road Dump Truck		(1) Grader, (1) Asphalt Layer, (1) Soil stabilizer, (1) Roller, (1) Dozers
Jamestown									
Field Management 2011	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2012	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2013	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2014	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2015	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2016	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2017	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2018	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2019	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2020	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2021	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2022	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2023	12	25	20	8	4	10		(6)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2024	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2025	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	
Field Management 2026	12	20	16	8	4	8		(4)Onsite Field Trucks, Backup Equipment (see note 2): (1)Loaders, (1)Haul Trucks, (1)Water Trucks, (1) Man Lift	

SOURCE: MACTEC

Note:

1. Number of truck trips making deliveries, and number of truck trips required for materials removal, see assumptions for trip details.
2. Back up equipment is kept onsite to minimize downtime if a piece of equipment breaks down and needs replacement. Typically this equipment will not be used on a day to day basis.
3. It should be assumed that all Man Lifts referenced in the "Construction Equipment" columns will be propane or electric powered.
4. Hunters Point and Candlestick Point will each utilize a new dedicated crushing plant located near the Bay. The crushing plants will be comprised of 1 loader, 1 hammer, 1 screener, 1 crusher and an adjacent batch plant. Each crushing plant will operate ½ time.

(2) = Number of pieces of specified equipment.

Changed since latest version of the table

Assumptions

Max. number of round trips to be performed by 1 haul truck is 4 which = 8 total trips

Each truck will be able to carry 20 tons of material

Personal vehicle trips to and from the construction site were not included in the truck trip calculations and are estimated to be 1 trip for every 2 workers as incentives will be offered for use of mass transit and car/van pooling.

Import fill will be brought onto the site through two primary modes; Trucks (60%) and Barge (40%).

Quantities do not account for concurrent remediation work occurring at Hunters Point Shipyard.

Draft: Bayview Waterfront Project - Construction Workers and Equipment for Shoreline Improvements by Construction Phase (Revision 2, 10-15-09)
Prepared by MACTEC for EIR analysis

Construction Phase	Yearly Average Duration (months)	Daily Construction Workers Max. Number of workers	Daily Construction Workers Avg. Number of workers	Daily Construction Truck Trips[1] Max. Number of truck trips	Daily Construction Truck Trips[1] Avg. Number of truck trips	Yearly Barge Trips Number of Round Trips	Number of on site equipment	Construction Equipment[2,3] Full Time	Construction Equipment[2] 1/2 Time	Construction Equipment[2] 1/4 Time
Hunters Point Shipyard										
2013 Shoreline										
Demolition and Improvements (HP-03)	9	14	12	0	0	0	5	(1) Floating Platforms, (1) Bobcat		
2014 Shoreline										
Demolition and Improvements (HP-03 and 04)	9	14	12	0	0	6	8	(2) Floating Platforms, (1) Bobcat		(1)Barge, (1) Cranes
2015 Shoreline										
Demolition and Improvements (HP-04 and 07)	10	38	33	4	2	35	9	(3) Floating Platforms, (2) Cranes, (1) Excavator, (2) Bobcat	(1)Barge	
2016 Shoreline										
Demolition and Improvements (HP-07)	10	24	21	4	2	35	8	(2) Floating Platforms, (2) Cranes, (1) Excavator, (1) Bobcat, (1) Pile Driver	(1)Barge	
2017 Shoreline										
Demolition and Improvements (HP-07 and 08)	10	40	35	4	2	70	14	(4) Floating Platforms, (4) Cranes, (2) Excavator, (2) Bobcat	(2)Barge	
2018 Shoreline										
Demolition and Improvements (HP-07 and 08)	10	40	35	4	2	60	14	(4) Floating Platforms, (4) Cranes, (2) Excavator, (2) Bobcat	(2)Barge	
2019 Shoreline										
Demolition and Improvements (HP- 08)	10	16	14	4	2	30	7	(2) Floating Platforms, (2) Cranes, (1) Excavator, (1) Bobcat	(1)Barge	
2022 Shoreline										
Demolition and Improvements (HP-11)	10	16	14	4	2	30	5	(2) Cranes, (1) Excavator, (1) Bobcat	(1)Barge	
2023 Shoreline										
Demolition and Improvements (HP-11)	10	16	14	4	2	30	5	(2) Cranes, (1) Excavator, (1) Bobcat	(1)Barge	
Candlestick Point										
2014 Shoreline Improvements (CP-03)	2	7	5	0	0	2	3	(1) Excavator		(1) Crane, (1) Barge
2019 Shoreline Improvements (CP-08)	2	7	5	0	0	2	3	(1) Excavator		(1) Crane, (1) Barge
2020 Shoreline Improvements (CP-09)	2	7	5	0	0	2	3	(1) Excavator		(1) Crane, (1) Barge
2022 Shoreline Improvements (CP-11)	3	7	5	0	0	4	3	(1) Excavator		(1) Crane, (1) Barge
2023 Shoreline Improvements (CP-12)	5	7	5	0	0	3	3	(1) Excavator		(1) Crane, (1) Barge
2024 Shoreline Improvements (CP-14)	5	7	5	0	0	4	3	(1) Excavator	(1) Crane, (1) Barge	

SOURCE: MACTEC

Note:

1. Number of truck trips making deliveries, and number of truck trips required for materials removal, see assumptions for trip details.
2. The construction equipment in this table identifies what will be required in addition to the equipment already onsite performing infrastructure work.
3. It should be assumed that all Floating Platforms referenced in the "Construction Equipment" columns will be propane or electric powered.

(2) = Number of pieces of specified equipment.

Assumptions

Each truck will be able to carry 15 cy of material
Each barge will be able to carry 2500 tons of material
Hunters Point Shipyard import fill will be brought on site by barge (100%)
Candlestick Point import fill will be brought on site by barge (50%), and sourced on site (50%).
Quantities do not account for work performed by Navy.

Appendix H3 ENVIRON, Ambient Air Quality and Human Health Risk Assessment, May 2010 [Main Text and Attachment IV Only]

Appendix H3: Ambient Air Quality Human Health Risk Assessment

Candlestick Point – Hunters Point Shipyard Phase II Development Plan San Francisco, California

Prepared for:
PBS&J
San Francisco, California

Prepared by:
ENVIRON International Corporation
San Francisco and Emeryville, California

Date:
~~October 30, 2009~~ May 4, 2010

Project Number:
03-20816A

Contents

List of Acronyms

AAQ	Ambient Air Quality
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
Cal/EPA	California Environmental Protection Agency
CEQA	California Environmental Quality Act
CP	Candlestick Point
DPM	Diesel Particulate Matter
EIR	Environmental Impact Report
EMFAC	EMission FACtor model
HHRA	Human Health Risk Assessment
HI	Hazard Index
HPS	Hunters Point Shipyard
MEI	Maximally Exposed Individual
NFL	National Football League
PBS&J	Post, Buckley, Schuh & Jernigan, Inc.
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter Less than 2.5 Microns in Aerodynamic Diameter
PM_{10}	Particulate Matter Less than 10 Microns in Aerodynamic Diameter
R&D	Research and Development
SFDPH	San Francisco Department of Public Health
TAC	Toxic Air Contaminants
USEPA	United States Environmental Protection Agency

List of Units

gsf	gross square footage
m^3	cubic meter
μg	microgram

1 Introduction

At the request of Post, Buckley, Schuh & Jernigan, Inc. (PBS&J), ENVIRON International Corporation (ENVIRON) has performed four ambient air quality (AAQ) human health risk assessments (HHRA) as part of the Environmental Impact Report (EIR) for the proposed Candlestick Point – Hunters Point Shipyard Phase II Development Plan ("Project"). The EIR for the Project is being prepared by PBS&J on behalf of the San Francisco Redevelopment Agency and the San Francisco Planning Department.

The Project will consist of the development of approximately 702-acre area east of U.S. 101 in the southeast area of the City and County of San Francisco and will occupy the waterfront area from south of India Basin to Candlestick Cove. The Project is comprised of two major sub-components: Candlestick Point (CP) and Hunters Point Shipyard (HPS) Phase II.

Details of the Project are described in Chapter II of the EIR. The Project proposed by Lennar Urban includes a mixed-use community with a range of residential, retail, office, research and development, civic and community uses, and parks and recreational open space. In addition, a major component would be a new stadium for the San Francisco 49ers, a National Football League (NFL) team. Necessary infrastructure improvements (including several roadway modifications) are also proposed in support of the Project development plan.

The EIR also examines variants to the Project:

- Variant 1 would include an additional 2.5 million gross square footage (gsf) of research and development space on the proposed stadium site. All other elements of the Project would remain the same.
- Variant 2 would redistribute 1,350 residential units to the proposed stadium site from Candlestick Point. All other elements of the Project would remain the same.
- A third variant (Variant 3) would include the same land use program and overall description as the Project, with different locations for the residential towers.
- Variant 4 is the same overall development plan as the Project, but with minor shifts in building locations to accommodate 570,000 gsf for the proposed utility systems (with 330,000 gsf located below ground).
- Variant 5 assumes that a new stadium would be constructed and shared between the San Francisco 49ers and the Oakland Raiders football teams. The land use program would remain the same as the proposed Project.

Chapter IV of the EIR analyzes these Variants. Evaluation of the variants in the EIR allows for consideration and approval of these variants without further environmental review.

ENVIRON conducted four AAQ HHRAs in support of the EIR for the Project, as follows:

1. **Human Health Risk Assessment of Construction-Related Diesel Particulate Matter:** This HHRA included evaluation of the potential health effects associated with exposure to diesel particulate matter (DPM) that may be emitted during Project-related construction activities.

2. **Human Health Risk Assessment of Chemicals Bound to Airborne PM_{10}:** This HHRA included an evaluation of the potential health effects associated with potential exposures to chemicals bound to particulate matter (PM) with a mean diameter of 10 microns or less (PM_{10}) released from soils during Project-related construction activities. Those chemicals present in soil dusts at concentrations above the residential cleanup goal are evaluated.

3. **Analysis of Toxic Air Contaminant Emissions from Stationary Sources in Research and Development Areas:** This HHRA involved a screening-level prospective analysis to evaluate potential health impacts from future stationary sources of toxic air contaminant (TAC) emissions in the areas designated for research and development (R&D) within the proposed Project.

4. **$PM_{2.5}$ Analysis of Traffic/Vehicular Emissions**: This HHRA included an evaluation of the potential health impacts associated with concentrations of particulate matter (PM) with a mean diameter of 2.5 microns or less ($PM_{2.5}$) along major thoroughfares in the vicinity of the Project due to Project-related traffic.

The HHRAs performed by ENVIRON have been conducted in accordance with the California Environmental Quality Act (CEQA) and were prepared using information obtained from PBS&J and Lennar Urban.

The HHRAs are presented in four separate attachments to this main report, as identified below. Attachment V presents documentation of the meteorological data used in the air dispersion modeling component of the four AAQ HHRAs. The methods used in each HHRA as well as the findings from each analysis are summarized below.

Since the HHRAs were completed, changes were made to the Project Description including the addition of roadway improvements on Ingerson and Jamestown Avenues, compaction of Candlestick Point construction schedule (completion in 2026), and slight changes to the Candlestick Point phasing boundaries. These changes to the Project Description were found not to change the HRA conclusions significantly, as documented in a technical memorandum included in Attachment VI. In addition to the above changes, Variant 4 (a new stadium constructed and shared between the San Francisco 49ers and the Oakland Raiders football teams) has been renumbered Variant 5; with a new Variant 4 (the Utilities Variant) which proposes centralized wastewater facilities, heating and cooling plants, and a transvac system for trash (tubes). This new Variant 4 includes 527,000 gsf of new development most of which is underground.

2 Analysis of Construction Equipment Emissions

ENVIRON performed an HHRA to evaluate the potential human health effects associated with potential exposure to DPM that may be emitted during construction activities related to the Project. The full HHRA is included as Attachment I.

2.1 Methodology

The methods used in the analysis of DPM emissions from Project-related construction emissions are consistent with CEQA guidelines and Bay Area Air Quality Management District (BAAQMD), California Environmental Protection (Ca/EPA) and United States Environmental Protection Agency (USEPA) risk assessment guidance. The HHRA incorporates conservative (i.e., health-protective) methodologies for the following: 1) the estimation of DPM emissions, 2) the calculation of airborne DPM concentrations at receptor locations, and 3) the estimation of excess lifetime cancer risks and noncancer health effects or hazard indices (HIs).

ENVIRON estimated DPM emissions for construction equipment associated with the Project construction activities. Construction activities considered in this evaluation include abatement, demolition, grading, excavation, and foundation and structure construction. Specifically, construction sources of DPM evaluated in this HHRA included off-road construction equipment such as lifts, loaders, excavators, dozers, and graders. ENVIRON also evaluated three types of vehicle traffic in this DPM construction HHRA:

- Equipment and material delivery,
- Spoils and debris hauling, and
- Construction employee commute.

Airborne DPM concentrations were then estimated at receptor locations using the DPM emissions estimates and the USEPA recommended air dispersion model American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) version 07026.

Offsite receptors evaluated in this HHRA included residents (child and adult), workers and sensitive receptors (school children) located in the surrounding community and along the expected travel routes of on-road delivery and haul trucks. Onsite receptors evaluated in this HHRA included residents at the Alice Griffith Housing area. As stated in the Chapter II of the EIR, the proposed Project includes rebuilding Alice Griffith Housing to provide one-for-one replacement units and ensuring that eligible Alice Griffith Housing residents have the opportunity to move to the new, upgraded units directly from their existing Alice Griffith Housing units without having to relocate to any other area. Based on the proposed plan outlined in the EIR, it is anticipated that construction activities within the Alice Griffith Housing area will be phased by parcel. While construction occurs at one parcel, residents will continue to reside at the remaining parcels. These residents were identified as onsite receptors for the Project.

Based on the results of the exposure evaluation and air dispersion modeling, ENVIRON developed quantitative estimates of excess lifetime cancer risks and noncancer HIs associated with potential exposure to DPM that may be emitted during construction activities related to the Project. The methods used to estimate excess lifetime cancer risks and noncancer HIs are consistent with risk assessment guidance from BAAQMD, Cal/EPA and USEPA.

In accordance with CEQA, the cancer risks and chronic noncancer HIs estimated in this HHRA were then compared to the BAAQMD CEQA thresholds of significance. Pursuant to BAAQMD *CEQA Guidelines* (BAAQMD 1999), projects that expose the public to TACs in excess of the following thresholds would be considered to have a significant air quality impact:

- Probability of contracting cancer for the maximally exposed individual (MEI) exceeds 1×10^{-5} (10 in a million);
- Ground level concentrations of noncarcinogenic TACs resulting in a Hazard Index greater than 1 for the MEI.

2.2 Findings

The results of this HHRA indicate that potential excess lifetime cancer risks to offsite residents, workers and sensitive receptors in areas surrounding the Project are below 10 in a million for DPM emitted from construction activity, assuming that certain mitigation measures are implemented as discussed in Attachment I. Further, estimated cancer risks for onsite residents at the Alice Griffith Housing area are also below 10 in a million. The estimated chronic noncancer hazard indices are below one for all receptors evaluated in this HHRA. Thus, based on the results of this HHRA, DPM emission related to Project construction activities should not have a significant air quality impact according to BAAQMD CEQA Guidelines (BAAQMD 1999).

The many conservative assumptions that have been used in this assessment regarding the estimation of emissions, ambient air concentrations, exposure assumptions, and carcinogenic potency lead to an overestimate of potential risks, the magnitude of which could be substantial.

A screening-level analysis was conducted to evaluate the potential impacts of changes to the Project Description on the HHRA conclusions. This screening-level analysis is described in Attachment VI: Technical Memorandum, Updated Project Description. Using this screening approach, the estimated excess lifetime cancer risks and chronic noncancer HIs for all receptors are below the BAAQMD CEQA thresholds of significance, and therefore, the impact from these emissions remains less than significant.

3 Analysis of Airborne Soils

ENVIRON performed a HHRA to evaluate the potential human health risks due to potential exposure to chemicals that may be present in airborne soils (dusts) emitted during Project-related construction activities. The full HHRA is included as Attachment II.

3.1 Methodology

The methods used in the analysis of soil dust emissions from Project-related construction activities are consistent with CEQA guidelines and BAAQMD, Ca/EPA, and USEPA risk assessment guidance. The dusts evaluated are referred to as PM_{10}, that is, PM with a mean aerodynamic diameter of 10 microns or less. PM_{10} corresponds to particles of a size that could be inhaled and retained in the lungs.

Conservative (i.e., health-protective) methodologies were applied for the following: 1) the estimation of PM_{10} emissions from soils, 2) the calculation of airborne PM_{10} and associated chemical concentrations at receptor locations, and 3) the estimation of excess lifetime cancer risks and noncancer health effects or HIs.

The sources of PM_{10} emissions evaluated were demolition and soil grading activities associated with Project construction activities. Those Project areas where PM_{10} emissions were from soils with chemicals present at concentrations above residential cleanup goals were included in the evaluation. Airborne PM_{10} concentrations were estimated at receptor locations using the PM_{10} emissions estimates and the USEPA recommended air dispersion model AERMOD version 07026. Chemical concentrations associated with the airborne PM_{10} were estimated based on the chemical concentrations in soils, referred to as the soil source terms.

Offsite receptors evaluated in the HHRA included residents (child and adult), workers, and sensitive receptors (school children) located in the surrounding community. Onsite receptors evaluated included residents at the Alice Griffith Housing area. As discussed in Section 2.1, it is anticipated that construction activities within the Alice Griffith Housing area will be phased by parcel. While construction occurs at one parcel, residents will continue to reside at the remaining parcels.

Inhalation exposures were quantitatively evaluated for all receptors. In addition, a sensitivity analysis – referred to as a multipath analysis – was conducted for specific chemicals to evaluate the potential contribution of other (noninhalation) exposure pathways. Specifically, airborne dusts released during construction activities could deposit on soils such that exposures could also occur through other pathways (i.e., incidental ingestion of and dermal contact with soil for all receptors, and for residents, ingestion of produce grown in residential gardens).

Based on the results of the exposure evaluation and air dispersion modeling, ENVIRON developed quantitative estimates of excess lifetime cancer risks and noncancer HIs associated with potential exposures to chemicals bound to PM_{10} emitted during construction activities. The methods used to estimate excess lifetime cancer risks and noncancer HIs are consistent with risk assessment guidance from BAAQMD, Cal/EPA, and USEPA. The estimated cancer risks and chronic noncancer HIs were then compared to the BAAQMD CEQA thresholds of significance presented in Section 2.1.

3.2 Findings

The results of this HHRA indicate that potential excess lifetime cancer risks to offsite residents, workers, and sensitive receptors surrounding the Project are below 10 in a million for inhalation exposures to chemicals bound to PM_{10} emitted during construction activities. Further, estimated cancer risks for onsite residents at the Alice Griffith Housing area are below 10 in a million. The estimated chronic noncancer HIs are below one for all receptors evaluated. Thus, based on the results of this HHRA, PM_{10} emissions related to Project construction activities should not have a significant air quality impact according to current BAAQMD CEQA Guidelines (BAAQMD 1999).

The results of the sensitivity analysis for cumulative exposures from inhalation and noninhalation (i.e., incidental ingestion of and dermal contact with soil for all receptors, and for residents, ingestion of produce grown in residential gardens) exposure pathways indicate that the estimated cancer risks and noncancer HIs are below BAAQMD thresholds for all populations evaluated.

A screening-level analysis was conducted to evaluate the potential impacts of changes to the Project Description on the HHRA conclusions. This screening-level analysis is described in Attachment VI: Technical Memorandum, Updated Project Description, which indicates that at the MEI worker, resident adult and resident child the estimated excess lifetime cancer risks continue to be below the threshold of 10 in a million (1.0×10^{-5}) and the noncancer chronic HIs and acute HIs are below the threshold of 1.0. The estimated excess lifetime cancer risks and chronic and acute noncancer HIs for all receptors are below the BAAQMD CEQA thresholds of significance, and therefore, the impact from these emissions remains less than significant.

4 Analysis of Operational Sources

ENVIRON performed a prospective screening-level analysis to evaluate potential health impacts from operational sources of TACs which may locate in the areas designated for R&D within the Project. The full analysis included as Attachment III.

4.1 Methodology

For this prospective screening-level analysis, ENVIRON made a series of assumptions:

- A wide range of stationary sources could operate in the R&D area; thus, the identity and amounts of the TACs emitted from these sources can not be determined at this time.
- The area designated for proposed R&D development would be divided into one-acre plots, which is consistent with the minimum size of a parcel based on the expected land uses within the R&D parcels.
- A single R& D facility (or stationary source) would be constructed on the one-acre plot.
- The cancer risk at the boundary of each one-acre plot was set not to exceed a designated cancer risk level or chronic noncancer HI threshold.
- It was conservatively assumed that all receptor locations surrounding the R&D area were residential.

Evaluation of the impacts associated with stationary sources consisted of two (2) steps:

1.) TAC emissions for each stationary source within a one-acre plot were estimated assuming that the cancer risk and HI at the plot boundary corresponded to 5 in a million and 0.5, respectively.

2.) TAC emissions from each stationary R&D source were summed to assess the cumulative impact of all potential stationary sources within the area designated for R&D development on the surrounding community.

Pursuant current BAAQMD *CEQA Guidelines* (BAAQMD 1999), projects that expose the public to TACs in excess of the following thresholds would be considered to have a significant air quality impact:

- Probability of contracting cancer for the MEI exceeds 1 x 10^{-5} (10 in a million);
- Ground level concentrations of noncarcinogenic TACs resulting in a HI greater than 1 for the MEI.

4.2 Findings

This analysis presents a conservative assessment of the cumulative excess lifetime cancer risk and chronic noncancer HI due to TAC emissions from the R&D areas at any surrounding receptor location. All receptors were initially evaluated as residential receptors. It assumes that each allowable location for TAC emissions will emit chemicals at the maximum allowable rate. In fact, the TAC emissions at some of these locations will be below the maximum rate (for example office building emissions for TAC would be zero or close to zero), and the resultant cumulative risks will also be lower.

Under this conservative evaluation, there are limited areas outside of the R&D areas that would exceed the proposed BAAQMD thresholds if they were residential locations. However, none of these areas are designated for residential land use in the proposed Project. If these areas were used for commercial or recreational land use, the frequency and duration of potential exposures would be less than that for a resident. Thus, the estimated risks and HIs would decrease below the proposed thresholds.

Further evaluation may be warranted if land use in the vicinity of the Project is modified or if the placement of the stationary sources does not conform to the assumptions made in this screening-level analysis.

5 Analysis of $PM_{2.5}$ Concentrations

ENVIRON performed an evaluation of $PM_{2.5}$ concentrations due to Project-associated traffic. The evaluation of potential health impacts from $PM_{2.5}$ is not required under current CEQA guidelines~~, but was performed in response to guidance developed by the San Francisco Department of Public Health (SFDPH)~~. The complete evaluation is included as Attachment IV.

5.1 Methodology

The methods used in the analysis of $PM_{2.5}$ emissions from Project-related traffic are consistent with guidance of the San Francisco Department of Public Health (SFDPH). As discussed in Attachement IV, based on guidance from the US Environmental Protection Agency, Bay Area Air Quality Management District, and SFDPH, a $PM_{2.5}$ action level of 0.2 microgram per cubic meter [µg/m^3] was chosen as a conservative action level for judging significance in this analysis. ~~The SFDPH is concerned that individuals who live in the proximity of heavily-travelled roads or freeways will incur adverse health effects as a result of exposure to vehicle emissions. To minimize contributions to health impacts associated with locating new residential projects near roadway "hot spots", the SFDPH developed a strategy to assess and mitigate air pollution at these locations. Their strategy is based on the use of an annual average threshold concentration of $PM_{2.5}$ (0.2 microgram per cubic meter [µg/m^3]) within a 150 meter zone of a new project as a means of assessing the potential for concern. The threshold concentration of $PM_{2.5}$ is meant to serve as a health-protective "proxy" or surrogate for pollutant exposures from vehicles i.e., $PM_{2.5}$ is not the only pollutant of concern. Instead, the $PM_{2.5}$ threshold serves as a concentration meant to protect the health of residents from all vehicle-associated emissions from a project.~~

Emissions from vehicle exhaust, tire wear, and brake wear were estimated using emission factors generated using the most recent version of the EMission FACtor model (EMFAC), developed by the California Air Resources Board (ARB). Vehicle volumes were estimated from the traffic report, prepared by the CHS Consulting Group.

The concentration of $PM_{2.5}$ from vehicular emissions was characterized by developing exposure point concentrations at residential receptors surrounding the thoroughfares and roadways evaluated: Third Street; Innes Avenue/Hunters Point Boulevard /Evans Avenue; Palou Avenue; Gilman Avenue/Paul Avenue; and Harney Way. Those thoroughfares were identified in the traffic report as primary or secondary roads which connect the proposed Project site and major arterials to U.S. 101. In addition, Evans Avenue/Hunters Point Boulevard /Evans Avenue, and Harney Way were selected since they were identified as streets with significant truck traffic and thus are expected to yield more $PM_{2.5}$ compared to other roads. Furthermore, Palou Avenue, Gilman Avenue/Paul Avenue were selected since there are residences in the vicinity of these roads where individuals may incur exposure to $PM_{2.5.}$

Annual average airborne concentrations of $PM_{2.5}$ attributable to Project-related traffic emissions were estimated by applying a Gaussian air dispersion model, approved by the USEPA and ARB for use in the environmental documentation of transportation projects. Both free flowing traffic and queuing at intersections were evaluated.

The potential health impacts from Project-associated $PM_{2.5}$ were evaluated by comparing predicted concentrations of $PM_{2.5}$ to the ~~SFDPH PM2.5 threshold~~ action level of 0.2 µg/m^3. The evaluation of potential health impacts from $PM_{2.5}$ is not required under current CEQA guidelines~~, but was conducted to comply with SFDPH guidance~~.

5.2 Findings

Modeled concentrations of $PM_{2.5}$ attributable to Project traffic do not exceed the ~~SFDPH threshold concentration~~ action level of 0.2 µg/m^3. The maximum $PM_{2.5}$ concentration in residential areas is below the 0.2 µg/m^3 action level, indicating that ~~by comparison to the SFDPH threshold,~~ residents in the areas impacted by Project traffic are not expected to experience adverse health effects above the proposed level of significance.

This evaluation utilized a number of conservative assumptions in modeling $PM_{2.5}$ concentrations which provide support for the determination that adverse effects of exposure to $PM_{2.5}$ are not likely.

A screening-level analysis was conducted to evaluate the potential impacts of changes to the Project Description on the HHRA conclusions. As described in Attachment VI: Technical Memorandum, Updated Project Description, $PM_{2.5}$ concentrations in the area surrounding Gilman, Ingerson, Jamestown, and Third Street are not expected to exceed 0.2 ~~micrograms per cubic meter (~~µg/m^3~~)~~ action level~~, the SFDPH threshold (SFDPH 2008)~~. The maximum estimated concentration is 0.15 µg/m^3, which occurs on the northern side of Gilman, near its easternmost end. As the impact from traffic $PM_{2.5}$ remains below the ~~SFDPH threshold~~ action level, the impact from these emissions remains less than significant.

6 References

Bay Area Air Quality Management District (BAAQMD). 1999. *BAAQMD CEQA Guidelines: Assessing the Air Quality Impacts of Projects and Plans*. December.

San Francisco Department of Public Health (SFDPH). 2008. *Assessment and Mitigation of Air Pollutant Health Effects from Intra-urban Roadways: Guidance for Land Use Planning and Environmental Review.* May 6.

Attachment IV:
$PM_{2.5}$ Analysis of Traffic/Vehicular Emissions

Candlestick Point– Hunters Point Shipyard
Phase II Development Plan,
San Francisco, California

Contents

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List of Acronyms

AAQS	Ambient Air Quality Standards
ARB	Air Resources Board
CEQA	California Environmental Quality Act
CP	Candlestick Point
DPM	Diesel Particulate Matter
EIR	Environmental Impact Report
EMFAC	EMission FACtor model
gfs	gross square footage
HPS	Hunters Point Shipyard
PBS&J	Post, Buckley, Schuh & Jernigan, Inc.
NAAQS	National Ambient Air Quality Standards
NED	National Elevation Dataset
NFL	National Football League
PAHs	Polynuclear Aromatic Hydrocarbons
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter Less than 2.5 Microns in Diameter
PM_{10}	Particulate Matter Less than 10 Microns in Diameter
R&D	Research and Development
SFDPH	San Francisco Department of Public Health
SFPD	San Francisco Police Department
SRA	State Recreation Area
UCSF	University of California San Francisco
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound

List of Units

m^3	cubic meter
mph	miles per hour
mg	milligram
μg	microgram
μm	micrometer or micron

1 Introduction

At the request of Post, Buckley, Schuh & Jernigan, Inc. (PBS&J), ENVIRON International Corporation (ENVIRON) estimated the concentration of particulate matter (PM) with a mean diameter of 2.5 microns or less ($PM_{2.5}$) in the vicinity of the proposed Candlestick Point (CP) – Hunters Point Shipyard (HPS) Phase II Development Plan ("Project"), and assessed the potential impacts of $PM_{2.5}$ concentrations attributable to Project-related traffic along the thoroughfares and nearby roads. The Project is situated such that there are several major thoroughfares which Project-related traffic would use to access neighboring freeways and other areas of San Francisco. Estimates for the Project-associated traffic, including average speeds, on each of these thoroughfares were taken directly from the traffic report (CHS Consulting Group et al. 2009) developed in support of the Environmental Impact Report (EIR).

1.1 Objectives and Methodology

The objective of this assessment is to estimate Project-related concentrations of $PM_{2.5}$ along major roadways in the vicinity of the Project, and to examine the potential health affects associated with these concentrations.

$PM_{2.5}$ from vehicle exhaust, tire wear, and brake wear were estimated using emission factors generated using the most recent version of the EMission FACtor model (EMFAC), developed by the Air Resources Board (ARB). On December 12, 2008, ARB adopted an On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation which affects exhaust emission for vehicles larger than 14,000 pounds gross vehicular weight. EMFAC 2007, the most recent EMFAC version, does not yet include impacts for the new ARB Regulation, therefore, ENVIRON used the emission reduction estimates developed for the ARB rulemaking process in order to evaluate the impacts of the new Regulation. Vehicle volumes were estimated from the traffic report (CHS Consulting Group et al. 2009).

The concentration of $PM_{2.5}$ from vehicular emissions was characterized by developing exposure point concentrations at residential receptors surrounding the thoroughfares evaluated. This analysis was conducted by estimating the average annual airborne concentrations of $PM_{2.5}$ expected to result from Project-related traffic emissions, and by conducting air dispersion modeling of those emissions. A Gaussian air dispersion model, approved by the United States Environmental Protection Agency (USEPA) and ARB for use in the environmental documentation of transportation projects, was used to estimate ambient air concentrations. Both free flowing traffic and queuing at intersections were evaluated.

The potential health impacts from Project-associated $PM_{2.5}$ were evaluated by comparing predicted concentrations of $PM_{2.5}$ to ~~the San Francisco Department of Public Health (SFDPH 2008) $PM_{2.5}$ threshold of~~ a 0.2 microgram per cubic meter (μg/m^3) action level. The evaluation of potential health impacts from $PM_{2.5}$ is not required under current CEQA guidelines. The analysis~~, but~~ was conducted in accordance with methods ~~to comply with~~ presented by the San

Francisco Department of Public Health (SFDPH) in their 2008 guidance ~~(2008). The SFDPH (2008) $PM_{2.5}$ threshold is documented in~~:

- SFDPH. 2008. *Assessment and Mitigation of Air Pollutant Health Effects from Intra-urban Roadways: Guidance for Land Use Planning and Environmental Review*. May 6.

1.2 Report Organization

This report is divided into eight sections as follows:

Section 1.0 – Introduction: describes the purpose and scope of this assessment and outlines the report organization.

Section 2.0 – Background: presents a description of the Project and provides the regulatory background.

Section 3.0 – Chemical Selection: describes the selection of the chemical evaluated in this Attachment.

Section 4.0 –Estimated $PM_{2.5}$ Concentrations in Air: discusses the methods used to estimate emissions of $PM_{2.5}$, including a description of the emission sources, the air dispersion model used to predict $PM_{2.5}$ concentrations, meteorological data, building and terrain considerations, land use analysis, identification of receptor locations, and results of the modeling.

Section 5.0 –Risk Characterization: presents a comparison of Project-associated $PM_{2.5}$ concentrations to the ~~SFDPH threshold concentration~~0.2 $\mu g/m^3$ action level.

Section 6.0 –Conclusions: summarizes the results of this assessment.

Section 7.0 –Uncertainty: discusses the different sources and types of uncertainties in this assessment.

Section 8.0 –References: includes all references cited in this report.

2 Background

2.1 Project Description

Details of the Project have been provided in the Project Description included in Chapter II of the EIR prepared by PBS&J. Based on information provided in this source, the Project will consist of the development of two areas collectively referred to as the Candlestick Point- Hunters Point Shipyard Phase II Development Plan (the "Project"). The description of the Project is organized under two major sub-components: Candlestick Point (CP) and Hunters Point Shipyard Phase II (HPS Phase II). The Project comprises an approximately 702-acre area shown on Figure 2-1 and Figure 2-2. The Project proposed by Lennar Urban includes a mixed-use community with a range of residential, retail, office, research and development, civic and community uses, and parks and recreational open space. In addition, a major component would be a new stadium for the San Francisco 49ers, a National Football League (NFL) team. Necessary infrastructure improvements (including several roadway modifications) are also proposed in support of the Project development plan, as shown on Figure 2-2.

A summary of the Project for the CP and HPS Phase II development are provided separately below. A more detailed discussion of the Project is included in Chapter II of the EIR.

Candlestick Point: This area is approximately 281 acres in size. Current land use in the CP area includes Candlestick Park stadium, and associated parking lots and access roadways. The area also includes several vacant privately owned parcels that are used primarily for stadium parking. Acquisition of these parcels is anticipated as part of the Project. Approximately 120 acres of the 154-acre Candlestick Point State Recreation Area (SRA) is also included within the Project and forms the south and east shoreline boundary.

The proposed Project for CP includes site preparation activities, including abatement, demolition of existing structures, and grading, and construction of residential units, parks and open space, retail space, community services, office space, hotel accommodations, and a performance arena. The development plan also includes a rebuild of Alice Griffith Housing which will provide upgraded units to existing residents.

Hunters Point Shipyard Phase II: The HPS Phase II area comprises 421 acres (dry-land) on the former Navy Parcels B, C, D and E. Navy Parcel F comprises approximately 440 acres of submerged lands in San Francisco Bay surrounding the central portion of the HPS Phase II area to the north, east and south. The entire HPS Phase II area is currently under the jurisdiction of the Navy. The HPS Phase II area includes many structures associated with ship repair, piers, dry-docks, storage, administrative, and other former Navy uses, largely from the World War II era. Most structures are vacant, although several former Navy buildings are currently leased and occupied. Current tenants at the HPS Phase II area include an estimated 252 artists located in studios on Parcels A and B, and a San Francisco Police Department (SFPD) facility on Parcel D-1 in Building 606. The proposed Project plan for this area includes new residential units, parks and open space, research and development (R&D), community services, artist studios and centers, neighborhood retail, and a new stadium for the San Francisco 49ers, a National Football League team. The stadium parking plan will accommodate parking for stadium events and will serve public recreational uses.

The EIR also examines variants to the Project:

- Variant 1 would include an additional 2.5 million gross square footage (gsf) of research and development space on the proposed stadium site. All other elements of the Project would remain the same.
- Variant 2 would redistribute 1,350 residential units to the proposed stadium site from Candlestick Point. All other elements of the Project would remain the same.
- A third variant (Variant 3) would include the same land use program and overall description as the Project, with different locations for the residential towers.
- Variant 4 assumes that a new stadium would be constructed and shared between the San Francisco 49ers and the Oakland Raiders football teams. The land use program would remain the same as the proposed Project.

Chapter IV of the EIR analyzes these Variants. Evaluation of the Variants in the EIR allows for consideration and approval of these variants without further environmental review.

2.2 Surrounding Area

The Project comprises an approximately 702-acre area east of U.S. 101 in the southeast area of the City and County of San Francisco and occupies the waterfront area from south of India Basin to Candlestick Cove (Figure 2-1 and Figure 2-2).

The CP area is immediately east of Executive Park, with the Bayview neighborhood to the north, the HPS Phase II to the northeast, and Candlestick Point State Recreation Area (SRA) along the Bay frontage generally to the east (Figure 2-1). The CP area is generally bounded by Hawes Street to the northwest and Jamestown Avenue to the southwest, the Candlestick Cove and South Basin areas of the Bay are to the south and east, respectively.

The HPS Phase II area is to the southeast of the Bayview Hunters Point neighborhood. As shown in Figure 2-1, the HPS Phase II area is generally bounded by San Francisco Bay to the north, east, and south. The south end of the western boundary extends from Yosemite Slough along Arelious Walker Drive to approximately Crisp Road, excluding the University of California San Francisco (UCSF) property. The northern boundary generally extends along Crisp Road and Spear Avenue. The northernmost end of the HPS Phase II area is contiguous with Earl Street.

Figure 2-3 shows the zoning information, obtained from the City of San Francisco, for areas in the immediate vicinity of the Project. To the west of the Project, the city areas are zoned mixed use residential and industrial. The area to the south is zoned for commercial or industrial use. The Project Area is bordered by the San Francisco Bay to the north and east.

2.3 Regulations and Guidance

The SFDPH (2008) has developed guidance for $PM_{2.5}$ that draws on a broad regulatory framework and a comprehensive body of scientific literature that has established strong correlations between $PM_{2.5}$ exposures and a number of adverse health effects. For example, under the Clean Air Act (USEPA), 1990, the USEPA regulates PM as a criteria air pollutant (USEPA, 2009), and has established national ambient air quality standards (NAAQS) for both particulate matter with a diameter less than ten microns (PM_{10}) (150 μg/m^3)[1] and $PM_{2.5}$ (15 or 35 μg/m^3)[2]. The State of California also regulates PM, and has ambient air quality standards (AAQS) for PM_{10} (20 or 50 μg/m^3)[3] and $PM_{2.5}$ (12 μg/m^3)[4] (ARB 2005a). ~~Of particular concern to the SFDPH is that $PM_{2.5}$ appears to have health effects below the NAAQS and AAQS as described by ARB (2008a) in their most recent examination of the relationship between particulate matter exposures and premature mortality.~~

Another information source that is key to the SFDPH guidance (SFDPH 2008) is ARB's 2005 guidance for land use planning (ARB 2005b). That guidance recommends against locating "sensitive land uses, including residential development" within 500 feet of a highway traveled by more than 100,000 vehicles a day (ARB 2005b). (The ARB guidance also addresses the location of sensitive land uses in the vicinity of distribution centers, railyards, and ports, but these sources are not of direct concern to the Project and are not addressed further.)

The SFDPH guidance was also developed to support compliance with the California Environmental Quality Act (CEQA), and to address specific goals of the City of San Francisco's General Plan which include:

> " …to reduce the level of pollutants in the air, to protect and improve public health, welfare, and quality of life…" (SFDPH 2008).

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[1] This is a 24-hour concentration that is not to be exceeded more than once per year on average over three years (USEPA 2009).

[2] 15 μg/m^{3}is an annual arithmetic mean concentration. Attainment is achieved if the three-year average of the weighted annual mean $PM_{2.5}$ concentrations from a single or multiple community-oriented monitors must not exceed 15.0 μg/m^3 (USEPA 2009). 35 μg/m^3 is a 24-hour concentration. Attainment is achieved if the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area does not exceed 35 μg/m^3 (USEPA 2009)

[3] 20 μg/m^3 is an annual arithmetic mean concentration of PM_{10}; 50 μg/m^3 is the 24-hour annual arithmetic mean concentration of PM_{10} (ARB 2005a).

[4] 12 μg/m^3 is an annual arithmetic mean concentration of $PM_{2.5}$ (ARB 2005a).

2.3.1 Development of an ~~SFDPH Criterion~~Action Level for $PM_{2.5}$

~~The SFDPH is concerned that individuals who live in the proximity of heavily-travelled roads or freeways will incur adverse health effects as a result of exposure to vehicle emissions. To minimize contributions to health impacts associated with locating new residential projects near roadway "hot spots", the SFDPH developed a strategy to assess and mitigate air pollution at these locations. Their strategy is based on the use of an annual average threshold concentration of $PM_{2.5}$ (0.2 µg/m^3) within a 150 meter zone of a new project as a means of assessing the potential for concern. The threshold concentration of $PM_{2.5}$ is meant to serve as a health-protective "proxy" or surrogate for pollutant exposures from vehicles i.e., $PM_{2.5}$ is not the only pollutant of concern. Instead, the $PM_{2.5}$ threshold serves as a concentration meant to protect the health of residents from all vehicle-associated emissions from a project.~~

Health effects of individual chemicals or of a mixture are typically evaluated by the use of a toxicity criterion. However, despite the establishment of NAAQS and AAQS for $PM_{2.5}$, no toxicity criterion has been developed by either the state or federal government. The reasons for this are complex, and are related both to how these criteria are developed, as well as the properties of $PM_{2.5}$. That is, toxicity criteria are typically derived for a chemical based on standardized exposures to known concentrations or doses of the material; effects (if any) can then be correlated to a specific quantity. However, for $PM_{2.5}$, its toxicity is at least partially dependent on the mixture of metals, polynuclear aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) or other chemicals sorbed to the surface of the particulate. This heterogeneity of $PM_{2.5}$ depends on the source of the particulate, and varies with the fuel type, engine type, dust, etc. that is the source of the $PM_{2.5}$. This variability precludes the derivation of a single representative toxicity criterion. Instead, epidemiologists have examined the relationship between $PM_{2.5}$ concentrations in ambient air and correlated these to effects within a population. Exposure to $PM_{2.5}$ has been linked to an increase in premature mortality, hospitalizations, cardiovascular events, and asthma attacks, among others (see ARB 2008a). The mathematical expression which relates changes in exposure to ambient concentrations of a pollutant, such as $PM_{2.5}$, to changes in an adverse effect such as premature mortality is known as a concentration-response function.

The concentration-response function incorporates a term for relative risk, which describes the incremental increase in effect for a given concentration of a pollutant i.e., a 1.4% increase in the annual incidence of premature mortality per 1.0 µg /m^3 increase in $PM_{2.5}$. The SFDPH criterion for $PM_{2.5}$ of 0.2 µg/m^3 is based on these concepts (SFDPH 2008). The SFDPH (2008) guidance provides specific rationale for selection of the $PM_{2.5}$ threshold concentration as follows:

- "*A threshold of 0.2 µg/m^3 represents about 8-10% of the intra-urban range of PM 2.5 ambient concentration based on available and reliable monitoring data in San Francisco.*
- *A change in ambient concentration of $PM_{2.5}$ by 0.2 µg/m^3, independent of other vehicle pollutants would result in significant forecasted health impacts.*

- *Based on a recent study of intra-urban pollution in Los Angeles, a 0.2 μg/m^3 increase in PM 2.5 would result in a 0.28% increase in non-injury mortality or an increase of about twenty-one excess death per 1,000,000 population per year from non-injury causes in San Francisco (Jerrett et al. 2005). This effect is well above the one-in-a-million lifetime de minimus risk threshold for premature death considered insignificant by most regulatory agencies (Asante-Duah 2002).*
- *Applying the health effects assessment methodology and Concentration Response Functions in the ARB Staff Report on AAQS for PM published in 2002, a 0.2 μg/m^3 increase in $PM_{2.5}$ affecting a population of 100,000 adults would result in about 20 extra premature deaths per year (ARB 2002). This effect is well above the one-in-a-million lifetime de minimus risk threshold for premature death considered insignificant by most regulatory agencies (Asante-Duah 2002).*
- *A 0.2 μg/m^3 increase in $PM_{2.5}$ would also result in ~ 160 days per year with respiratory symptoms, 108 days with work limitations, and 577 days with minor activity limitations in the same adult population."*

The Bay Area Air Quality Management District (BAAQMD) does not currently recommend a threshold of significance for determining impacts associated with localized exposures to $PM_{2.5}$, but is addressing this issue in its draft CEQA guidelines (BAAQMD 2009b). California ARB also has not established a health-protective threshold for $PM_{2.5}$.

The 0.2 ug/m^3 identified level is in accord with proposed CEQA guidelines developed by BAAQMD for $PM_{2.5}$.[5] According to BAAQMD, "emissions from a new source or emissions affecting a new receptor would be considered significant where ground-level concentrations of $PM_{2.5}$ from any source would result in an average annual increase greater than 0.3 μg/m^3."[6] This determination is based on the lower range of a US EPA proposed Significant Impact Level (SIL) for stationary sources, which is interpreted by the US EPA as the level of ambient impact that is considered to represent a "significant contribution" to regional nonattainment. The BAAQMD goes on to indicate that the US EPA did not design this threshold for addressing community risks and hazards, but it was designed to protect human public health at a regional level by helping an area to maintain the NAAQS. The BAAQMD determined this SIL to be a reasonable goal at the local scale and, therefore, a useful reference for comparison. The BAAQMD states that this proposed threshold (0.3 μg/m^3) is consistent with the SFDPH threshold of 0.2 μg/m^3. The BAAQMD reached that conclusion based on an ARB report that determined an increase in mortality from a 0.3 μg/m^3 increment of $PM_{2.5}$ was consistent with the estimated increase in

5 Bay Area Air Quality Management District, *California Environmental Quality Act Guidelines Update: Proposed Thresholds of Significance*, December 7, 2009.

6 Bay Area Air Quality Management District, *California Environmental Quality Act Air Quality Guidelines: Proposed Thresholds of Significance*, December 7, 2009, page 43.

mortality assumed by SFDPH in identifying the 0.2 ug/m^3 increment. BAAQMD further states that "On balance, the Air District estimates that the SFDPH threshold and the [District proposed threshold of 0.3 µg/m^3], in combination with the cumulative threshold for $PM_{2.5}$, will afford similar levels of health protection." As discussed at the end of this section, BAAQMD is recommending a cumulative threshold for $PM_{2.5}$ of 0.8 µg/m^3, which is the mid-range US EPA proposed SIL.

Based on these proposed thresholds, the most stringent limit, 0.2 µg/m^3, was chosen as a conservative action level for judging significance in this analysis.

~~2.3.2 Application of SFDPH Criterion for $PM_{2.5}$~~

~~If exposure to $PM_{2.5}$ from Project traffic is below the threshold of 0.2 µg /m^3 (or if traffic exposures are "fully mitigated"), no further analysis of health effects is required (SFDPH 2008). However, if $PM_{2.5}$ concentrations exceed 0.2 µg/m^3, then SFDPH guidance suggests estimating $PM_{2.5}$-related effects on "excess" (or premature) mortality. SFDPH guidance (SFDPH 2008) provides a simplified version of a $PM_{2.5}$ concentration-response function designed to provide a rapid means of estimating excess mortality from $PM_{2.5}$ exposures. The equation suggested by the SFDPH to estimate excess mortality from $PM_{2.5}$ is:~~

~~*Excess Mortality$_{\text{Traffic-attributable PM2.5}}$ = (Concentration$_{\text{Traffic-attributable PM2.5}}$) x (Incidence Non-Injury Mortality) x (Relative Risk$_{\text{PM2.5}}$)*~~ ~~(Eq. 1)~~

~~Where:~~

~~Concentration $_{\text{Traffic-attributable PM2.5}}$~~	~~=~~	~~Concentration of $PM_{2.5}$ generated by Project sources;~~
~~Incidence Non-injury Mortality~~	~~=~~	~~Annual mortality incidence from all non-injury causes; and~~
~~Relative Risk$_{\text{PM2.5}}$~~	~~=~~	~~0.014, or a 1.4% increase in annual mortality incidence per 1.0 µg/m^3 increase in $PM_{2.5}$ (based on Jerrett et al. 2005).~~

3 Chemical Selection

As this analysis follows SFDPH guidance (2008) for evaluating roadways exposure, ~~specifies that while~~ the assessment methodologies contained in that document are specific to $PM_{2.5}$, that $PM_{2.5}$ is used as a "proxy" i.e., as a surrogate, for vehicle-related pollutant emissions and associated exposure to these chemicals. Consistent with this framework, analysis of potential Project-associated emissions focuses solely on $PM_{2.5.}$

4 Estimated $PM_{2.5}$ Concentrations in Air

4.1 Roads Evaluated

The Project is situated such that there are several major thoroughfares which Project-related traffic would use to access neighboring freeways and other areas of San Francisco. The traffic throughputs for roads of potential concern were assessed and determined~~,~~ based upon Project-related traffic volume and expected impact. Those thoroughfares modeled include Third Street, Innes Avenue/Hunters Point Boulevard /Evans Avenue, Palou Avenue, Gilman Avenue/Paul Avenue, and Harney Way. Those thoroughfares are identified in the traffic report as primary or secondary roads which connect the proposed Project site and major arterials to U.S. 101. In addition, Evans Avenue/Hunters Point Boulevard /Evans Avenue, and Harney Way were selected since they have been identified as streets with significant truck traffic and thus are expected to yield more $PM_{2.5}$ compared to other roads. Furthermore, Palou Avenue, Gilman Avenue/Paul Avenue were selected since there are residences in the vicinity of these roads where individuals may incur exposure to $PM_{2.5.}$

4.2 Emissions Estimation

Emission factors and traffic volumes were calculated for each hour of the weekday for all vehicles in order to estimate $PM_{2.5}$ emissions. Weekend traffic conditions were assumed to be the same as weekday conditions. This approach is expected to yield more conservative estimates of $PM_{2.5}$ concentrations, since weekday traffic volumes are generally greater than on the weekend. Three categories of emissions were taken into account: 1) running emissions from exhaust, 2) running emissions from tire wear and brake wear, and 3) idling or queuing emissions from exhaust. There are no emissions of $PM_{2.5}$ during idling (queuing) from tire wear and brake wear.

Information to estimate emissions for the Project-related traffic on each of the modeled thoroughfares, including peak hour traffic volumes, peak hour number of idling cars, and average speeds, was taken directly from the traffic report developed in support of the EIR (CHS Consulting Group et al. 2009).

$PM_{2.5}$ emissions from vehicle exhaust and tire wear and brake wear were estimated using emission factors generated by the ARB's EMFAC 2007 and modified to account for the On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation (the ARB Regulation, or the Regulation) that was approved by the ARB on December 11, 2008, which affects emissions for vehicles larger than 14,000 pounds gross vehicular weight (ARB 2008b). EMFAC is a mathematical model that was developed to calculate emission rates from motor vehicles that operate on highways, freeways, and local roads in California and is used by ARB to project changes in future emissions of on-road mobile sources. The most recent version of this model, EMFAC 2007, incorporates local motor vehicle data, information and estimates regarding the distribution of VMT by speed, and number of starts per day.

Annual average emission factors were generated using the average temperature and relative humidity for the Project area, as calculated from the meteorological data, discussed in Section 4.6 below. EMFAC allows the estimation of emissions for in-use fleets from 1970 through 2040. The traffic report's future traffic scenario provides estimates of traffic conditions for 2030, and in-use fleet emissions were estimated for that year. EMFAC 2007 does not yet include impacts for the new ARB Regulation mentioned above; therefore, the emission reduction percentage developed for the ARB rulemaking process was applied to the EMFAC-derived emission factors, as discussed below, to account for the impact of the Regulation on project-related emissions.

4.2.1 Emission Factors

Using EMFAC, $PM_{2.5}$ emission factors (in g/vehicle-mile for running emissions, and in g/vehicle-idling hour for idling emissions) were estimated for calendar year 2030 based on the vehicle fleets of San Francisco County for vehicles of all model years. The traffic report (CHS Consulting Group et al. 2009) provided a.m. and p.m. peak hour speeds along about half of the roadway segments modeled; the average peak hour speed was 21.4 miles per hour (mph) with a standard deviation of 2.4 mph. Thus, for all roadway segments, the emission factors corresponding to travel speed of 20 mph (in g/vehicle-mile) were used for running emissions, while emission factors corresponding to 0 mph (in g/vehicle-idling hour) were used for idling emissions.

EMFAC also presents the fraction of trips that each vehicle class makes on roads in San Francisco County at each hour of the weekday. The emission factors from each vehicle class were multiplied by these hourly trip fractions, then summed across all applicable vehicle classes for each hour to estimate hourly emission factors. The applicable vehicle classes for each modeled thoroughfare were determined by whether truck restrictions are designated in the traffic report (CHS Consulting Group et al. 2009). The traffic report identifies truck restrictions that prevent trucks weighing over 6,000 pounds from driving on segments of Gilman Avenue and Palou Avenue (CHS Consulting Group et al. 2009). For these segments, heavy-duty trucks were excluded from the emission factor estimates. For all other roads modeled, the emission factors were used for all vehicle classes and all model years.

Finally, the ratio of the 2025 projected $PM_{2.5}$ emissions under ARB Regulation to the baseline $PM_{2.5}$ emissions without Regulation[7] was used to scale down running emissions for regulated vehicle classes including mid heavy-duty trucks, heavy heavy-duty trucks, school buses, and other buses. For this scaling, the year 2025 was used in absence of 2030 data. Hourly running emission factors in grams per vehicle-mile for all modeled roadway segments are shown in Table 4-1. Since the ARB Regulation is not explicitly applicable to idling emissions, idling emissions were not scaled using the ratio.

[7] The emission inventory was developed by ARB to assist the rulemaking process. http://www.arb.ca.gov/regact/2008/truckbus08/truckbus08.htm

Hourly idling emission factors in grams per vehicle-idling hour for all modeled roadway segments are presented in Table 4-1.

4.2.2 Traffic Volume

Hourly peak a.m. and hourly peak p.m. traffic volumes were obtained for each modeled roadway segment from the traffic report (CHS Consulting Group et al. 2009). As mentioned above, EMFAC generates trips-per-day by vehicle-class by hour for San Francisco. All trips for each hour of the day were summed, and then the hourly trip fractions were calculated. For segments with truck restrictions, the hourly total trips were modified so as to exclude trips made by heavy-duty trucks, then recalculated the hourly trip fractions.

To estimate daily trips, the average of the AM peak hour trips was divided by the appropriate a.m. peak hour trip fraction and the p.m. peak hour trips divided by the appropriate p.m. peak hour trip fraction. To divide the daily trips into hourly trips for each road segment, the segment's daily trips were multiplied by the calculated appropriate hourly trip fractions. For the peak a.m. and peak p.m. hours, the actual estimates from the traffic study were used.

The hourly traffic volumes on all modeled road segments are shown in Table 4-2.

4.2.3 Queuing

Queuing emissions were estimated for all intersections along the modeled thoroughfares, which, according to the traffic report, have traffic signals or stop signs (CHS Consulting Group et al. 2009). Forty-one queues, or locations were identified where vehicles would idle at a traffic signal. No stop signs were identified as affecting traffic on the modeled roads.

To model queuing emissions, the methodology used in CAL3QHCR was followed while employing actual data from the traffic report (CHS Consulting Group et al. 2009). The traffic report provides information by ultimate direction through the intersection: left turn, through, or right turn. To estimate queue emissions per hour for each direction, the following equation was used:

> Queue Emissions (g/hr) = Idling Emission Factor (g/vehicle-hr) x Number of Vehicles Idling (vehicle) x Red & Yellow Phase per Cycle (sec/cycle) x Number of Cycles per Hour (cycle/hr) ÷ 3600 (sec/hr)

The idling emission factors (in g/vehicle-hr) were estimated using the methodology described in Section 4.1.1. For each queue, the number of vehicles idling per direction during the a.m. peak hour and the p.m. peak hour were obtained from the traffic report (CHS Consulting Group et al. 2009). The hourly traffic volumes, calculated as described in Section 4.1.2, were then used to determine the a.m. hour with the maximum number of vehicles. The ratio of hourly traffic volume to this a.m. peak hour traffic volume was then used to estimate the number of vehicles idling per direction during the a.m. hours (hours 24-11). The same approach was used for the p.m. hours (hours 12-23).

The queuing time per cycle was estimated to be equal to cycle time minus duration of the green light presented in the traffic report; this means that cars are assumed to queue during the yellow and red phases. The number of cycles per hour was calculated from the cycle time (seconds/cycle), provided in the traffic report (CHS Consulting Group et al. 2009).

In order to follow the "nominal free flow" methodology as used by CAL3QHCR, the queue emissions were converted from grams per hour to grams per vehicle-mile. The following formula was used for the conversion.

> Queue Emissions (g/vehicle-mile) = Queue Emissions (g/hr) ÷ Hourly Traffic Volume (vehicle/hr) ÷ (Average Queue Length (m) ÷ 1609.344 (m/mile))

The hourly traffic volumes were estimated using the methodology described in Section 4.1.2. The length of the queue in each direction for each hour, according to CAL3QHCR methodology, is estimated to be six meters for each vehicle idling in that direction for the given hour, with a minimum of six meters used. To estimate an average length across the entire day, the hourly queue length was multiplied by the hourly emission factors and summed across all hours. This approach gives queue emissions in grams per vehicle-mile for every hour of the day on all roadway segments, allowing the queuing emissions to be modeled as running emissions.

4.3 Refined Air Dispersion Modeling

The concentration of $PM_{2.5}$ from vehicular emissions was characterized by developing exposure point concentrations at residential receptors surrounding the thoroughfares evaluated. This analysis was conducted by estimating the average annual airborne concentrations of $PM_{2.5}$ that will result from emissions from the Project-related traffic and by conducting air dispersion modeling of those emissions.

To estimate ambient air concentrations, a Gaussian air dispersion model, approved by the USEPA and ARB for use in preparing environmental documentation for transportation projects, was used. CAL3QHCR is a refined version of USEPA's CAL3QHC, which is a multi-source model developed in 1990 to estimate air concentrations of vehicle emissions near roadway intersections. CAL3QHC is based on the same line-source dispersion algorithm used in CALINE3, and CAL3QHCR adds the ability to evaluate multiple-year meteorological observations rather than evaluating only the worst-case meteorological assumptions. CAL3QHCR uses a meteorological data set that incorporates representative hourly surface and twice-daily upper air data for estimating the dispersion of emissions through the atmosphere.

In addition to the observed meteorological data set, the model uses the roadway geometries, receptor locations, vehicular emission factors (from EMFAC), signal timing (if applicable), and intersection configuration. The GIS shapefile developed by the SFDPH for their CAL3QHCR model setup as basis of the SFDPH land use guidance was requested. That shapefile presents roadway geometries, vehicular traffic volume and emission factors. The roadway geometries were used along with refinements (i.e., dividing roads into two directions, adding Project-related vehicular traffic volume and emission factors) whenever applicable in order to estimate $PM_{2.5}$ concentrations due to Project-related traffic.

Annual average concentrations were calculated for all receptors. No differentiation was made for potential differences in daytime versus nighttime traffic, or for daytime and nighttime exposure. Both free flowing traffic and queuing at intersections were evaluated.

4.3.1 Modeled Pollutants and Averaging Periods

$PM_{2.5}$ emissions were modeled using one year of meteorological data. Using those data, a one-year average concentration was calculated.

4.3.2 Modeling Sources

Emissions from all Project-related traffic on the selected thoroughfares was modeled. Those road segments were represented in CAL3QHCR by a series of straight line segments, each with constant height, width, hourly traffic volume, and hourly emission rates. Widths of the segments under consideration were determined from aerial photographs, and heights were set to zero meters as discussed in the terrain section below. For all running emissions, the mixing zone was set to the road width (along the direction of traffic flow) plus three meters on each side to account for wake effects. For all queuing emissions, the mixing zone was set to the road width since there are no wake effects while idling. Tables 4-3 and 4-4 summarize the source parameters used as inputs in CAL3QHCR for running emissions and queuing emissions, respectively. Figures 4-1 and 4-2 show the location of the travel lanes modeled for running emissions and queuing emissions, respectively.

4.3.3 Terrain

The terrain surrounding the selected thoroughfares was evaluated using National Elevation Dataset (NED) files from the United States Geological Survey (USGS). The area is generally flat with roads ranging from three to 50 meters in elevation and surrounding area ranging from three to 80 meters in elevation; the majority of the roads are at elevations between three and 30 meters with only one segment on Palou Avenue rising above 50 meters. CAL3QHCR limits sources to be placed at elevations of ±10 meters, while receptors can be placed at any elevation. Due to the generally flat nature of the area, all sources were modeled at 0 meters with all receptors at 1.8 meters as recommended by CAL3QHCR documentation.

4.3.4 Meteorological Data

Details regarding the meteorological data used for modeling are presented in Attachment V.

4.3.5 Receptor Locations

Residential receptors were evaluated along the modeled thoroughfares~~, as recommended in the SFDPH land use guidance (SFDPH 2008)~~. A three-tiered approach was employed to determine the location of these residential receptors. First two receptor grids were placed alongside the thoroughfares that were modeled: 1) a coarse grid of receptors spaced 50 meters apart positioned from the edge of the mixing area to 250 meters from the roadway and 2) a fine grid consisting of receptors spaced 10-meters from the edge of the mixing area to 50 meters from the roadway. San Francisco zoning maps obtained from the City and County of San Francisco Planning Department[8] were then overlaid on the receptor grids to identify receptors within residential zones. Finally, visual screening was conducted on Google Street View to indentify possible residential buildings in commercial and/or industrial zones. The modeled residential receptors are shown in Figure 4-3. Land use zoning in relation to modeled roads is shown in Figure 4-4. Sensitive receptors, such as schools and hospitals, within one mile of the site were also modeled and are summarized in Table 4-5.

4.4 Results of Emissions Estimations

The results of the dispersion modeling are shown in Figure 4-5. All modeled $PM_{2.5}$ concentrations are at or below 0.2 μg/m^3. The highest modeled concentrations occur at intersections and along roads that do not have a truck restriction. The maximum modeled $PM_{2.5}$ concentration is 0.2 μg/m^3, which occurs on the northern edge of Innes Avenue, west of Arelious Walker Drive. As can also be seen in Figure 4-5, $PM_{2.5}$ concentrations are dominated by running emissions.

[8] City and County of San Francisco Planning Department zoning maps are available at http://www.municode.com/Resources/gateway.asp?pid=14145&sid=5

5 Risk Characterization

Modeled concentrations of $PM_{2.5}$ attributable to Project traffic do not exceed the ~~SFDPH (2008) threshold concentration of~~ 0.2 µg/m³ action level (Figure 4-5). In general, the areas most impacted by Project-associated $PM_{2.5}$ concentrations are major intersections, such as those at 3rd Street and (1) Palou Avenue and (2) Gilman Avenue/Paul Avenue (Figure 4-5). The maximum $PM_{2.5}$ concentration in residential areas is 0.2 µg/m³, which meets the action level discussed previously, indicating that ~~by comparison to the SFDPH (2008) threshold,~~ residents in the areas impacted by Project traffic are not expected to experience adverse health effects above the proposed significance level.

This evaluation utilized a number of conservative assumptions in modeling $PM_{2.5}$ concentrations which provide support for the determination that adverse effects of exposure to $PM_{2.5}$ are not likely. These conservative assumptions include:

- The peak traffic speed emission factor (grams/mile) from EMFAC2007 was used for all traffic. Since the traffic speed during non-peak hours would be expected to yield lower emissions than during peak hours, this approach yielded higher modeled concentrations of $PM_{2.5}$ than using separate emission factors for peak and non-peak times.
- Weekday traffic volumes were assumed to occur 365 days per year. This approach is expected to yield more conservative estimates of $PM_{2.5}$ concentrations, since weekday traffic volumes are generally greater than on the weekend.
- It was assumed that vehicles idle for the entire duration of the yellow and red phases of a traffic light. This results in higher estimated $PM_{2.5}$ concentrations than the more realistic assumption that idling occurs only during some or all of the red light phase.
- The ARB (2008b) regulation for On-Road Heavy-Duty Diesel Vehicles (In-Use) was applied to queuing emissions only. This assumption yields higher concentrations of $PM_{2.5}$ than if the regulation had been applied to operating emissions as well.

6 Conclusions

Project-related traffic is predicted to yield concentrations of $PM_{2.5}$ that do not exceed the 0.2 μg/m^3 action level, ~~SFDPH (2008) concentration threshold for residential uses.~~ The maximum $PM_{2.5}$ concentration in residential areas is below the 0.2 μg/m^3 action level, ~~,~~ indicating that ~~by comparison to the SFDPH (2008) threshold,~~ residents in the areas impacted by Project traffic are not expected to experience adverse health effects above the proposed level of significance.

7 Uncertainties

7.1 Method of Emission Estimation

Emission factors were estimated based on the vehicle fleets of San Francisco County, which may differ than the vehicle mix along the thoroughfares evaluated. EMFAC 2007's emission factors for the year 2030 were used and adjusted to account for the ARB Regulation. To account for the ARB regulation, the expected emissions reductions for the year 2025 were used in lieu of 2030 data. Additionally, the emission factors for 2030 contain uncertainties related to future advances in vehicle technology. Similarly, vehicle volumes were estimated based on the traffic report (CHS Consulting Group et al. 2009), which makes estimates of future Project-related vehicle volumes. As the traffic report results are based on a traffic model that contains uncertainties, the vehicle volumes used also contain uncertainties.

Further, peak hour traffic and peak hour number of idling vehicles from the traffic report were used together with the default hour of day fraction of trips to calculate the hourly traffic volume and hourly idling vehicle volumes. The hour of day fraction of trips for the projected area could differ from the default values provided in EMFAC for 2030 for the San Francisco County, thus bringing additional uncertainties.

Finally, ARB's EMFAC provides weekday trip distribution. Weekday traffic volume and number of idling vehicles from the traffic report were used in this analysis and applied to 365 days of the modeled year. However, weekend traffic conditions could differ significantly from weekday traffic conditions.

Together, all of the uncertainties above influence the emissions estimation.

7.2 Estimation of Exposure Concentrations

There are a number of uncertainties associated with the estimation of $PM_{2.5}$ concentrations from air dispersion modeling of potential emissions from the Project. This section briefly describes some of those uncertainties.

7.2.1 Estimates from Air Dispersion Models

As discussed in Section 4, the USEPA-recommended dispersion model CAL3QHCR was used to estimate annual average $PM_{2.5}$ concentrations due to Project-related traffic at the hypothetical receptor locations. This model uses the Gaussian plume equation to calculate ambient air concentrations from vehicular emission sources. For this model, the magnitude of error for the maximum concentration is estimated to range from 10 to 40% (USEPA 2005a). Therefore, modeled exposure concentrations used in this assessment represent approximate exposure concentrations.

7.2.2 Source Representation

The source parameters (*i.e.*, road elevation and width) used to model emissions are sources of uncertainty. As CAL3QHCR limits source elevations to ±10 meters and as the area is generally flat, road elevations were assumed to be uniformly 0 meters. Widths were estimated using aerial photographs and could contain uncertainties related to human error. Therefore, exposure concentrations used in this assessment represent approximate exposure concentrations.

7.2.3 Meteorological Data Selection

Uncertainty also exists in the meteorological data used in the CAL3QHCR air dispersion model. Onsite meteorological data, which should be representative of the meteorological condition of the modeled roadway segments, was used. However, buildings that are near the roads and which may potentially block some of the winds were not considered. Additionally, CALINE-3, a model on which CAL3QHCR is based, is highly sensitive to extremely low mixing heights (USEPA 1995). Since a 300-meter constant mixing height is used in the metrological data (By Area Air Quality Management District 2009a), some potentially extreme conditions occurring when the mixing height is below 100 meters are lost.

8 References

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Tables

Table 4-1
Summary of Emission Factors
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]
1	2.21E-02	*2.03E-02*	7.06E-03	*6.97E-03*	3.01E-02	*1.69E-03*	0.00E+00	*0.00E+00*
2	2.15E-02	*2.03E-02*	7.09E-03	*6.97E-03*	3.24E-02	*1.19E-03*	0.00E+00	*0.00E+00*
3	3.16E-02	*2.27E-02*	7.38E-03	*6.99E-03*	1.42E-01	*1.27E-02*	0.00E+00	*0.00E+00*
4	2.13E-02	*2.05E-02*	7.14E-03	*6.97E-03*	2.40E-02	*5.46E-04*	0.00E+00	*0.00E+00*
5	2.04E-02	*2.03E-02*	7.11E-03	*6.97E-03*	1.97E-02	*1.66E-04*	0.00E+00	*0.00E+00*
6	2.44E-02	*2.07E-02*	7.11E-03	*6.97E-03*	4.70E-02	*2.72E-03*	0.00E+00	*0.00E+00*
7	2.19E-02	*2.06E-02*	7.01E-03	*6.97E-03*	1.69E-02	*3.12E-03*	0.00E+00	*0.00E+00*
8	2.07E-02	*2.01E-02*	6.99E-03	*6.97E-03*	8.79E-03	*1.21E-03*	0.00E+00	*0.00E+00*
9	2.39E-02	*2.04E-02*	7.06E-03	*6.97E-03*	4.37E-02	*3.43E-03*	0.00E+00	*0.00E+00*
10	3.48E-02	*2.19E-02*	7.33E-03	*6.99E-03*	1.66E-01	*1.39E-02*	0.00E+00	*0.00E+00*
11	3.21E-02	*2.15E-02*	7.27E-03	*6.98E-03*	1.36E-01	*1.04E-02*	0.00E+00	*0.00E+00*
12	2.89E-02	*2.10E-02*	7.19E-03	*6.98E-03*	1.00E-01	*7.13E-03*	0.00E+00	*0.00E+00*
13	2.54E-02	*2.05E-02*	7.10E-03	*6.97E-03*	6.14E-02	*3.97E-03*	0.00E+00	*0.00E+00*
14	2.46E-02	*2.04E-02*	7.09E-03	*6.97E-03*	5.39E-02	*3.39E-03*	0.00E+00	*0.00E+00*
15	2.52E-02	*2.05E-02*	7.10E-03	*6.97E-03*	6.03E-02	*3.84E-03*	0.00E+00	*0.00E+00*
16	2.60E-02	*2.07E-02*	7.11E-03	*6.97E-03*	6.66E-02	*4.96E-03*	0.00E+00	*0.00E+00*
17	2.45E-02	*2.05E-02*	7.08E-03	*6.97E-03*	5.09E-02	*3.73E-03*	0.00E+00	*0.00E+00*
18	2.19E-02	*2.02E-02*	7.02E-03	*6.97E-03*	2.24E-02	*1.96E-03*	0.00E+00	*0.00E+00*
19	2.16E-02	*2.01E-02*	7.01E-03	*6.97E-03*	1.84E-02	*1.28E-03*	0.00E+00	*0.00E+00*
20	2.13E-02	*2.01E-02*	7.00E-03	*6.97E-03*	1.54E-02	*1.01E-03*	0.00E+00	*0.00E+00*
21	2.10E-02	*2.00E-02*	7.01E-03	*6.97E-03*	1.46E-02	*8.07E-04*	0.00E+00	*0.00E+00*
22	2.02E-02	*1.99E-02*	6.99E-03	*6.97E-03*	5.77E-03	*2.03E-04*	0.00E+00	*0.00E+00*
23	2.04E-02	*2.00E-02*	7.00E-03	*6.97E-03*	9.77E-03	*3.91E-04*	0.00E+00	*0.00E+00*
24	2.02E-02	*1.99E-02*	7.00E-03	*6.97E-03*	8.36E-03	*2.51E-04*	0.00E+00	*0.00E+00*

Notes:

1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust; non-exhaust refers to running emissions from tire and brake wear.
3. Exhaust refers to idling emissions from vehicle exhaust; non-exhaust refers to idling emissions from tire and brake wear.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:

HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 4-2
Summary of Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Fraction of Trip/Day, All Vehicles[1]	Fraction of Trip/Day, *No HD Vehicles*[2]	3rd Street Segments					
			101 Ramp to 12		12 to 11		11 to 10	
			Southbound	Northbound	Southbound	Northbound	Southbound	Northbound
1	0.0080	*0.0084*	0	21	0	21	27	21
2	0.0040	*0.0041*	0	11	0	11	14	11
3	0.0020	*0.0015*	0	5	0	5	7	5
4	0.0016	*0.0017*	0	4	0	4	6	4
5	0.0027	*0.0028*	0	7	0	7	9	7
6	0.0044	*0.0045*	0	12	0	12	15	12
7	0.0174	*0.0191*	0	46	0	46	60	46
8	0.0512	*0.0567*	0	137	0	136	176	135
9	0.0545	*0.0563*	0	145	0	145	187	143
10	0.0625	*0.0480*	0	146	0	145	179	154
11	0.0617	*0.0512*	0	165	0	164	211	162
12	0.0795	*0.0723*	0	212	0	212	273	209
13	0.0837	*0.0831*	0	251	0	251	334	234
14	0.0688	*0.0692*	0	184	0	183	236	181
15	0.0744	*0.0738*	0	198	0	198	255	196
16	0.0792	*0.0779*	0	211	0	211	271	208
17	0.0732	*0.0743*	0	195	0	195	251	193
18	0.0730	*0.0786*	0	195	0	194	250	192
19	0.0587	*0.0638*	0	157	0	156	201	154
20	0.0466	*0.0509*	0	124	0	124	160	123
21	0.0312	*0.0340*	0	83	0	83	107	82
22	0.0267	*0.0295*	0	71	0	71	91	70
23	0.0190	*0.0208*	0	51	0	51	65	50
24	0.0160	*0.0175*	0	43	0	43	55	42

Hour	Fraction of Trip/Day, All Vehicles[1]	Fraction of Trip/Day, *No HD Vehicles*[2]	3rd Street Segments					
			10 to 9		9 to 8		8 to 56	
			Southbound	Northbound	Southbound	Northbound	Southbound	Northbound
1	0.0080	*0.0084*	24	24	38	39	55	61
2	0.0040	*0.0041*	12	12	19	20	27	31
3	0.0020	*0.0015*	6	6	9	10	13	15
4	0.0016	*0.0017*	5	5	8	8	11	13
5	0.0027	*0.0028*	8	8	13	13	18	21
6	0.0044	*0.0045*	13	13	21	22	30	34
7	0.0174	*0.0191*	52	52	83	85	119	133
8	0.0512	*0.0567*	153	152	243	251	350	392
9	0.0545	*0.0563*	163	162	259	267	372	417
10	0.0625	*0.0480*	164	163	231	293	268	507
11	0.0617	*0.0512*	185	183	293	302	421	472
12	0.0795	*0.0723*	238	236	377	390	543	609
13	0.0837	*0.0831*	281	279	485	428	784	602
14	0.0688	*0.0692*	206	205	327	338	470	527
15	0.0744	*0.0738*	222	221	353	365	508	569
16	0.0792	*0.0779*	237	235	376	388	541	606
17	0.0732	*0.0743*	219	218	348	359	500	561
18	0.0730	*0.0786*	219	217	347	358	499	559
19	0.0587	*0.0638*	176	174	279	288	401	449
20	0.0466	*0.0509*	139	139	221	229	318	357
21	0.0312	*0.0340*	93	93	148	153	213	239
22	0.0267	*0.0295*	80	79	127	131	182	204
23	0.0190	*0.0208*	57	56	90	93	130	145
24	0.0160	*0.0175*	48	48	76	78	109	122

Table 4-2
Summary of Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Fraction of Trip/Day, All Vehicles[1]	Fraction of Trip/Day, *No HD Vehicles*[2]	3rd Street Segments					
			56 to 7		7 to 6		6 to 5	
			Southbound	Northbound	Southbound	Northbound	Southbound	Northbound
1	0.0080	*0.0084*	55	58	52	58	47	49
2	0.0040	*0.0041*	28	29	26	29	23	24
3	0.0020	*0.0015*	13	14	13	14	11	12
4	0.0016	*0.0017*	11	12	11	12	10	10
5	0.0027	*0.0028*	18	20	17	19	16	16
6	0.0044	*0.0045*	30	32	29	32	26	27
7	0.0174	*0.0191*	120	127	113	125	102	106
8	0.0512	*0.0567*	351	373	333	368	299	310
9	0.0545	*0.0563*	374	397	354	391	318	330
10	0.0625	*0.0480*	269	487	259	477	317	368
11	0.0617	*0.0512*	423	449	401	443	360	374
12	0.0795	*0.0723*	546	579	516	571	464	482
13	0.0837	*0.0831*	788	566	740	563	552	521
14	0.0688	*0.0692*	472	501	447	494	402	417
15	0.0744	*0.0738*	510	541	483	534	434	451
16	0.0792	*0.0779*	543	576	514	569	462	480
17	0.0732	*0.0743*	502	533	476	526	427	444
18	0.0730	*0.0786*	501	532	474	525	426	443
19	0.0587	*0.0638*	403	427	381	422	343	356
20	0.0466	*0.0509*	320	339	303	335	272	282
21	0.0312	*0.0340*	214	227	203	224	182	189
22	0.0267	*0.0295*	183	194	173	192	156	162
23	0.0190	*0.0208*	130	138	123	136	111	115
24	0.0160	*0.0175*	110	116	104	115	93	97
Hour	Fraction of Trip/Day, All Vehicles[1]	Fraction of Trip/Day, *No HD Vehicles*[2]	3rd Street Segments					
			5 to 57		57 to 4		4 to 3	
			Southbound	Northbound	Southbound	Northbound	Southbound	Northbound
1	0.0080	*0.0084*	47	49	44	49	56	62
2	0.0040	*0.0041*	24	25	22	25	28	31
3	0.0020	*0.0015*	11	12	11	12	14	15
4	0.0016	*0.0017*	10	10	9	10	12	13
5	0.0027	*0.0028*	16	17	15	17	19	21
6	0.0044	*0.0045*	26	27	24	27	31	34
7	0.0174	*0.0191*	102	107	95	107	122	136
8	0.0512	*0.0567*	299	315	281	315	359	398
9	0.0545	*0.0563*	319	335	299	335	383	424
10	0.0625	*0.0480*	317	376	274	377	394	453
11	0.0617	*0.0512*	361	379	338	380	433	480
12	0.0795	*0.0723*	465	489	436	489	558	619
13	0.0837	*0.0831*	554	526	550	525	647	695
14	0.0688	*0.0692*	403	424	377	424	483	536
15	0.0744	*0.0738*	435	457	407	458	522	578
16	0.0792	*0.0779*	463	487	434	487	556	616
17	0.0732	*0.0743*	428	450	401	451	514	570
18	0.0730	*0.0786*	427	449	400	450	513	568
19	0.0587	*0.0638*	343	361	322	361	412	457
20	0.0466	*0.0509*	273	287	255	287	327	363
21	0.0312	*0.0340*	183	192	171	192	219	243
22	0.0267	*0.0295*	156	164	146	164	187	207
23	0.0190	*0.0208*	111	117	104	117	133	148
24	0.0160	*0.0175*	94	98	88	98	112	124

Table 4-2
Summary of Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Fraction of Trip/Day, All Vehicles[1]	Fraction of Trip/Day, No HD Vehicles[2]	Paul Ave/Gilman Ave Segments				Palou Ave Segments	
			34 to 9		9 to 18		30 to 54	
			Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
1	0.0080	0.0084	52	64	37	47	43	40
2	0.0040	0.0041	25	31	19	24	21	20
3	0.0020	0.0015	9	12	9	11	8	7
4	0.0016	0.0017	10	13	8	10	9	8
5	0.0027	0.0028	17	21	13	16	14	13
6	0.0044	0.0045	28	34	21	26	23	22
7	0.0174	0.0191	118	145	82	102	97	92
8	0.0512	0.0567	204	480	240	299	434	225
9	0.0545	0.0563	348	430	255	318	287	272
10	0.0625	0.0480	297	366	165	386	245	232
11	0.0617	0.0512	316	390	289	360	261	247
12	0.0795	0.0723	447	551	372	464	369	349
13	0.0837	0.0831	728	564	562	460	212	472
14	0.0688	0.0692	427	527	322	402	353	333
15	0.0744	0.0738	456	563	348	434	376	356
16	0.0792	0.0779	481	594	370	462	398	376
17	0.0732	0.0743	459	566	343	427	379	358
18	0.0730	0.0786	486	600	342	426	401	379
19	0.0587	0.0638	394	487	275	343	326	308
20	0.0466	0.0509	314	388	218	272	259	245
21	0.0312	0.0340	210	259	146	182	174	164
22	0.0267	0.0295	182	225	125	156	151	142
23	0.0190	0.0208	128	158	89	111	106	100
24	0.0160	0.0175	108	133	75	93	89	84

Hour	Fraction of Trip/Day, All Vehicles[1]	Fraction of Trip/Day, No HD Vehicles[2]	Palou Ave Segments				Evans Ave/Innes Ave Segments	
			54 to 55		55 to 6		47 to 46	
			Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
1	0.0080	0.0084	38	33	41	35	57	57
2	0.0040	0.0041	18	16	20	17	29	29
3	0.0020	0.0015	7	6	7	6	14	14
4	0.0016	0.0017	8	7	8	7	12	12
5	0.0027	0.0028	13	11	14	12	19	19
6	0.0044	0.0045	20	18	22	19	31	32
7	0.0174	0.0191	86	76	93	80	124	125
8	0.0512	0.0567	380	186	396	193	364	366
9	0.0545	0.0563	253	225	276	236	387	390
10	0.0625	0.0480	215	192	235	201	565	395
11	0.0617	0.0512	230	205	250	214	438	441
12	0.0795	0.0723	324	289	354	303	565	569
13	0.0837	0.0831	189	392	233	414	432	668
14	0.0688	0.0692	310	276	338	290	489	492
15	0.0744	0.0738	331	295	361	309	528	532
16	0.0792	0.0779	350	312	381	327	562	566
17	0.0732	0.0743	333	297	363	311	520	524
18	0.0730	0.0786	353	314	385	330	519	523
19	0.0587	0.0638	286	255	312	267	417	420
20	0.0466	0.0509	228	203	249	213	331	333
21	0.0312	0.0340	153	136	166	143	222	223
22	0.0267	0.0295	132	118	144	124	189	191
23	0.0190	0.0208	93	83	102	87	135	136
24	0.0160	0.0175	78	70	86	73	114	114

Table 4-2
Summary of Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Fraction of Trip/Day, All Vehicles[1]	Fraction of Trip/Day, *No HD Vehicles*[2]	Evans Ave/Innes Ave Segments					
			46 to 48		48 to 4		4 to 58	
			Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
1	0.0080	*0.0084*	54	52	34	33	11	11
2	0.0040	*0.0041*	27	26	17	16	6	5
3	0.0020	*0.0015*	13	13	8	8	3	3
4	0.0016	*0.0017*	11	11	7	7	2	2
5	0.0027	*0.0028*	18	18	11	11	4	4
6	0.0044	*0.0045*	30	29	18	18	6	6
7	0.0174	*0.0191*	118	113	73	71	24	24
8	0.0512	*0.0567*	346	333	215	208	70	69
9	0.0545	*0.0563*	368	355	229	221	75	74
10	0.0625	*0.0480*	546	359	336	235	118	79
11	0.0617	*0.0512*	416	402	259	250	85	84
12	0.0795	*0.0723*	537	518	334	323	109	108
13	0.0837	*0.0831*	398	609	252	364	72	121
14	0.0688	*0.0692*	465	448	289	279	95	93
15	0.0744	*0.0738*	502	484	312	302	102	101
16	0.0792	*0.0779*	534	516	332	321	109	107
17	0.0732	*0.0743*	494	477	307	297	101	99
18	0.0730	*0.0786*	493	476	306	296	100	99
19	0.0587	*0.0638*	396	382	246	238	81	80
20	0.0466	*0.0509*	315	304	196	189	64	63
21	0.0312	*0.0340*	211	203	131	127	43	42
22	0.0267	*0.0295*	180	174	112	108	37	36
23	0.0190	*0.0208*	128	124	80	77	26	26
24	0.0160	*0.0175*	108	104	67	65	22	22

Hour	Fraction of Trip/Day, All Vehicles[1]	Fraction of Trip/Day, *No HD Vehicles*[2]	Evans Ave/Innes Ave Segments		Harney Way Segments			
			58 to 16		29 to 59		59 to 60	
			Southbound	Northbound	Northbound	Westbound	Eastbound	Westbound
1	0.0080	*0.0084*	11	11	79	87	78	91
2	0.0040	*0.0041*	6	5	40	44	39	44
3	0.0020	*0.0015*	3	3	19	21	19	17
4	0.0016	*0.0017*	2	2	16	18	16	18
5	0.0027	*0.0028*	4	4	27	29	26	30
6	0.0044	*0.0045*	6	6	44	48	43	49
7	0.0174	*0.0191*	24	24	172	189	169	207
8	0.0512	*0.0567*	71	69	506	555	497	555
9	0.0545	*0.0563*	75	74	539	591	529	611
10	0.0625	*0.0480*	118	79	486	570	480	570
11	0.0617	*0.0512*	85	84	610	668	598	555
12	0.0795	*0.0723*	110	108	786	862	771	784
13	0.0837	*0.0831*	73	121	1004	907	980	901
14	0.0688	*0.0692*	95	93	681	746	668	749
15	0.0744	*0.0738*	103	101	735	806	721	800
16	0.0792	*0.0779*	109	107	783	858	768	845
17	0.0732	*0.0743*	101	99	724	793	710	805
18	0.0730	*0.0786*	101	99	722	792	708	852
19	0.0587	*0.0638*	81	80	581	636	569	692
20	0.0466	*0.0509*	64	63	461	505	452	551
21	0.0312	*0.0340*	43	42	309	339	303	369
22	0.0267	*0.0295*	37	36	264	289	259	320
23	0.0190	*0.0208*	26	26	188	206	184	225
24	0.0160	*0.0175*	22	22	158	173	155	190

Notes:

1. Hourly fraction of trips per day calculated from EMFAC total trips per hour for San Francisco County in 2030 were used to convert AM peak hour and PM peak hour traffic volumes into hourly traffic count. AM and PM peak hour traffic volumes were extracted from the Traffic Report. Detailed discussion of the methodology is presented in Appendix IV section 4.2.

2. The fractions of trips per day, excluding heavy-duty vehicles, are used for segments with truck restrictions which forbid trucks over 14,000 lbs. Those segments with truck restrictions are shown in *italics.*

Abbreviations:
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 4-3
CAL3QHCR Source Parameters, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
10 to 9 Northbound	Link_23	Above ground	553,238	4,175,107	553,267	4,175,189	0	14
	Link_106	Above ground	553,211	4,175,027	553,238	4,175,107	0	14.5
10 to 9 Southbound	Link_62	Above ground	553,229	4,175,112	553,200	4,175,030	0	14.5
	Link_78	Above ground	553,255	4,175,192	553,229	4,175,112	0	12
101 Ramp to 12 Northbound	Link_9	Above ground	553,058	4,174,718	553,106	4,174,787	0	12
11 to 10 Northbound	Link_91	Above ground	553,181	4,174,941	553,211	4,175,027	0	14
11 to 10 Southbound	Link_77	Above ground	553,200	4,175,030	553,189	4,175,003	0	14.5
	Link_83	Above ground	553,189	4,175,003	553,170	4,174,947	0	12
12 to 11 Northbound	Link_8	Above ground	553,106	4,174,787	553,152	4,174,858	0	12
	Link_29	Above ground	553,152	4,174,858	553,181	4,174,941	0	12.5
12 to 11 Southbound	Link_84	Above ground	553,170	4,174,947	553,142	4,174,864	0	12
	Link_103	Above ground	553,142	4,174,864	553,095	4,174,794	0	13
29 to 59 Northbound	Link_157	Above ground	553,692	4,173,849	553,871	4,173,865	0	14.5
	Link_158	Above ground	553,871	4,173,865	554,079	4,173,943	0	13.5
29 to 59 Westbound	Link_161	Above ground	553,868	4,173,873	553,688	4,173,857	0	14.5
	Link_162	Above ground	554,074	4,173,951	553,868	4,173,873	0	14.5
30 to 54 Eastbound	Link_25	Above ground	554,633	4,175,790	554,659	4,175,772	0	13.5
	Link_26	Above ground	554,494	4,175,888	554,633	4,175,790	0	13.5
	Link_88	Above ground	554,329	4,176,005	554,494	4,175,888	0	13.5
30 to 54 Westbound	Link_141	Above ground	554,498	4,175,893	554,332	4,176,010	0	13.5
	Link_142	Above ground	554,663	4,175,777	554,637	4,175,795	0	12.5
	Link_143	Above ground	554,637	4,175,795	554,498	4,175,893	0	13.5

Table 4-3
CAL3QHCR Source Parameters, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
34 to 9 Eastbound	Link_7	Above ground	553,259	4,175,187	553,426	4,175,074	0	12
	Link_18	Above ground	554,253	4,174,490	554,419	4,174,377	0	15.5
	Link_19	Above ground	554,088	4,174,609	554,253	4,174,490	0	16
	Link_20	Above ground	554,036	4,174,646	554,088	4,174,609	0	15
	Link_21	Above ground	553,922	4,174,725	554,036	4,174,646	0	14
	Link_22	Above ground	553,755	4,174,842	553,922	4,174,725	0	12
	Link_24	Above ground	553,426	4,175,074	553,592	4,174,958	0	12
	Link_28	Above ground	553,592	4,174,958	553,755	4,174,842	0	12
34 to 9 Westbound	Link_122	Above ground	554,040	4,174,651	553,926	4,174,730	0	16
	Link_123	Above ground	553,926	4,174,730	553,759	4,174,847	0	16
	Link_124	Above ground	553,759	4,174,847	553,595	4,174,963	0	16
	Link_125	Above ground	554,423	4,174,382	554,256	4,174,495	0	14.5
	Link_126	Above ground	553,430	4,175,079	553,260	4,175,193	0	15
	Link_129	Above ground	553,595	4,174,963	553,430	4,175,079	0	15
	Link_130	Above ground	554,256	4,174,495	554,091	4,174,614	0	15.5
	Link_133	Above ground	554,091	4,174,614	554,040	4,174,651	0	17.5
4 to 3 Northbound	Link_92	Above ground	553,958	4,177,533	553,980	4,177,616	0	14.5
	Link_99	Above ground	553,931	4,177,442	553,958	4,177,533	0	12
4 to 3 Southbound	Link_105	Above ground	553,962	4,177,595	553,946	4,177,539	0	13
	Link_121	Above ground	553,946	4,177,539	553,921	4,177,447	0	11.5
4 to 58 Eastbound	Link_115	Above ground	553,877	4,177,473	553,925	4,177,439	0	12
	Link_116	Above ground	553,197	4,177,952	553,877	4,177,473	0	15
4 to 58 Westbound	Link_119	Above ground	553,881	4,177,478	553,204	4,177,954	0	15
	Link_120	Above ground	553,927	4,177,451	553,881	4,177,478	0	14.5

Table 4-3
CAL3QHCR Source Parameters, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
46 to 48 Eastbound	Link_5	Above ground	554,924	4,176,316	555,002	4,176,261	0	14.25
	Link_6	Above ground	555,002	4,176,261	555,168	4,176,145	0	14.25
	Link_10	Above ground	554,703	4,176,889	554,854	4,176,783	0	13
	Link_11	Above ground	554,913	4,176,630	554,905	4,176,539	0	13.5
	Link_12	Above ground	554,907	4,176,666	554,913	4,176,630	0	13.5
	Link_13	Above ground	554,854	4,176,783	554,907	4,176,666	0	13.5
	Link_14	Above ground	554,905	4,176,539	554,894	4,176,440	0	14.5
	Link_15	Above ground	554,898	4,176,346	554,924	4,176,316	0	14.5
	Link_16	Above ground	554,888	4,176,389	554,898	4,176,346	0	14.5
	Link_17	Above ground	554,894	4,176,440	554,888	4,176,389	0	14.5
46 to 48 Westbound	Link_144	Above ground	555,172	4,176,151	555,007	4,176,268	0	15.5
	Link_145	Above ground	554,930	4,176,322	554,905	4,176,350	0	13.5
	Link_146	Above ground	554,905	4,176,350	554,896	4,176,389	0	13.5
	Link_147	Above ground	554,896	4,176,389	554,902	4,176,439	0	13.5
	Link_148	Above ground	555,007	4,176,268	554,929	4,176,323	0	13.5
	Link_149	Above ground	554,902	4,176,439	554,912	4,176,537	0	13.5
	Link_151	Above ground	554,913	4,176,538	554,921	4,176,631	0	13.5
	Link_152	Above ground	554,921	4,176,631	554,915	4,176,668	0	13.5
	Link_153	Above ground	554,915	4,176,668	554,858	4,176,790	0	13.5
	Link_154	Above ground	554,858	4,176,790	554,709	4,176,896	0	15
47 to 46 Eastbound	Link_104	Above ground	555,168	4,176,145	555,334	4,176,028	0	14.5
47 to 46 Westbound	Link_150	Above ground	555,339	4,176,034	555,172	4,176,151	0	15.5

Table 4-3
CAL3QHCR Source Parameters, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
48 to 4 Eastbound	Link_4	Above ground	554,539	4,177,004	554,703	4,176,889	0	12.8
	Link_31	Above ground	553,925	4,177,439	554,042	4,177,355	0	13
	Link_34	Above ground	554,042	4,177,355	554,206	4,177,240	0	13
	Link_93	Above ground	554,206	4,177,240	554,539	4,177,004	0	16
48 to 4 Westbound	Link_1	Above ground	554,709	4,176,896	554,618	4,176,961	0	12.8
	Link_2	Above ground	554,618	4,176,961	554,595	4,176,986	0	12.8
	Link_3	Above ground	554,595	4,176,986	554,548	4,177,018	0	12.8
	Link_85	Above ground	554,548	4,177,018	554,215	4,177,253	0	16
	Link_98	Above ground	554,051	4,177,368	553,927	4,177,451	0	18
	Link_100	Above ground	554,215	4,177,253	554,051	4,177,368	0	16
5 to 57 Northbound	Link_40	Above ground	553,764	4,176,826	553,788	4,176,913	0	14.5
	Link_43	Above ground	553,740	4,176,739	553,764	4,176,826	0	14.5
	Link_46	Above ground	553,716	4,176,649	553,740	4,176,739	0	14.5
	Link_47	Above ground	553,693	4,176,563	553,716	4,176,649	0	14.5
	Link_108	Above ground	553,788	4,176,913	553,812	4,177,001	0	12.5
5 to 57 Southbound	Link_41	Above ground	553,778	4,176,920	553,754	4,176,832	0	14.5
	Link_42	Above ground	553,754	4,176,832	553,730	4,176,745	0	14.5
	Link_45	Above ground	553,730	4,176,745	553,706	4,176,656	0	14.5
	Link_48	Above ground	553,706	4,176,656	553,683	4,176,569	0	14.5
	Link_109	Above ground	553,801	4,177,007	553,778	4,176,920	0	12.5
54 to 55 Eastbound	Link_89	Above ground	554,165	4,176,121	554,329	4,176,005	0	13.5
	Link_90	Above ground	553,998	4,176,238	554,165	4,176,121	0	13.5
54 to 55 Westbound	Link_139	Above ground	554,168	4,176,126	554,002	4,176,243	0	13.5
	Link_140	Above ground	554,332	4,176,010	554,168	4,176,126	0	13

Table 4-3
CAL3QHCR Source Parameters, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
55 to 6 Eastbound	Link_96	Above ground	553,662	4,176,475	553,833	4,176,355	0	11.5
	Link_97	Above ground	553,833	4,176,355	553,998	4,176,238	0	12.5
55 to 6 Westbound	Link_137	Above ground	553,836	4,176,360	553,665	4,176,480	0	13.5
	Link_138	Above ground	554,002	4,176,243	553,836	4,176,360	0	14.5
56 to 7 Northbound	Link_44	Above ground	553,526	4,175,948	553,550	4,176,037	0	12
	Link_54	Above ground	553,598	4,176,213	553,622	4,176,300	0	14.5
	Link_58	Above ground	553,574	4,176,126	553,598	4,176,213	0	14.5
	Link_59	Above ground	553,567	4,176,103	553,574	4,176,126	0	14.5
	Link_60	Above ground	553,550	4,176,037	553,567	4,176,103	0	14.5
56 to 7 Southbound	Link_55	Above ground	553,611	4,176,304	553,587	4,176,216	0	14.5
	Link_56	Above ground	553,587	4,176,216	553,563	4,176,129	0	14.5
	Link_57	Above ground	553,563	4,176,129	553,557	4,176,105	0	14.5
	Link_63	Above ground	553,540	4,176,041	553,515	4,175,951	0	12
	Link_64	Above ground	553,557	4,176,105	553,540	4,176,041	0	14.5
57 to 4 Northbound	Link_30	Above ground	553,884	4,177,264	553,907	4,177,351	0	13.5
	Link_32	Above ground	553,907	4,177,351	553,931	4,177,442	0	12
	Link_36	Above ground	553,860	4,177,176	553,884	4,177,264	0	13
	Link_38	Above ground	553,836	4,177,089	553,860	4,177,176	0	12
	Link_94	Above ground	553,824	4,177,045	553,836	4,177,089	0	12
	Link_95	Above ground	553,812	4,177,001	553,824	4,177,045	0	13.5
57 to 4 Southbound	Link_33	Above ground	553,921	4,177,447	553,897	4,177,356	0	12
	Link_35	Above ground	553,897	4,177,356	553,873	4,177,270	0	14
	Link_37	Above ground	553,873	4,177,270	553,849	4,177,182	0	13
	Link_39	Above ground	553,849	4,177,182	553,825	4,177,095	0	14
	Link_107	Above ground	553,825	4,177,095	553,801	4,177,007	0	12

Table 4-3
CAL3QHCR Source Parameters, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
58 to 16 Northbound	Link_117	Above ground	553,204	4,177,954	553,102	4,178,207	0	15
58 to 16 Southbound	Link_118	Above ground	553,096	4,178,204	553,197	4,177,952	0	15
59 to 60 Eastbound	Link_155	Above ground	553,545	4,173,721	553,652	4,173,828	0	15.5
	Link_156	Above ground	553,652	4,173,828	553,692	4,173,849	0	14.5
59 to 60 Westbound	Link_159	Above ground	553,646	4,173,835	553,539	4,173,727	0	15.5
	Link_160	Above ground	553,688	4,173,857	553,646	4,173,835	0	14.5
6 to 5 Northbound	Link_50	Above ground	553,669	4,176,475	553,693	4,176,563	0	15.5
6 to 5 Southbound	Link_49	Above ground	553,683	4,176,569	553,659	4,176,482	0	14.5
7 to 6 Northbound	Link_51	Above ground	553,646	4,176,388	553,669	4,176,475	0	14.5
	Link_101	Above ground	553,622	4,176,300	553,646	4,176,388	0	14.5
7 to 6 Southbound	Link_52	Above ground	553,659	4,176,482	553,635	4,176,394	0	14.5
	Link_53	Above ground	553,635	4,176,394	553,611	4,176,304	0	14.5
8 to 56 Northbound	Link_65	Above ground	553,475	4,175,777	553,504	4,175,862	0	14.5
	Link_69	Above ground	553,446	4,175,693	553,475	4,175,777	0	14.5
	Link_70	Above ground	553,417	4,175,612	553,446	4,175,693	0	14.5
	Link_71	Above ground	553,386	4,175,526	553,417	4,175,612	0	12
	Link_113	Above ground	553,515	4,175,906	553,526	4,175,948	0	12.5
	Link_114	Above ground	553,504	4,175,862	553,515	4,175,906	0	12
8 to 56 Southbound	Link_66	Above ground	553,515	4,175,951	553,493	4,175,869	0	12
	Link_67	Above ground	553,493	4,175,869	553,464	4,175,783	0	12
	Link_68	Above ground	553,464	4,175,783	553,435	4,175,700	0	14.5
	Link_72	Above ground	553,406	4,175,616	553,376	4,175,533	0	12
	Link_110	Above ground	553,435	4,175,700	553,406	4,175,616	0	12.5

Table 4-3
CAL3QHCR Source Parameters, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
9 to 18 Eastbound	Link_61	Above ground	552,942	4,175,275	553,019	4,175,252	0	10.5
	Link_75	Above ground	553,171	4,175,208	553,259	4,175,187	0	10.5
	Link_76	Above ground	552,804	4,175,315	552,866	4,175,297	0	10.5
	Link_79	Above ground	553,079	4,175,235	553,171	4,175,208	0	9.5
	Link_80	Above ground	553,019	4,175,252	553,079	4,175,235	0	11
	Link_81	Above ground	552,866	4,175,297	552,942	4,175,275	0	10.5
	Link_82	Above ground	552,691	4,175,348	552,804	4,175,315	0	15.5
9 to 18 Westbound	Link_127	Above ground	553,260	4,175,193	553,172	4,175,214	0	12.5
	Link_128	Above ground	553,020	4,175,258	552,944	4,175,280	0	12.5
	Link_131	Above ground	552,805	4,175,321	552,693	4,175,354	0	12
	Link_132	Above ground	552,868	4,175,303	552,805	4,175,321	0	12.5
	Link_134	Above ground	553,172	4,175,214	553,080	4,175,240	0	12.5
	Link_135	Above ground	552,944	4,175,280	552,868	4,175,303	0	12.5
	Link_136	Above ground	553,080	4,175,240	553,020	4,175,258	0	13
9 to 8 Northbound	Link_27	Above ground	553,298	4,175,276	553,328	4,175,359	0	14
	Link_86	Above ground	553,267	4,175,189	553,281	4,175,227	0	12.5
	Link_87	Above ground	553,281	4,175,227	553,298	4,175,276	0	12.5
	Link_111	Above ground	553,357	4,175,442	553,386	4,175,526	0	12
	Link_112	Above ground	553,328	4,175,359	553,357	4,175,442	0	14.5
9 to 8 Southbound	Link_73	Above ground	553,286	4,175,280	553,255	4,175,192	0	12
	Link_74	Above ground	553,315	4,175,363	553,286	4,175,280	0	14.5
	Link_102	Above ground	553,376	4,175,533	553,315	4,175,363	0	12

Notes:
1. Segments are identified by the bounding intersections, using the intersection numbering developed in Figure 26A of the Traffic Report, and by the direction of traffic flow.
2. CAL3QHCR limits relative elevations to a range of -10 meters to +10 meters. Here, the elevations are fairly flat. Therefore, the site is assigned an elevation of 0 meters.
3. As defined in CAL3QHCR, mixing zone width for a given free flow link is calculated by adding 6 meters to the width of the road. The width of the road is obtained by visual observation of high-resolution aeiral photograph.

Abbreviations:
CAL3QHCR: a steady-state Gaussian dispersion model
UTMx: X coordinate in Universal Transverse Mercator coordinate system, zone 10N
UTMy: Y coordinate in Universal Transverse Mercator coordinate system, zone 10N

Sources:
CHS Consulting Group et al. 2009. Bayview Waterfront Project Transportation Study: Preliminary Draft 1 Report.

Table 4-4
CAL3QHCR Source Parameters, Queuing Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
10 to 9 Northbound	Link_5	Above ground	553248.4	4175125.8	553266.7	4175189.2	0	8
10 to 9 Southbound	Link_15	Above ground	553209.1	4175055.7	553200.3	4175030.2	0	8.5
101 Ramp to 12 Northbound	Link_3	Above ground	553059.5	4174720.4	553105.8	4174786.9	0	6
11 to 10 Northbound	Link_22	Above ground	553199.4	4174994.8	553210.8	4175026.8	0	8
11 to 10 Southbound	Link_20	Above ground	553183.5	4174986.0	553170.0	4174947.3	0	6
12 to 11 Northbound	Link_7	Above ground	553167.8	4174895.8	553181.1	4174942.0	0	6.5
12 to 11 Southbound	Link_26	Above ground	553145.1	4174862.5	553094.0	4174792.2	0	7
29 to 59 Northbound	Link_43	Above ground	554041.4	4173928.8	554078.8	4173942.9	0	7.5
29 to 59 Westbound	Link_45	Above ground	553703.3	4173858.6	553688.1	4173857.3	0	8.5
30 to 54 Eastbound	Link_6	Above ground	554639.9	4175785.7	554659.5	4175771.9	0	7.5
30 to 54 Westbound	Link_40	Above ground	554433.7	4175938.4	554332.3	4176009.8	0	7.5
34 to 9 Eastbound	Link_4	Above ground	554398.6	4174390.9	554419.3	4174376.9	0	9.5
34 to 9 Westbound	Link_36	Above ground	553334.6	4175160.2	553260.4	4175192.7	0	9
4 to 3 Northbound	Link_23	Above ground	553938.7	4177459.9	553985.5	4177635.7	0	8.5
4 to 3 Southbound	Link_35	Above ground	553965.0	4177612.3	553921.0	4177447.0	0	5.5
4 to 58 Eastbound	Link_31	Above ground	553907.5	4177451.1	553925.4	4177438.3	0	6
4 to 58 Westbound	Link_34	Above ground	553232.5	4177934.3	553203.8	4177954.5	0	9
46 to 48 Eastbound	Link_2	Above ground	555151.2	4176156.0	555167.6	4176144.5	0	8.25
46 to 48 Westbound	Link_41	Above ground	554788.8	4176839.1	554729.3	4176881.4	0	9
48 to 4 Eastbound	Link_1	Above ground	554666.8	4176914.5	554702.7	4176889.2	0	6.8
48 to 4 Westbound	Link_25	Above ground	553974.4	4177426.1	553927.4	4177450.8	0	12
5 to 57 Northbound	Link_28	Above ground	553786.8	4176914.8	553812.1	4177001.2	0	6.5
5 to 57 Southbound	Link_9	Above ground	553706.6	4176657.9	553682.6	4176569.1	0	8.5
54 to 55 Eastbound	Link_21	Above ground	554251.2	4176059.6	554328.8	4176004.9	0	7.5
54 to 55 Westbound	Link_39	Above ground	554051.5	4176207.7	554001.6	4176242.8	0	7.5
55 to 6 Eastbound	Link_24	Above ground	553946.7	4176274.2	553998.1	4176237.9	0	6.5
55 to 6 Westbound	Link_38	Above ground	553771.4	4176405.1	553665.1	4176479.9	0	7.5

Table 4-4
CAL3QHCR Source Parameters, Queuing Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
56 to 7 Northbound	Link_14	Above ground	553598.6	4176213.3	553621.6	4176300.3	0	8.5
56 to 7 Southbound	Link_16	Above ground	553533.5	4176018.0	553515.0	4175950.5	0	6
57 to 4 Northbound	Link_8	Above ground	553895.3	4177307.0	553931.1	4177442.4	0	6
57 to 4 Southbound	Link_27	Above ground	553824.9	4177093.5	553801.3	4177006.7	0	6
58 to 16 Northbound	Link_32	Above ground	553164.2	4178052.5	553102.3	4178206.5	0	9
58 to 16 Southbound	Link_33	Above ground	553116.8	4178151.2	553197.4	4177951.8	0	9
59 to 60 Eastbound	Link_42	Above ground	553669.3	4173836.8	553692.2	4173849.1	0	8.5
59 to 60 Westbound	Link_44	Above ground	553646.5	4173835.1	553632.4	4173820.9	0	9.5
6 to 5 Northbound	Link_11	Above ground	553669.0	4176476.1	553693.5	4176565.8	0	9.5
6 to 5 Southbound	Link_10	Above ground	553682.5	4176568.7	553658.3	4176478.9	0	8.5
7 to 6 Northbound	Link_12	Above ground	553647.2	4176385.5	553668.9	4176475.9	0	8.5
7 to 6 Southbound	Link_13	Above ground	553625.5	4176362.3	553611.1	4176304.1	0	8.5
8 to 56 Northbound	Link_30	Above ground	553503.7	4175868.8	553526.5	4175947.6	0	6.5
8 to 56 Southbound	Link_17	Above ground	553392.3	4175577.9	553376.1	4175532.8	0	6
9 to 18 Eastbound	Link_19	Above ground	552691.2	4175349.6	553259.4	4175186.7	0	4.5
9 to 18 Westbound	Link_37	Above ground	552945.0	4175280.2	552692.6	4175354.0	0	6
9 to 8 Northbound	Link_29	Above ground	553367.4	4175471.9	553386.3	4175525.6	0	6
9 to 8 Southbound	Link_18	Above ground	553273.7	4175250.3	553255.3	4175192.1	0	6

Notes:
1. Segments are identified by the bounding intersections, using the intersection numbering developed in Figure 26A of the Traffic Report, and by the direction of traffic flow.
2. CAL3QHCR limits relative elevations to a range of -10 meters to +10 meters. Here, the elevations are fairly flat. Therefore, the site is assigned an elevation of 0 meters.
3. As defined in CAL3QHCR, mixing zone width for a given queue link is equal to the width of the road. The width of the road is obtained by visual observation of high-resolution aeiral photograph.

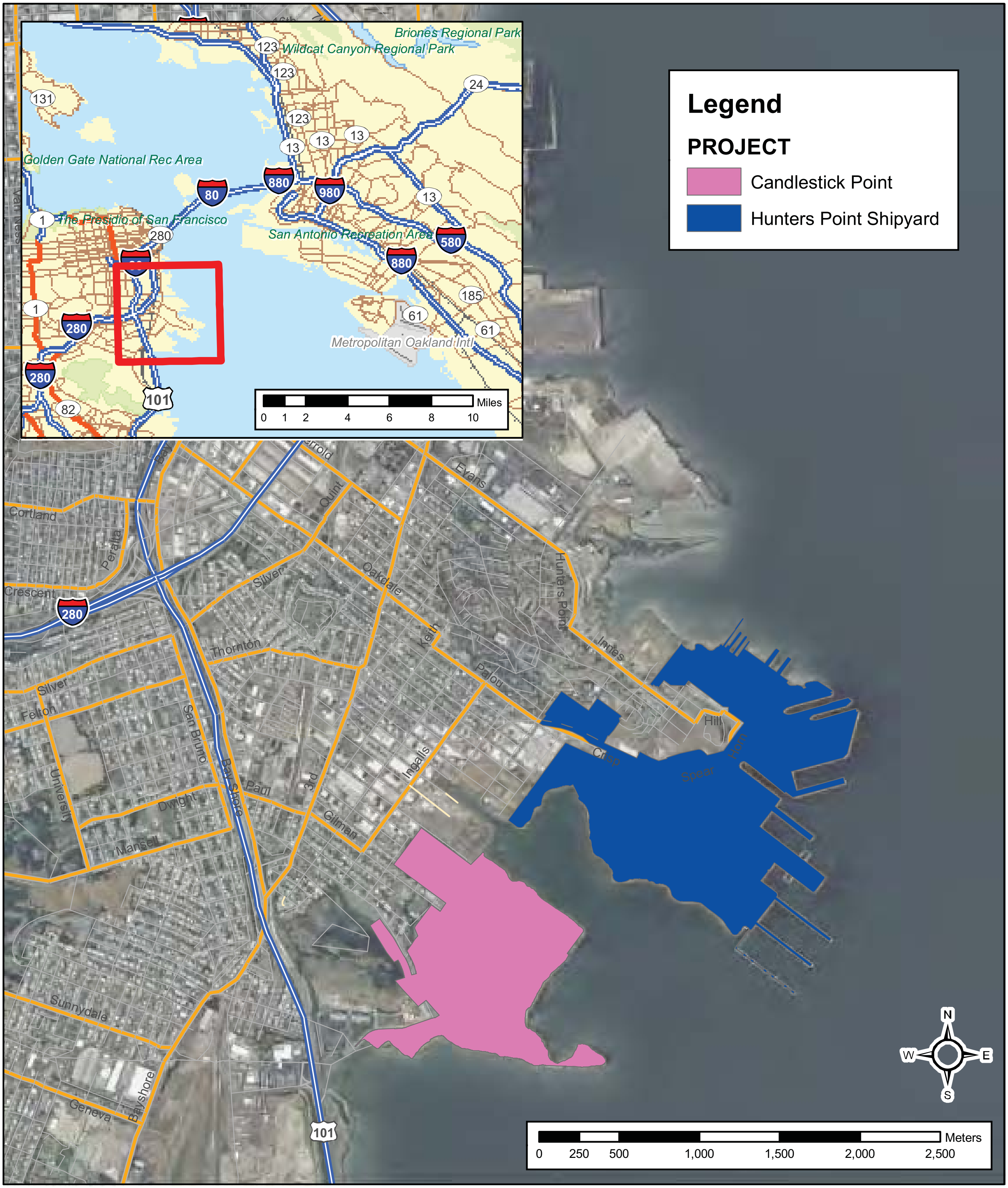
Abbreviations:
CAL3QHCR: a steady-state Gaussian dispersion model
UTMx: X coordinate in Universal Transverse Mercator coordinate system, zone 10N
UTMy: Y coordinate in Universal Transverse Mercator coordinate system, zone 10N

Sources:
CHS Consulting Group et al. 2009. Bayview Waterfront Project Transportation Study: Preliminary Draft 1 Report.

Table 4-5
Summary of Sensitive Receptors
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Facility	Address	City	State	Zip	Type	UTMX	UTMY
Bayview Essential School Of Music, Art, And Social Justice	1195 Hudson Ave.	San Francisco	CA	94124	School	554,459	4,176,382
Bayview Hunters Point Foundation Third St. Clinic	4301 Third Street	San Francisco	CA	94124	Hospital	553,819	4,176,989
Bret Harte Elementary	1035 Gilman Ave.	San Francisco	CA	94124-3710	School	553,855	4,174,760
Burnett Children Center	1520 Oakdale Ave.	San Francisco	CA	94124	School	553,851	4,176,470
Charles Drew College Preparatory Academy	50 Pomona Ave.	San Francisco	CA	94124-2344	School	553,432	4,176,226
Child's Time	3061 San Bruno Avenue	San Francisco	CA	94134	Childcare	552,737	4,175,268
El Dorado Elementary	70 Delta St.	San Francisco	CA	94134	School	552,261	4,174,761
EOC - Busy Bee	548 Delta Street	San Francisco	CA	94134	Childcare	552,046	4,174,192
EOC - Martin Luther King Child Care Center	200 Cashmere	San Francisco	CA	94124	Childcare	554,119	4,176,788
EOC - Soujourner Truth Child Care Center	1 Cashmere	San Francisco	CA	94124	Childcare	554,430	4,176,649
Frandelja Enrichment Center (Preschool)	950 Gilman Street	San Francisco	CA	94124	Childcare	553,991	4,174,701
George Washington Carver Elementary	1360 Oakdale Ave.	San Francisco	CA	94124-2724	School	554,074	4,176,310
Kipp Bayview Academy	1060 Key Ave.	San Francisco	CA	94124	School	553,176	4,174,859
Malcolm X Academy	350 Harbor Rd.	San Francisco	CA	94124-2474	School	554,582	4,176,461
Martha Hills Learning Center - Preschool	1044 Jamestown Avenue	San Francisco	CA	94124	Childcare	553,381	4,174,820
Muhammad University Of Islam	5048 Third Street	San Francisco	CA	94124	School	553,607	4,176,356
North East Medical Services-Leland Avenue	82 Leland Avenue	San Francisco	CA	94134	Hospital	552,421	4,174,022
Our Lady Of The Visitacion Elementary	785 Sunnydale Avenue	San Francisco	CA	94134	School	552,032	4,173,809
Phillip And Sala Burton Academic High	400 Mansell St.	San Francisco	CA	94134	School	552,421	4,174,988
S. R. Martin College Preparatory	5 Thomas Mellon Circle, Suite 225	San Francisco	CA	94134	School	553,552	4,173,936
SFCCD - Grace Child Development Center - Preschool	1551 Newcomb	San Francisco	CA	94124	Childcare	553,840	4,176,545
SFSU - Hunter's View Head Start	125 West Point Road	San Francisco	CA	94124	Childcare	554,535	4,176,681
SFSU - Southeast Headstart Center	1300 Phelps Avenue	San Francisco	CA	94124	Childcare	553,425	4,176,843
Southeast Families United/Mission Head Start	1337 Evans Avenue	San Francisco	CA	94124	Childcare	554,319	4,177,143
Visitacion Valley Child And Family Dev. Center	103 Tucker Avenue	San Francisco	CA	94134	Childcare	552,335	4,174,457
Visitacion Valley Community Center	50 Raymond Avenue	San Francisco	CA	94134	Childcare	552,514	4,174,066
Whitney Young Child Dev. Ctr. - Preschool	100 Whitney Young Circle	San Francisco	CA	94124	Childcare	554,215	4,176,579

Figures



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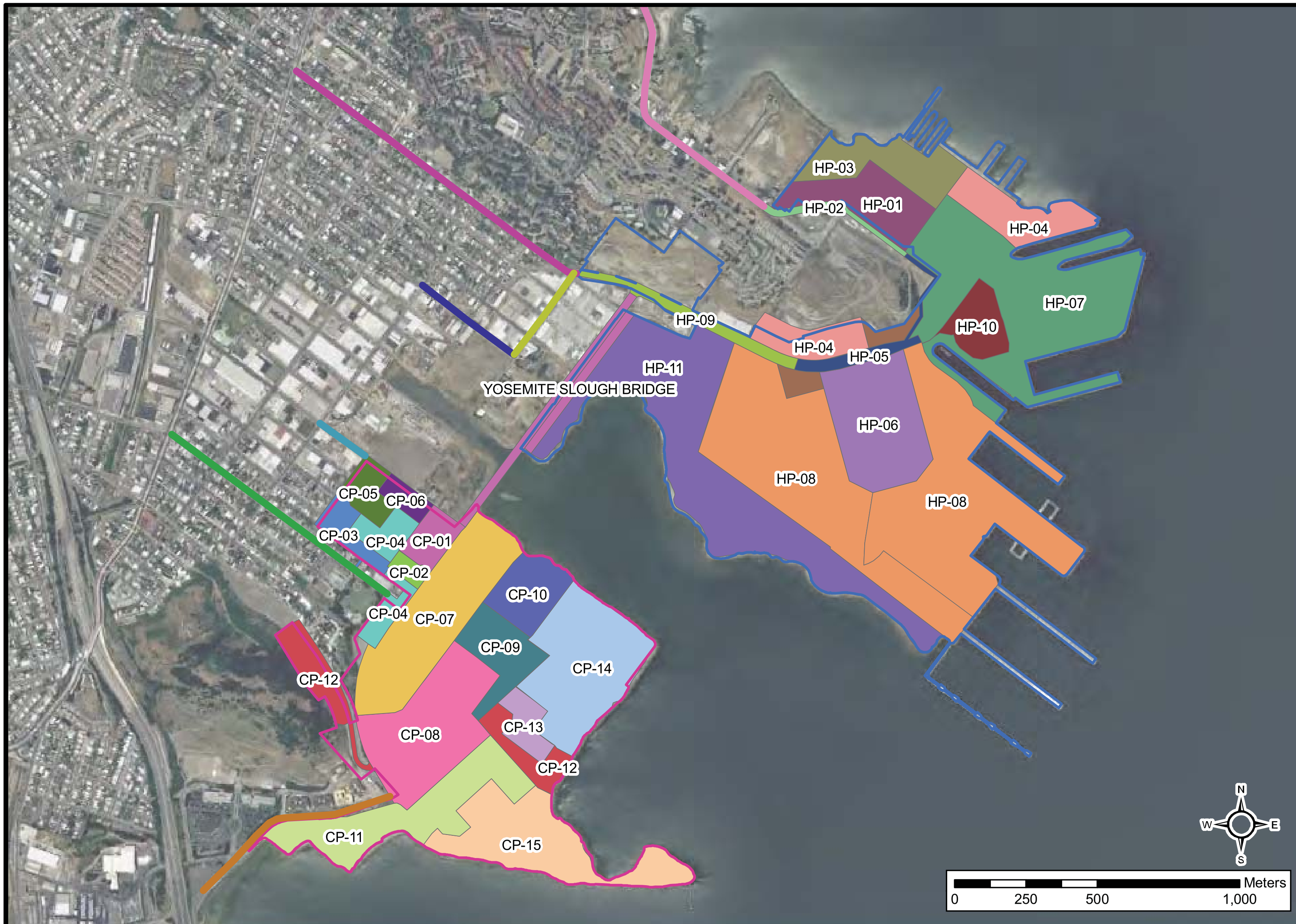
Project Site Vicinity Map
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure
2-1

Drafter: EH Date: 09/17/2009

Contract Number: 0320816A



Legend

Road Improvement Construction

- Carroll Ave
- Gilman Ave
- Harney Way
- Hunter's Point Blvd
- Ingall St
- Palou Ave
- Thomas Ave

PROJECT

- Candlestick Point
- Hunters Point Shipyard

Note:
1. CP, HP designations reflect proposed construction phases.
2. Alice Griffith Housing area is represented by CP-01 through CP-06.

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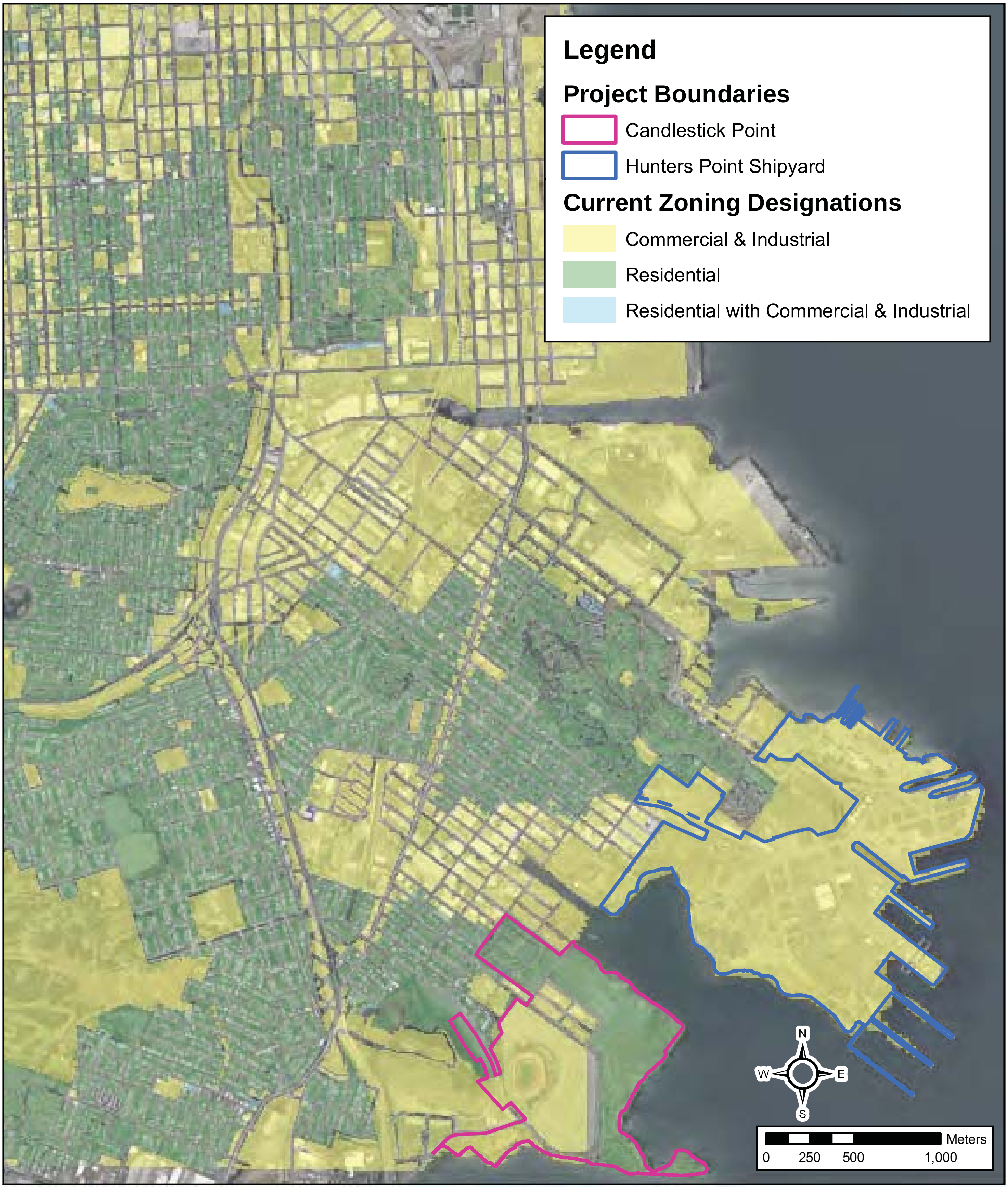
Project Overview
Candlestick Point - Hunters Point Shipyard Phase II
Development Plan
San Francisco, California

Drafter: EH Date: 09/21/2009 Contract Number: 0320816A Approved: Revised:

Figure
2-2



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Surrounding Land Use
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure
2-3

Drafter: EH Date: 09/17/2009

Contract Number: 0320816A

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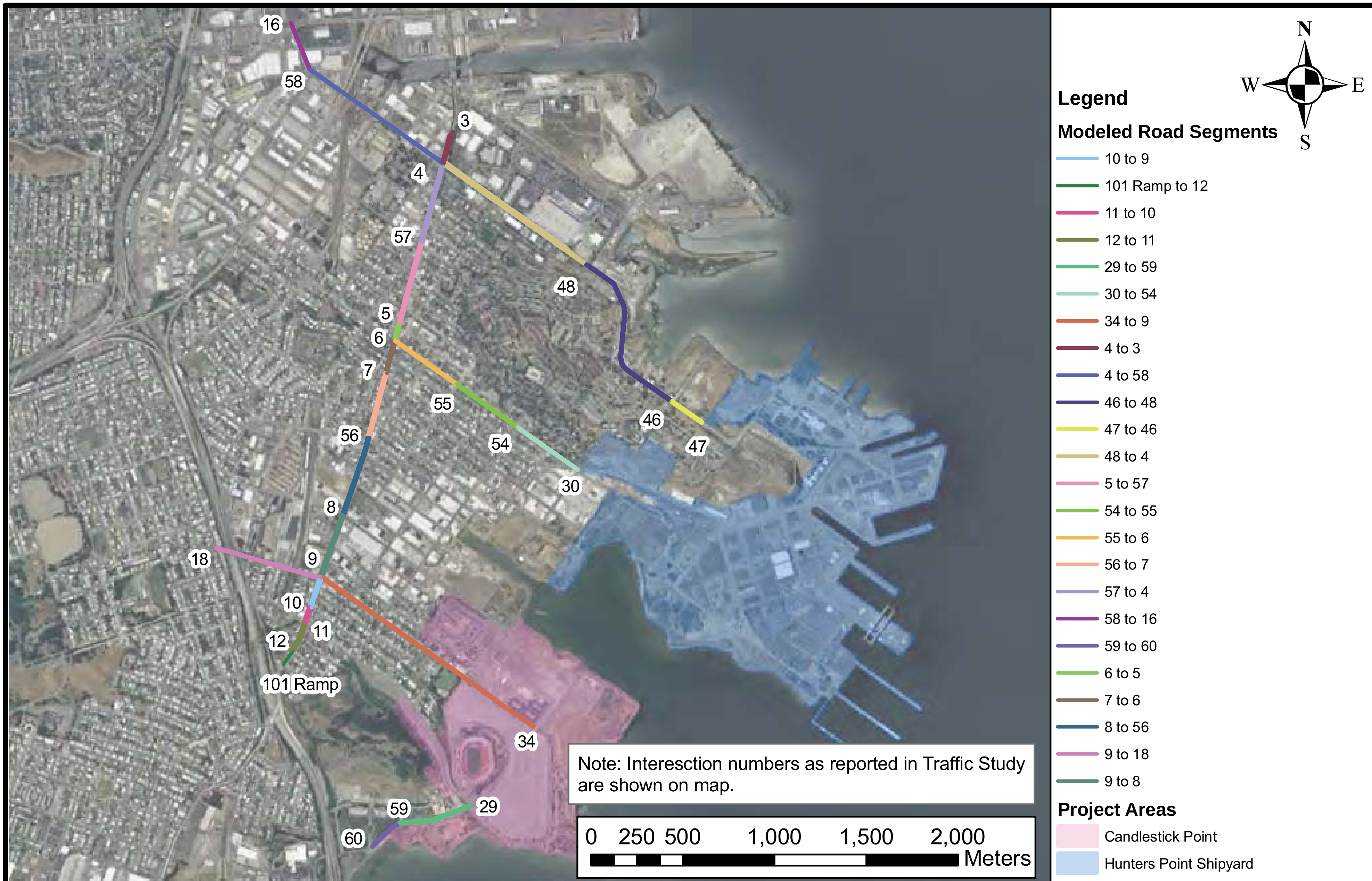

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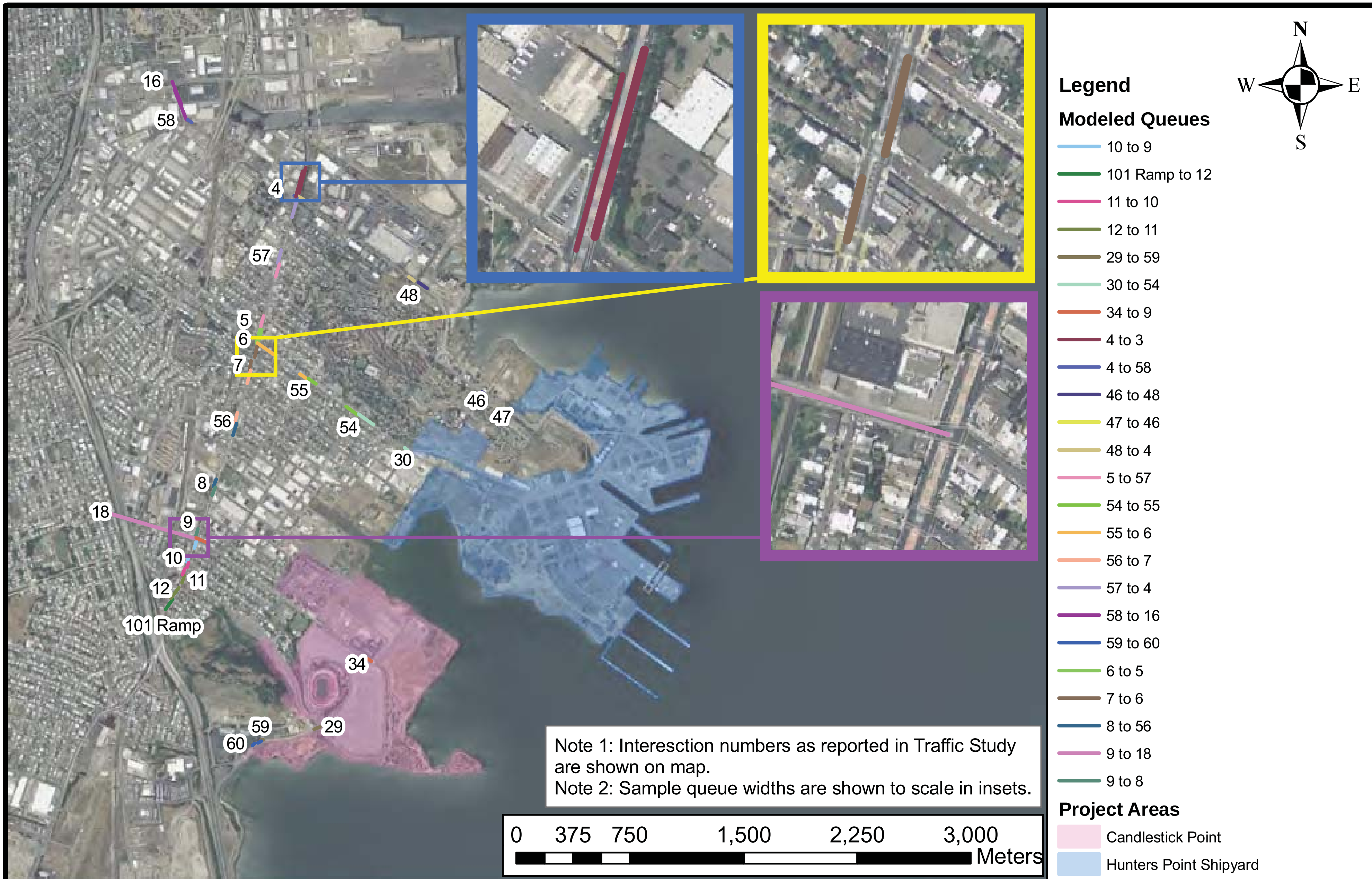
Location of Travel Lanes Modeled, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure **4-1**

Drafter: KD Date: 7/29/2009 Contract Number: 03-20816A Approved: Revised:

DRAFT



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Location of Modeled Queues
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure **4-2**

Drafter: KD | Date: 7/29/2009 | Contract Number: 03-20816A | Approved: | Revised:

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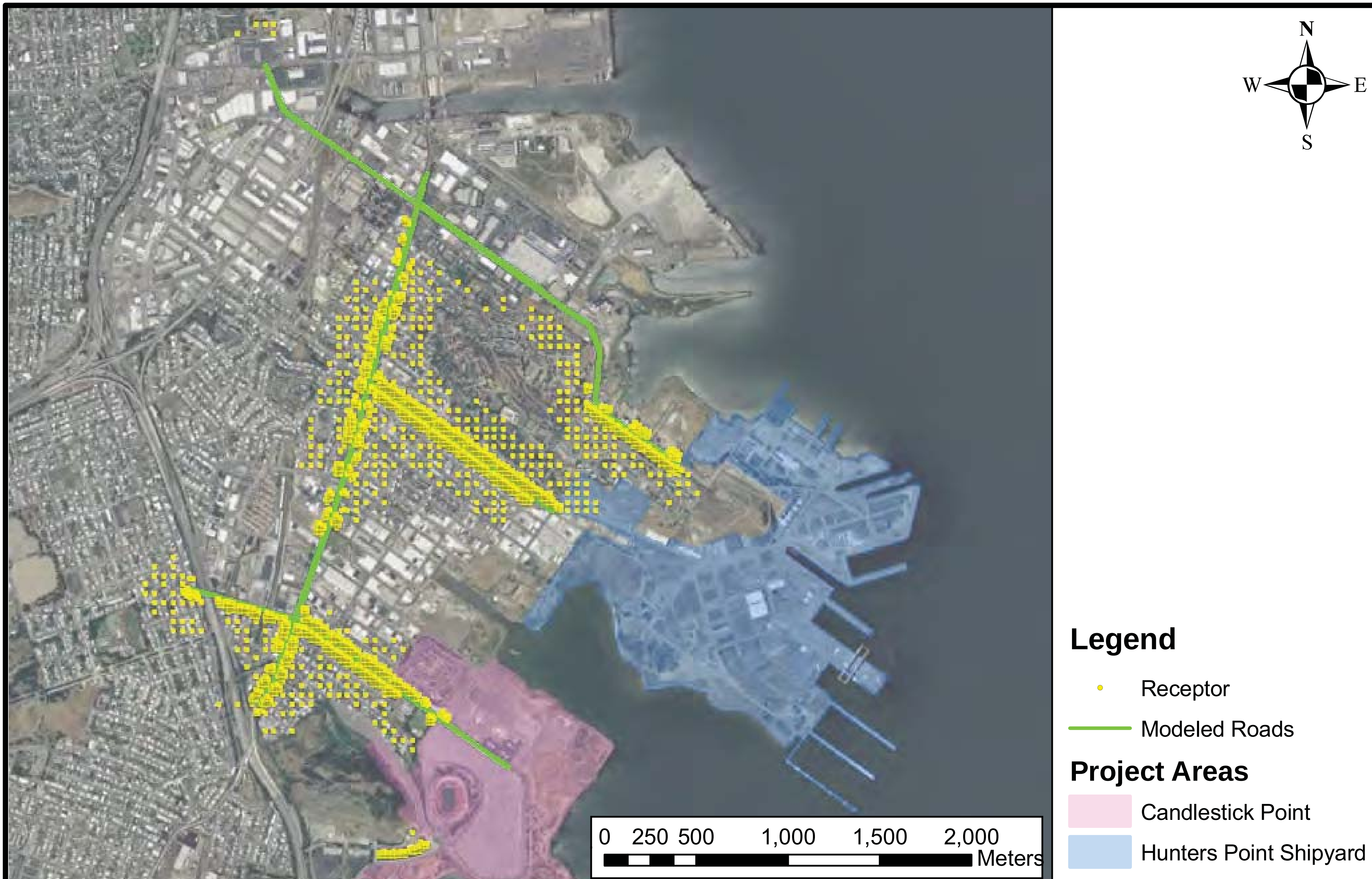

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Location of Modeled Residential Receptors
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure **4-3**

Drafter: KD | Date: 7/29/2009 | Contract Number: 03-20816A | Approved: | Revised:

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Land Use Zoning in Relation to Modeled Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Drafter: KD Date: 7/23/2009 Contract Number: 03-20816A Approved: Revised:

Figure
4-4

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Modeled Concentrations of PM2.5
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Drafter: KD Date: 7/23/2009 Contract Number: 03-20816A Approved: Revised:

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Appendix H4 ENVIRON, Community Hazards and San Francisco Health Code Article 38 Analyses Candlestick Point–Hunters Point Shipyard Phase II Redevelopment Project, May 2010

ENVIRON

May 4, 2010

Mr. Michael Rice
Post, Buckley, Schuh & Jerrigan, Inc.
353 Sacramento Street, Suite 1000
San Francisco, CA 94111

Re: Community Hazards and San Francisco Health Code Article 38 Analyses
Candlestick Point–Hunters Point Shipyard Phase II Redevelopment Project

Dear Mr. Rice:

At the request of Post, Buckley, Schuh & Jerrigan, Inc. (PBS&J), ENVIRON International Corporation (ENVIRON) previously conducted four human health risk analyses (HHRAs) in support of the Draft Environmental Impact Report (DEIR) process for the Candlestick Point – Hunter's Point Shipyard Phase II Redevelopment Project ("Project"). These HHRAs included evaluation of Construction Emissions, Airborne Contaminated Soil, Emissions from Stationary Sources and Traffic/Vehicular Emissions. In this letter report, we present three additional evaluations for the Project: 1) an analysis of onsite residential receptors that addresses single source and cumulative community hazard impacts pursuant to the proposed Bay Area Air Quality Management District (BAAQMD) California Environmental Quality Act (CEQA) guidance; 2) at the request of the San Francisco Planning Department, a cumulative analysis of offsite residential receptors; and 3) evaluation of the Project for compliance with *San Francisco Health Code* Article 38.

The remainder of this letter is divided into five sections. Section 1.0 outlines the Project background. Section 2.0 presents the community hazard analysis of single sources on onsite residential receptors. Section 3.0 presents the cumulative analysis of community hazards for onsite residential receptors including source identification and emissions estimation, air dispersion modeling, risk analysis and risk characterization. Section 4.0 presents the cumulative analysis for offsite residential receptors. Section 5.0 describes the evaluation of the Project for compliance with *San Francisco Health Code* Article 38. Section 6.0 summarizes the conclusions from these evaluations.

1.0 Background

Details of the Project have been provided in the Project Description included in Chapter II of the DEIR prepared by PBS&J. Based on information provided in this source, the Project will consist of the development of two areas collectively referred to as the Candlestick Point-Hunters Point Shipyard Phase II Development Plan (the "Project"). The description of the Project is organized under two major sub-components: Candlestick Point (CP) and Hunters Point Shipyard Phase II (HPS Phase II). The Project comprises an approximately 702-acre area.

The Project proposed by Lennar Urban includes a mixed-use community with a range of residential, retail, office, research and development, civic and community uses, and parks and recreational open space. In addition, a major component would be a new stadium for the San Francisco 49ers, a National Football League (NFL) team. Necessary infrastructure improvements (including several roadway modifications) are also proposed in support of the Project development plan.

The Project construction activities are anticipated to occur over an approximately 20 year period, beginning in 2011 and concluding in 2031 with full operation by 2032.

A more detailed discussion of the Project is included in Chapter II of the DEIR.

2.0 Community Hazard Analysis – Single Source

The community hazard analysis addresses single source and cumulative impacts pursuant to proposed BAAQMD CEQA Guidelines ("Draft BAAQMD CEQA Guidelines"). By the time the DEIR was released on November 12, 2009, the BAAQMD had released several versions of draft guidelines and significance thresholds in September 2009, October 7, 2009 (thresholds only), and November 2, 2009. The BAAQMD also released accompanying documents that support the basis for the significance thresholds in October 2009 and November 2, 2009. After release of the Draft EIR, updated draft guidelines were released on December 7, 2009.[1] Throughout the process the significance thresholds and methodology have changed and the BAAQMD continues to evaluate and revise these documents and the recommended approaches used to quantify impacts from a project. The BAAQMD is still conducting public workshops in May 2010 and taking public comment, and it is expected to release revised thresholds and basis documents in advance of the June 2010 Board meeting. For the purpose of this analysis, the December 7, 2009 thresholds and methodologies are used to make significance determinations as well as materials released during public workshops in April 2010.[2]

In the December 7, 2009, guidance[3] and accompanying threshold basis document,[4] the BAAQMD proposed a single source cancer risk, non-cancer hazard index, and $PM_{2.5}$ [particulate matter less than 2.5 microns in diameter] threshold, considering whether new sensitive receptors would be exposed to Toxic Air Contaminants (TACs) and $PM_{2.5}$ concentrations exceeding thresholds from any single source within 1,000 feet of the Project. The thresholds are:

- An excess cancer risk level of more than 10 in one million or a chronic or acute hazard index (HI) greater than 1.0 for TACs
- An incremental increase of greater than 0.3 micrograms per cubic meter (μg/m^3) annual average $PM_{2.5}$.

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1 BAAQMD, 2009b. *California Environmental Quality Act Air Quality Guidelines*, December 7.

2 BAAQMD, 2010. CEQA Guidelines Update, Public Workshop Slides, Oakland, CA, April 26.

3 Bay Area Air Quality Management District, *California Environmental Quality Act Guidelines*, December 7, 2009.

4 Bay Area Air Quality Management District, *California Environmental Quality Act Guidelines Update: Proposed Thresholds of Significance*, December 7, 2009.

When siting a new receptor, the BAAQMD recommends the Lead Agency examine existing or future proposed sources of TAC and/or $PM_{2.5}$ emissions that would adversely affect new receptors. These impacts include impacts from existing individual stationary sources and impacts from individual freeways or major roadways. The BAAQMD has provided more recent examples of how to conduct these single sources analyses. [5]

2.1 Stationary Sources

As discussed further in Section 3.1.1, according to the BAAQMD database, there are a total of three listed sources of TAC and $PM_{2.5}$ emissions within 1,000 feet of the Project boundary, all of which are diesel-fueled generators. These sources include the Griffith pump station, UCSF/Hunters Point Facility, and Bayview Greenwaste Facility. ENVIRON requested and received from the BAAQMD the daily emissions estimates and source parameters for use in modeling of these three sources. A discussion of the approaches used to model emissions from these facilities and estimate risks, hazards and $PM_{2.5}$ concentration is presented in detail in Section 3 of this technical letter.

For these stationary sources (diesel generators), ENVIRON conservatively assumed that $PM_{2.5}$ emissions can be represented by diesel particulate emissions (DPM) emissions.

Screening Level Single-Source Cancer Risk, Non-cancer Hazard Index (HI) and PM2.5 Concentration from Offsite Sources within 1000 Feet of Project Sensitive Receptors

Source	High End Cancer Risk (in a million)	Single-Source Cancer Risk Threshold (in a million)	Chronic Non-Cancer HI (-)	Single-Source Chronic Non-Cancer HI (-)	Annual Average $PM_{2.5}$ Concentration (ug/m^3)	Single-Source $PM_{2.5}$ Threshold (ug/m^3)
Griffith Pump Station	0.003	10	$2.2*10^{-6}$	1.0	$1.1*10^{-5}$	0.3
UCSF/Hunters Point	0.02		$1.5*10^{-5}$		$7.6*10^{-5}$	
Bayview Greenwaste – Current	135		$8.5*10^{-2}$		0.42	
Bayview Greenwaste – ATCM Compliant	1.2		$7.7*10^{-4}$		$3.8*10^{-3}$	

Note: Analysis based on BAAQMD, CEQA Guidelines Update, Public Workshop Slides, Oakland, CA, April 26, 2010.

As the table above demonstrates, only the Bayview Greenwaste Facility currently exceeds the cancer risk and $PM_{2.5}$ thresholds. Depending on the classification and permit status of diesel engine at the Bayview Greenwaste Facility, it is reasonable to expect that by the time new Project sensitive receptors will be located next to the facility (by 2013, at the earliest), this facility will be operating in compliance with the California Air Resources Board (ARB) Airborne Toxic

5 BAAQMD, 2010. CEQA Guidelines Update, Public Workshop Slides, Oakland, CA, April 26.

Control Measure (ATCM) for Stationary Compression-Ignition Engines Rule.[6] As the table indicates, with compliance with the ATCM, the estimated cancer risks, non-cancer hazards, and annual average $PM_{2.5}$ concentration from this source would be below the indicated thresholds.

2.2 Freeway/Major Roadway Sources

In their draft CEQA Air Quality Guidelines and as discussed in public workshops, the BAAQMD recommends the evaluation of all roadways with daily traffic greater than 10,000 vehicles within 1,000 feet of the Project boundary as sources of $PM_{2.5}$.[7] The roadways evaluated for the single-source on-site residential receptor analysis are portions of Carroll Avenue; Innes Avenue; Arelious Walker Avenue; Gilman Avenue; Jamestown Avenue; and Harney Way.[8]

Screening Level Single-Source PM2.5 Concentration from Roadways with Traffic >10,000 Vehicles per Day within 1000 Feet of Project Sensitive Receptors

Roadway	Future Cumulative Traffic Volume (vehicles per day)	Location of Roadway Relative to On-site Sensitive Receptor[a]	Minimum Distance to Sensitive Receptor (feet)[b,c]	BAAQMD Screening $PM_{2.5}$ Concentration (ug/m^3)b	Single-Source $PM_{2.5}$ Threshold (ug/m^3)
Harney Way	36,400	West	100	0.26	0.3
Arelious Walker	25,300	West	100	0.21	
Jamestown	15,000	North	100	0.16	
Gilman	25,000	North	100	0.25	
Carroll	10,300	South	100	0.16	
Innes	24,000	West	100	0.21	

[a]With the exception of Harney and Arelious Walker, all streets run in a northwest-southeast configuration. As a conservative measure, it was assumed that the roadways were east-west directional, which correspond to the maximum impacts in the BAAQMD screening tables.

[b]100 feet is the minimum distance presented in the BAAQMD screening table.

[c]BAAQMD, CEQA Guidelines Update, Public Workshop Slides, Oakland, CA, April 26, 2010.

6 BAAQMD's reported emissions are consistent with a source operating as a prime engine; however, the permit to operate has language to indicate it is classified as a standby emergency generator. The ARB has issued ATCMs to address both stationary prime/emergency diesel engines as well as portable equipment:
* Amended Airborne Toxic Control Measure for Stationary Compression Ignition Engines, effective October 18, 2007.
* Airborne Toxic Control Measure For Diesel Particulate Matter From Portable Engines Rated At 50 Horsepower And Greater, effective September 12, 2007.

7 To date, the BAAQMD has only provided screening level guidance for PM2.5 in their CEQA Guidelines Update, Public Workshop Slides, Oakland, CA, April 26, 2010.

8 CHS Consulting Group, Fehr & Peers, LCW Consulting 2009. Bayview Waterfront Project Transportation Study: Preliminary Draft 1 Report. Prepared for City of San Francisco Planning Department.

As the table above demonstrates, concentrations of $PM_{2.5}$ at the minimum screening distance (100 feet) from these roadways would be below the indicated thresholds. It is recognized that Project receptors could be located less than 100 feet from roadways, which is not addressed by the BAAQMD screening tables. As discussed in Section 5 of this technical letter, any new sensitive receptors on the Project which exceed a $PM_{2.5}$ concentration of 0.2 µg/m^3 from cumulative traffic would be required to install filtration under *San Francisco Health Code* Article 38. As such, compliance with Article 38 will ensure that no cumulative exposures above 0.2 µg/m^3 would be experienced by new receptors in the Project site and, therefore, the BAAQMD threshold of 0.3 µg/m^3 would not be exceeded.

3.0 Community Hazard Analysis – Cumulative Sources

As proposed in the Draft BAAQMD CEQA Guidelines, a cumulative impacts analysis would "examine TAC and/or $PM_{2.5}$ sources that are located within 1,000 feet of a proposed project site." "A project would have a cumulative significant impact if the aggregate total of all past, present, and foreseeable future sources within a 1,000 foot radius (or beyond where appropriate) from the fence line of a source, or from the location of a receptor, plus the contribution from the project, exceeds the following:

- An excess cancer risk level of more than 100 in one million or a chronic or acute [hazard index] HI greater than 1.0 for TACs; or
- 0.8 µg/m^3 annual average PM2.5."

During a meeting attended by representatives from ENVIRON, the City of San Francisco Planning Department, and BAAQMD on January 13, 2010, the District stated that the cumulative impacts analysis described in the Draft BAAQMD CEQA Guidelines should consist of an evaluation of cancer risks and noncancer hazards associated with offsite sources within a 1,000 foot radius of the Project and potential impacts of those sources on onsite residents only, assuming 70 years of exposure. This cumulative analysis was completed based on the BAAQMD's guidance coupled with information provided by the BAAQMD to ENVIRON regarding the emission sources requiring analysis within the 1,000 foot radius of the Project.

3.1 Source Identification and Emissions Estimation

<u>3.1.1 Stationary Sources</u>

To perform a cumulative impacts analysis, sources of TACs and $PM_{2.5}$ within a 1,000 foot radius of the proposed Project were identified. According to Draft BAAQMD CEQA Guidelines, "sources of TACs include, but are not limited to, land uses such as freeways and high volume roadways, truck distribution centers, ports, rail yards, refineries, chrome plating facilities, dry cleaners using perchloroethylene, and gasoline dispensing facilities." Non-permitted TAC and $PM_{2.5}$ sources (such as facilities that host a high volume of diesel truck activity) were also considered by taking into account roadway traffic that would be most affected by these sources.

In December 2009, BAAQMD Staff provided the City of San Francisco Planning Department with a listing of facilities in southeastern San Francisco with currently permitted sources of TAC emissions. According to this database, ENVIRON determined there are three listed sources within 1,000 feet of the Project boundary, all of which were diesel-fueled generators. ENVIRON requested and received from the BAAQMD the daily emissions estimates and source parameters for use in modeling of these three sources. For these stationary sources (diesel generators), ENVIRON conservatively assumed that DPM emissions are equivalent to $PM_{2.5}$ exhaust emissions. Emission rates and source parameters of these three sources used in modeling are summarized in Table 1.

In BAAQMD's Draft CEQA Air Quality Guidelines, there is discussion of several possible non-permitted sources of $PM_{2.5}$ and TACs that may contribute a large amount of emissions. These include freeways, distribution centers, warehouses, rail yards, ports, and truck stops. In the draft CEQA guidelines, the BAAQMD recommends the evaluation of all roadways with daily traffic greater than 10,000 vehicles within 1,000 feet of a project boundary.

3.1.2 Traffic/Vehicular Sources

Consistent with the description above, ENVIRON evaluated all roads and intersections within 1,000 feet of the Project that have traffic information available from the traffic report performed by CHS Consulting Group et al in 2009.[9] The cumulative analysis includes existing traffic plus future projections including Project-related traffic.

The roadways evaluated for this cumulative analysis are portions of Egbert Avenue, Carroll Avenue, Thomas Avenue, Revere Avenue, Palou Avenue, and Innes Avenues east of 3rd Street; Arelious Walker Avenue between Harney Way and Van Dyke Avenue; Ingalls Avenue between Palou and Egbert Avenues; Gilman, Jamestown and Ingerson Avenues; and Harney Way. Arelious Walker between Harvey Way and Van Dyke Avenue, and Ingalls Avenue from Palou Avenue to Egbert Avenue, were included, though they did not have predicted traffic volumes greater than 10,000 vehicles per day. ENVIRON had previously evaluated health impacts of Jamestown Avenue, and Ingerson Avenue using a semi-quantitative approach, and also included both roadways in the current evaluation.

ENVIRON considered vehicular running emissions of $PM_{2.5}$ from exhaust and non-exhaust, DPM, total organic gases (TOG) from gasoline vehicle exhaust and non-exhaust, and TOG from diesel vehicle exhaust. Vehicular queuing emissions of $PM_{2.5}$ from exhaust, DPM, TOG from diesel vehicle exhaust, and TOG from gasoline vehicle exhaust and non-exhaust were also considered.

Vehicular emission factors used in the cumulative analysis were generated in the same way that the $PM_{2.5}$ emission factors were generated in technical analyses supporting the DEIR (see Appendix H3, Attachment IV of the DEIR) with PM_{10} emission factors for exhaust of diesel vehicles generated from EMFAC to represent DPM emission factors. TOG emission factors generated from EMFAC for catalytic gasoline vehicles, including exhaust emissions, and evaporative emissions were extracted. Similar to the approach taken in the DEIR, differences between emissions of catalytic and non-catalytic gasoline vehicles were not considered, and all gasoline vehicles were assumed to be equipped with catalytic converters.

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9 Several roadways presented in the CHS Consulting Group report had traffic volumes slightly less than 10,000 vehicles per day. As a conservative measure, all roadways, regardless of traffic volume, were included in this analysis.

ENVIRON used queuing data from the traffic study, as was done in the technical analyses supporting the DEIR (see Appendix H3, Attachment IV of the DEIR). The traffic study did not provide all necessary queuing data for intersection 33 (where Egbert Avenue crosses Ingalls Street); ENVIRON used intersection 32 (where Carroll Avenue crosses Ingalls Street) queuing data absent this information, based on the similarity of the intersection locations to the Project site, and to nearly freeway (i.e., US-101), and the similarities of land use pattern surrounding the those intersections. Both intersections have four-way stop signs and are located on Ingalls Avenue, separated by only two blocks.

Emission factors for vehicular running and queuing operations are summarized in Tables 2a through 2h.

3.2 Air Dispersion Modeling

3.2.1 Stationary Sources

ENVIRON performed air dispersion modeling using methodology consistent with that used in Appendix H, Attachment I, of the DEIR, with a few modifications, discussed below.

In addition to emissions estimates for each stationary source, BAAQMD provided source parameters needed for air dispersion modeling. Additionally, ENVIRON examined aerial photographs to obtain heights of buildings in close vicinity to each source under evaluation.

Building downwash algorithms incorporated into AERMOD account for the plume dispersion effects of the aerodynamic wakes and eddies produced by buildings and structures; building downwash algorithms were used. Based on BAAQMD's Draft CEQA Air Quality Guidelines, in order to evaluate health impacts of offsite sources to onsite receptors, ENVIRON created a receptor grid with 20 meter spacing, which covers the future onsite residential development proposed. Three receptor grids were created based on the future land use map of the proposed Project. The onsite residential receptors included in the evaluation are shown on Figure 1. Note that even though the receptor grids cover the designated residential areas, each individual receptor does not necessarily fall on the actual location of the future residential buildings. For example, one receptor could be at the yard or parking lot of the residential area. Therefore concentrations calculated for each receptor should be viewed in the context of concentrations calculated for the neighboring receptors.

The locations of the three stationary sources considered in this cumulative impact analysis are presented on Figure 2.

3.2.2 Traffic/Vehicular Sources

ENVIRON used methodologies consistent with Appendix H, Attachment IV, of the DEIR, with a few updates, summarized here.

ENVIRON refined the methodology regarding terrain. In the Draft EIR, roads were set to zero meter elevations (e.g., ground level), with all receptors at 1.8 meters as recommended by CAL3QHCR documentation. In this updated analysis, ENVIRON used National Elevation Dataset (NED) files from the United States Geological Survey (USGS) to estimate elevations for roadways and receptors. ENVIRON estimated the height of each roadway using the average elevation within five meters of the road read from the NED file. CAL3QHCR restricts roadway heights to be within -10 meters to 10 meters. Since the lowest roadway under evaluation is approximately 3.3 meters, ENVIRON subtracted 13.3 meters from each roadway elevation so that the lowest roadway elevation was at -10 meters. All receptor elevations were determined using the surface elevations from NED files plus 1.8 meters to represent the CAL3QHCR-recommended breathing height, before being adjusted by subtracting 13.3 meters. This approach ensured that the relative height between roadway segments and receptors in the model reflect the actual conditions, with the exception that for roads with average elevations above 10 meters after this adjustment, ENVIRON set the elevation to 10 meters. This further adjustment suppressed the vertical distance between some of the roadways and most receptors and thus will lead to more conservative results. The only exception is the cluster of elevated residential receptors located on the hillside of Bayview Park, in which case, due to the adjustment described above, the modeled difference in elevation was greater than the actual distance in elevation. The effect is not significant; however, as estimated $PM_{2.5}$ concentrations at locations closer (both horizontally and vertically) to the roadways are much lower than significance thresholds. Therefore, due to their increased distance, the estimated concentrations at these hillside receptors will be lower still.

Additionally, ENVIRON refined the hourly traffic volumes for each roadway depending on the pollutant being modeled. ENVIRON used the hourly diesel and gasoline fractions of total trips in San Francisco County from EMFAC to calculate hourly traffic volumes for diesel and gasoline vehicles, respectively. For the $PM_{2.5}$ models, the hourly traffic volumes from all vehicles were used, as was done in the DEIR. Hourly traffic volumes from diesel vehicles were used for the DPM and diesel vehicle TOG models. Similarly, hourly traffic volumes from gasoline vehicles were used for the gasoline vehicle TOG models. ENVIRON updated the receptors in the cumulative analysis, as well. Onsite receptors identical to those used in the stationary source air dispersion modeling domain were used.

The locations of the traffic/vehicular sources considered in this cumulative impact analysis are presented on Figure 2. The hourly traffic volumes of the modeled roadway segments are presented in Tables 3a through 3c. The vehicular source parameters representing running and queuing operations of the traffic are presented in Table 4 and 5.

3.3 Risk Analysis

3.3.1 Identification of Chemicals of Concern

TACs and $PM_{2.5}$ emitted from all stationary and traffic/vehicular sources were considered in this cumulative analysis.

For traffic-related impacts, the chemicals of concern evaluated were chosen in accordance with the indicator chemical approach that is consistent with OEHHA guidance.[10] DPM from diesel exhaust along with several indicator chemicals associated with gasoline exhaust were evaluated. A United States Environmental Protection Agency (USEPA) guidance document[11]

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10 California Environmental Protection Agency (Cal/EPA). 2003. *Air Toxics Hot Spots Program Risk Assessment Guidelines: The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments.* Office of Environmental Health Hazard Assessment. August.

11 USEPA. 2002. *Technical Description of the Toxics Module for MOBILE 6.2 and Guidance on its Use for Emission Inventory Preparation.* Air and Radiation. EPA420-R-02-029. November.

identifies acetaldehyde; benzene; 1,3-butadiene; formaldehyde; acrolein; and methyl-t-butyl ether (MTBE) as the chemicals that dominate risk from mobile sources, based on the results of the USEPA's National-Scale Air Toxics Assessment. ENVIRON included all indicator chemicals except MTBE as it is no longer present in gasoline formulations sold in California. Potential carcinogenic effects, as well as acute and chronic noncancer hazard HIs, from exposure to these compounds were evaluated.

3.3.2 Exposure Assessment

As previously discussed, the BAAQMD guidance[12] was that the cumulative analysis described in the Draft BAAQMD CEQA Guidelines should consist of an evaluation of risk associated with offsite stationary and traffic/vehicular sources within a 1,000 foot radius of the Project and potential impacts of those sources on on-site residents, assuming 70 years of exposure.

For this cumulative analysis, ENVIRON identified residential receptors based on the proposed residential land uses identified for the Project in the DEIR. As previously discussed, the receptor locations considered in this cumulative analysis are presented in Figure 1.

Only the inhalation exposure pathway was considered in this cumulative analysis for TACs emitted from stationary and traffic/vehicular sources. As previously discussed, $PM_{2.5}$ was evaluated using the 0.8 $\mu g/m^3$ Threshold of Significance proposed in the Draft BAAQMD CEQA Guidelines. Selection of additional pathways for a multipathway analysis is specific to the chemical and land use designations in the area potentially impacted by the Project. The California Environmental Protection Agency (Cal/EPA)[13] has identified chemicals that must be evaluated in a multipathway analysis and none of the TACs evaluated in this cumulative analysis are listed by Cal/EPA as a multipathway chemical. Thus, ENVIRON only conducted an evaluation of inhalation exposures.

The residential exposure parameters used in this cumulative impact analysis are consistent with those used in the DEIR, with the exception of the exposure duration. As requested by the BAAQMD, exposures were evaluated over a 70 year lifetime for residents.

The exposure assumptions used for evaluating inhalation exposures to TACs for residential populations are presented in Table 6.

3.3.3 Toxicity Assessment

The toxicity assessment characterizes the relationship between the magnitude of exposure and the nature and magnitude of adverse health effects that may result from such exposure. For purposes of calculating exposure criteria to be used in risk assessments, adverse health effects are classified into two broad categories – cancer and noncancer endpoints. Toxicity values used to estimate the likelihood of adverse effects occurring in humans at different exposure levels are identified as part of the toxicity assessment component of a risk assessment.

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12 Meeting between representatives from ENVIRON, PBS&J, and BAAQMD on January 13, 2010. San Francisco, California.

13 California Environmental Protection Agency (Cal/EPA). 2003. *Air Toxics Hot Spots Program Risk Assessment Guidelines: The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments.* Office of Environmental Health Hazard Assessment. August.

Consistent with the methodology used in the DEIR and Cal/EPA risk assessment guidance, ENVIRON used current Cal/EPA toxicity values for TACs to estimate cancer risks associated with exposure to emissions resulting from the Project. Specifically, toxicity values were obtained from the Cal/EPA *OEHHA Table of Approved Cancer Potency Factors*[14] (CPFs) and *OEHHA Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary*[15] and are presented in Table 7.

3.3.4 Risk Characterization Methods

The results of this cumulative analysis are presented as estimated excess lifetime cancer risks, noncancer hazard indices, and modeled $PM_{2.5}$ concentrations which are then compared to the applicable proposed Thresholds of Significance in the Draft BAAQMD CEQA Guidelines. The methodology used to estimate excess lifetime cancer risks, noncancer HIs, and modeled $PM_{2.5}$ concentrations is described below.

Cancer risk estimates represent the probability of cancer (presented as a probability per million people) related to potential exposures to TAC emissions quantified in this cumulative analysis. Noncancer HIs are represented as the ratio between the estimated TAC exposure-point concentrations and associated RELs identified as part of the toxicity assessment. The excess lifetime cancer risks and noncancer HIs estimated in this evaluation are then compared to Thresholds of Significance proposed in the Draft BAAQMD CEQA Guidelines to determine if any significant impacts can be associated with sources located within a 1,000 foot radius of the Project, as identified by the BAAQMD.

The cancer risks and noncancer HIs are estimated for the maximally impacted individual resident (MEIR). The MEIR is defined in the context of this evaluation as the onsite residential location with the highest estimated acute, chronic, or cancer health impact based on the proposed residential land uses identified for the Project.

The methodology used to estimate cancer risks and chronic noncancer HIs as presented in the DEIR were also used in this cumulative analysis. However, acute effects were not evaluated as part of the analysis conducted for the DEIR.

The potential for acute effects was evaluated by comparing the annual one-hour maximum concentrations with the acute RELs. Acute hazard quotients (HQs) were estimated for those chemicals for which an REL was available. The equation used to calculate acute HQs is as follows:

$$HQ_i = \frac{C_i}{REL_i}$$

Where:

HQ_i	=	Acute hazard quotient for chemical_i
C_i	=	One-hour maximum air concentration for chemical_i ($\mu g/m^3$)
REL_i	=	Acute noncancer reference exposure level for chemical_i ($\mu g/m^3$)

14 California Environmental Protection Agency (Cal/EPA). 2009. *Table of Approved Cancer Potency Factors, Toxicity Criteria Database*. July 21.

15 California Environmental Protection Agency (Cal/EPA). 2008. *OEHHA Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary.* Office of Environmental Health Hazard Assessment. December 18.

ENVIRON conservatively summed the chemical-specific HQs to obtain an acute HI as follows:

$$HI = \sum HQ_i$$

Target organ segregation for acute effects was not conducted because the acute HI for all chemicals is well below the Threshold of Significance of one for acute effects proposed in the Draft BAAQMD CEQA Guidelines. The acute HIs presented in this cumulative analysis conservatively overestimates the true one hour maximum at any one time because one hour maximum air concentrations were summed regardless of time of occurrence (i.e., hour of year) which can differ by source.

3.4 Risk Characterization

This section compares the estimated excess lifetime cancer risks, noncancer HIs, and $PM_{2.5}$ concentrations for the MEIR to the Thresholds of Significance proposed in the Draft BAAQMD CEQA Guidelines.

3.4.1 Cancer Risks and Noncancer Hazards Estimated for Stationary and Traffic/Vehicular Sources of TACs

As shown in Table 8, the cancer risk associated with all stationary and traffic/vehicular sources for the MEIR under the existing scenario in which it is assumed that the Bay-View Greenwaste Management facility operates as it does today, is 148 in a million (148×10^{-6}) assuming high-end exposure assumptions (exposure duration of 70 years). The MEIR is located within the boundary of the Alice Griffith Housing Area and is approximately 340 feet from the Bay-view Greenwaste Facility. Approximately 97% of the cancer risk, or 143 in a million (143×10^{-6}), can be attributed to a diesel generator located at the Bay-View Greenwaste Management facility. The estimated cancer risks for the onsite MEIR assuming average exposures is slightly lower than those estimated using high-end exposure assumptions.

It is unlikely that the diesel generator currently at the site will continue to operate for the full 70 years beyond the 2030 initiation of the 70 year risk duration (i.e. ending at year 2100). It is more likely that this diesel generator will be replaced by a generator that has much lower emissions, due strictly to age, if not Reasonably Achievable Control Technology (RACT) requirements. A replacement generator would not be permitted emissions at the level at which the generator is currently operating, rather it would have to comply with BAAQMD or California Air Resources Board (ARB) regulations in effect at the time of replacement.

Under the scenario in which it is assumed that the Bay-View Greenwaste Management facility operates in accordance with the ARB Airborne Toxic Control Measure (ATCM) for Stationary Compression-Ignition Engines, emissions from the diesel generator located at the Bay-View Greenwaste Management facility are reduced by approximately 99% due to the application of an ATCM compliant diesel generator. This reduction in DPM emissions significantly reduces the estimated cancer risks at the MEIR. Under the ATCM compliance scenario, the estimated cancer risk for the MEIR is 43 in a million (43×10^{-6}) assuming high-end exposure assumptions. In addition, the MEIR under the ATCM compliance scenario is located near the intersection of Gilman Avenue and Arelious Walker Drive. The estimated cancer risk for the onsite MEIR assuming average exposures is slightly lower than those estimated using high-end exposure assumptions. The results for the ATCM compliance scenario are presented in Table 8.

As shown on Table 8, the estimated chronic and acute noncancer HIs for all onsite residents are 0.1 and 0.23 or below under the scenario in which Bay-View Greenwaste Management does not comply with the ATCM, respectively. Estimated chronic and acute noncancer HIs are even lower under the ATCM compliance scenario.

3.4.2 $PM_{2.5}$ Originating from Stationary and Traffic/Vehicular Sources

The concentration of $PM_{2.5}$ at the MEIR and attributable to stationary and traffic/vehicular sources (0.5 $\mu g/m^3$) does not exceed the Threshold of Significance $PM_{2.5}$ concentration of 0.8 $\mu g/m^3$ proposed in the Draft BAAQMD CEQA Guidelines.

The $PM_{2.5}$ concentration is further reduced to 0.4 $\mu g/m^3$ under the ATCM compliance scenario.

4.0 Evaluation of Offsite Receptors

At the request of the San Francisco Planning Department, ENVIRON also evaluated the cumulative risks (cancer risks, acute and chronic noncancer hazard indices, and $PM_{2.5}$ concentrations) for offsite residential receptors within the 1,000 foot radius, assuming a 70 year exposure. The methodology used for this evaluation was the same as that used to evaluate the cumulative risks for the onsite residential receptors. Offsite residential receptors evaluated are shown on Figure 3.

As shown in Table 9, the estimated cancer risk associated with all stationary and traffic/vehicular sources for the MEIR under the scenario in which the Bay-View Greenwaste Management facility operates as it does today is 88 in a million (88×10^{-6}), assuming high-end exposure assumptions. The MEIR is located near the Gilman Avenue and Arelious Walker Drive intersection. Approximately 91% of the cancer risk, or 80 in a million (80×10^{-6}), can be attributed to a traffic/vehicular sources. The estimated cancer risks for the offsite MEIR assuming average exposures is slightly lower than those estimated using high-end exposure assumptions.

Under the scenario in which the Bay-View Greenwaste Management facility operates in compliance with the ARB's ATCM rule, emissions from the diesel generator located at the Bay-View Greenwaste Management facility are reduced by approximately 99% due to the application of an ATCM compliant diesel generator. This reduction in DPM emissions results in the same location of MEIR and slightly reduces the estimated cancer risks at the MEIR. Under the mitigated scenario, the estimated cancer risk for the MEIR is 80 in a million (80×10^{-6}) assuming high-end exposure assumptions. In addition, the MEIR under the ATCM- compliant scenario is located near the intersection of Gilman Avenue and Arelious Walker Drive. The estimated cancer risk for the offsite MEIR, assuming average exposures, is slightly lower than those estimated using high-end exposure assumptions. The results for the ATCM-compliant scenario are presented in Table 9.

As shown on Table 9, the estimated chronic and acute noncancer HIs for all offsite residents are 0.11 and 0.31 or below under the existing scenario in which the Bay-View Greenwaste Management facility operates as it does today, respectively. As expected, since the MEIR is relatively far from the modeled stationary sources, estimated chronic and acute noncancer HIs are only slightly lower than or equal to the values under the ATCM-compliant scenario.

Under the existing scenario, the concentration of $PM_{2.5}$ at the MEIR and attributable to stationary and traffic/vehicular sources (0.74 μg/m^3) does not exceed the Threshold of Significance $PM_{2.5}$ concentration of 0.8 μg/m^3 proposed in the Draft BAAQMD CEQA Guidelines.

The $PM_{2.5}$ concentration is further reduced to 0.72 μg/m^3 under the ATCM-compliant scenario.

5.0 Compliance with San Francisco Health Code Article 38

The potential health impacts from $PM_{2.5}$ associated with traffic were evaluated for compliance with *San Francisco Health Code* Article 38. The *San Francisco Health Code* Article 38 requires an air quality assessment to evaluate the concentration of $PM_{2.5}$ from local roadway traffic sources that may impact new structures containing ten or more dwelling units. If the air quality assessment indicates the estimated concentration of $PM_{2.5}$ at the site attributable to all roadway vehicle emissions within 500 feet (approximately 150 meters) of the project would be greater than 0.2 μg/m^3 (micrograms per cubic meter), Section 3807 requires development on the site to be designed or relocated to avoid exposure greater than 0.2 μg/m^3, or a ventilation system to be installed that would be capable of removing 80 percent of ambient $PM_{2.5}$ from habitable areas of the residential units.

Roadways evaluated in this analysis include portions of Egbert and Carroll Avenues east of 3rd Street; Arelious Walker between Harney Way and Carroll Avenue; Gilman, Jamestown and Ingerson Avenues; and Harney Way.

Exceedances of 0.2 μg/m^3 are located at future residential sites located near the following roadways:

- Approximately 30 meters from the intersection of Harney Way and Arelious Walker
- Approximately 15 meters from the intersection of Gilman and Arelious Walker
- Approximately 15 meters on each side of Arelious Walker just east of Alice Griffith

Under SF Health Code Section 3807, one of the following actions is required: (1) residential uses must be designed or located on the site in a way that would avoid residential exposures above a $PM_{2.5}$ concentration of 0.2 μg.m^3, or (2) a ventilation system must be installed at the site that would be capable of removing greater than 80% of ambient $PM_{2.5}$ from habitable areas of dwelling units.

6.0 Conclusions

In summary, the results of the single-source community hazards analysis indicate that potential excess cancer risks to onsite residents are below 10 in a million for TACs emitted from offsite stationary and traffic/vehicular sources within a 1,000 foot radius of the Project assuming that the Bay-View Greenwaste Management facility comes into compliance with the ARB's ATCM rule before 2013. The estimated acute and chronic noncancer hazard indices are below one for all receptors evaluated in this cumulative analysis under both the ATCM compliant and ATCM non-compliant scenarios. In addition, the $PM_{2.5}$ concentrations for onsite residents are below the single-source $PM_{2.5}$ concentration of 0.3 μg/m^3 proposed in the Draft BAAQMD CEQA Guidelines.

Additionally, the results of the cumulative community hazards analysis indicate that potential excess cancer risks to onsite residents are below 100 in a million for TACs emitted from offsite stationary and traffic/vehicular sources within a 1,000 foot radius of the Project assuming that the Bay-View Greenwaste Management facility comes into compliance with the ARB's ATCM rule before 2013. The estimated acute and chronic noncancer hazard indices are below one for all receptors evaluated in this cumulative analysis under both the ATCM compliant and ATCM non-compliant scenarios. In addition, the $PM_{2.5}$ concentrations for onsite residents are below the $PM_{2.5}$ concentration of 0.8 μg/m^3 proposed in the Draft BAAQMD CEQA Guidelines.

At the request of the San Francisco Planning Department, ENVIRON also evaluated the potential cumulative impacts within the 1,000 radius for offsite residential receptors. For the offsite residential receptors, under both the ATCM non-compliant and compliant scenarios, the estimated excess cancer risks are below 100 in a million, the estimated acute and chronic noncancer hazard indices are below one, and the cumulative $PM_{2.5}$ concentrations are below 0.8 μg/m^3.

For San Francisco Article 38, all future traffic/vehicular sources are predicted to yield concentrations of $PM_{2.5}$ that exceed the San Francisco Health Code Article 38 $PM_{2.5}$ action level at residential sites in three areas. The estimated cumulative traffic $PM_{2.5}$ concentrations at some onsite residential locations directly adjacent to Arelious Walker could exceed the San Francisco Health Code Article 38. Consequently, residential development at these locations would be required by SF Health Code Section 3807 to either locate the residential units in a way to avoid the residential exposure or install ventilation systems that will remove 80% of $PM_{2.5}$ from habitable areas of the dwelling units.

Please feel free to contact us if you have any questions about this analysis. Thank you for the opportunity to assist you with this matter.

Sincerely,

Shari B. Libicki, PhD
Principal

Elizabeth A. Miesner, MS
Principal

Attachments:

Table 1: Point Source Parameters and Emission Factors
Table 2a: Summary of Vehicular PM2.5 Emission Factors, Arterial Roads
Table 2b: Summary of Vehicular DPM Emission Factors, Arterial Roads
Table 2c: Summary of Vehicular Diesel TOG Emission Factors, Arterial Roads
Table 2d: Summary of Vehicular Gasoline TOG Emission Factors, Arterial Roads
Table 2e: Summary of Vehicular PM2.5 Emission Factors, Local Roads
Table 2f: Summary of Vehicular DPM Emission Factors, Local Roads
Table 2g: Summary of Vehicular Diesel TOG Emission Factors, Local Roads
Table 2h: Summary of Vehicular Gasoline TOG Emission Factors, Local Roads
Table 3a: Summary of All Traffic Volumes by Modeled Road Segment
Table 3b: Summary of Diesel Traffic Volumes by Modeled Road Segment
Table 3c: Summary of Gasoline Traffic Volumes by Modeled Road Segment
Table 4: CAL3QHCR Source Parameters, Running Emissions
Table 5: CAL3QHCR Source Parameters, Queuing Emissions
Table 6: Onsite Residential Exposure Assumptions for Carcinogens
Table 7: Carcinogenic and Noncarcinogenic Toxicity Values
Table 8: Summary of Estimated Cancer Risks and Noncancer Hazard Indices (HIs) at the Onsite Maximally Exposed Individual Resident (MEIR)
Table 9: Summary of Estimated Cancer Risks and Noncancer Hazard Indices (HIs) at the Offsite Maximally Exposed Individual Resident (MEIR)

Figure 1: Onsite Residential Receptors for Cumulative Analysis
Figure 2: Sources Modeled in Cumulative Analysis
Figure 3: Offsite Residential Receptors for Cumulative Analysis

T A B L E S

Table 1
Point Source Parameters and Emission Factors
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Source	UTMx	UTMy	Elevation (m)	Type	DPM Emission Rate (g/s)		Stack Height (m)	Stack Temperature (K)	Stack Velocity (m/s)	Stack Diameter (m)
					Unmitigated	Mitigated				
Griffith Pump Station	554508.51	4175459.84	5.42	Point	7.61E-06		2.44	644.26	51.74	0.15
Bay-View Greenwaste Management	553923.36	4175152.73	5.77	Point	1.10E-02	9.94E-05	1.83	644.26	51.74	0.08
UCSF/Hunters Point	554798.27	4175754.88	8.01	Point	3.61E-05		2.44	644.26	51.74	0.15

Abbreviations:
DPM = diesel particulate matter
g = gram
K = Kelvin
m = meter
s = second

Table 2a
Summary of Vehicular PM2.5 Emission Factors, Arterial Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*
1	1.42E-02	*1.28E-02*	7.06E-03	*6.97E-03*	3.01E-02	*1.69E-03*	0.00E+00	*0.00E+00*
2	1.37E-02	*1.28E-02*	7.09E-03	*6.97E-03*	3.24E-02	*1.19E-03*	0.00E+00	*0.00E+00*
3	2.13E-02	*1.45E-02*	7.38E-03	*6.99E-03*	1.42E-01	*1.27E-02*	0.00E+00	*0.00E+00*
4	1.36E-02	*1.30E-02*	7.14E-03	*6.97E-03*	2.40E-02	*5.46E-04*	0.00E+00	*0.00E+00*
5	1.30E-02	*1.28E-02*	7.11E-03	*6.97E-03*	1.97E-02	*1.66E-04*	0.00E+00	*0.00E+00*
6	1.59E-02	*1.31E-02*	7.11E-03	*6.97E-03*	4.70E-02	*2.72E-03*	0.00E+00	*0.00E+00*
7	1.40E-02	*1.31E-02*	7.01E-03	*6.97E-03*	1.69E-02	*3.12E-03*	0.00E+00	*0.00E+00*
8	1.32E-02	*1.27E-02*	6.99E-03	*6.97E-03*	8.79E-03	*1.21E-03*	0.00E+00	*0.00E+00*
9	1.55E-02	*1.29E-02*	7.06E-03	*6.97E-03*	4.37E-02	*3.43E-03*	0.00E+00	*0.00E+00*
10	2.36E-02	*1.40E-02*	7.33E-03	*6.99E-03*	1.66E-01	*1.39E-02*	0.00E+00	*0.00E+00*
11	2.16E-02	*1.37E-02*	7.27E-03	*6.98E-03*	1.36E-01	*1.04E-02*	0.00E+00	*0.00E+00*
12	1.92E-02	*1.33E-02*	7.19E-03	*6.98E-03*	1.00E-01	*7.13E-03*	0.00E+00	*0.00E+00*
13	1.67E-02	*1.30E-02*	7.10E-03	*6.97E-03*	6.14E-02	*3.97E-03*	0.00E+00	*0.00E+00*
14	1.61E-02	*1.29E-02*	7.09E-03	*6.97E-03*	5.39E-02	*3.39E-03*	0.00E+00	*0.00E+00*
15	1.65E-02	*1.30E-02*	7.10E-03	*6.97E-03*	6.03E-02	*3.84E-03*	0.00E+00	*0.00E+00*
16	1.71E-02	*1.31E-02*	7.11E-03	*6.97E-03*	6.66E-02	*4.96E-03*	0.00E+00	*0.00E+00*
17	1.59E-02	*1.30E-02*	7.08E-03	*6.97E-03*	5.09E-02	*3.73E-03*	0.00E+00	*0.00E+00*
18	1.41E-02	*1.28E-02*	7.02E-03	*6.97E-03*	2.24E-02	*1.96E-03*	0.00E+00	*0.00E+00*
19	1.38E-02	*1.27E-02*	7.01E-03	*6.97E-03*	1.84E-02	*1.28E-03*	0.00E+00	*0.00E+00*
20	1.36E-02	*1.27E-02*	7.00E-03	*6.97E-03*	1.54E-02	*1.01E-03*	0.00E+00	*0.00E+00*
21	1.34E-02	*1.26E-02*	7.01E-03	*6.97E-03*	1.46E-02	*8.07E-04*	0.00E+00	*0.00E+00*
22	1.28E-02	*1.26E-02*	6.99E-03	*6.97E-03*	5.77E-03	*2.03E-04*	0.00E+00	*0.00E+00*
23	1.29E-02	*1.26E-02*	7.00E-03	*6.97E-03*	9.77E-03	*3.91E-04*	0.00E+00	*0.00E+00*
24	1.28E-02	*1.26E-02*	7.00E-03	*6.97E-03*	8.36E-03	*2.51E-04*	0.00E+00	*0.00E+00*

Notes:
1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Draft EIR Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust; non-exhaust refers to running emissions from tire and brake wear.
3. Exhaust refers to idling emissions from vehicle exhaust; non-exhaust refers to idling emissions from tire and brake wear.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:
EIR: Environmental Impact Report
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 2b
Summary of Vehicular DPM Emission Factors, Arterial Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*
1	4.87E-02	*1.69E-01*	0.00E+00	*0.00E+00*	7.27E-01	*1.46E-01*	0.00E+00	*0.00E+00*
2	3.76E-02	*1.77E-01*	0.00E+00	*0.00E+00*	7.46E-01	*9.91E-02*	0.00E+00	*0.00E+00*
3	3.29E-02	*1.96E-01*	0.00E+00	*0.00E+00*	7.27E-01	*0.00E+00*	0.00E+00	*0.00E+00*
4	5.88E-02	*1.75E-01*	0.00E+00	*0.00E+00*	6.36E-01	*1.55E-01*	0.00E+00	*0.00E+00*
5	4.71E-02	*1.83E-01*	0.00E+00	*0.00E+00*	6.45E-01	*6.51E-02*	0.00E+00	*0.00E+00*
6	7.56E-02	*1.40E-01*	0.00E+00	*0.00E+00*	7.48E-01	*4.51E-01*	0.00E+00	*0.00E+00*
7	9.04E-02	*1.52E-01*	0.00E+00	*0.00E+00*	7.27E-01	*5.54E-01*	0.00E+00	*0.00E+00*
8	8.45E-02	*1.56E-01*	0.00E+00	*0.00E+00*	6.96E-01	*4.00E-01*	0.00E+00	*0.00E+00*
9	7.63E-02	*1.31E-01*	0.00E+00	*0.00E+00*	7.79E-01	*5.80E-01*	0.00E+00	*0.00E+00*
10	7.34E-02	*1.09E-01*	0.00E+00	*0.00E+00*	7.99E-01	*7.18E-01*	0.00E+00	*0.00E+00*
11	7.59E-02	*1.11E-01*	0.00E+00	*0.00E+00*	7.97E-01	*6.93E-01*	0.00E+00	*0.00E+00*
12	7.56E-02	*1.16E-01*	0.00E+00	*0.00E+00*	7.94E-01	*6.46E-01*	0.00E+00	*0.00E+00*
13	7.62E-02	*1.23E-01*	0.00E+00	*0.00E+00*	7.86E-01	*5.69E-01*	0.00E+00	*0.00E+00*
14	7.71E-02	*1.28E-01*	0.00E+00	*0.00E+00*	7.80E-01	*5.25E-01*	0.00E+00	*0.00E+00*
15	7.53E-02	*1.24E-01*	0.00E+00	*0.00E+00*	7.85E-01	*5.61E-01*	0.00E+00	*0.00E+00*
16	7.69E-02	*1.26E-01*	0.00E+00	*0.00E+00*	7.87E-01	*6.02E-01*	0.00E+00	*0.00E+00*
17	7.62E-02	*1.31E-01*	0.00E+00	*0.00E+00*	7.81E-01	*5.59E-01*	0.00E+00	*0.00E+00*
18	7.95E-02	*1.55E-01*	0.00E+00	*0.00E+00*	7.25E-01	*3.69E-01*	0.00E+00	*0.00E+00*
19	8.62E-02	*1.62E-01*	0.00E+00	*0.00E+00*	6.65E-01	*1.62E-01*	0.00E+00	*0.00E+00*
20	8.29E-02	*1.64E-01*	0.00E+00	*0.00E+00*	6.63E-01	*1.49E-01*	0.00E+00	*0.00E+00*
21	7.44E-02	*1.60E-01*	0.00E+00	*0.00E+00*	7.04E-01	*1.96E-01*	0.00E+00	*0.00E+00*
22	8.02E-02	*1.68E-01*	0.00E+00	*0.00E+00*	6.33E-01	*1.05E-01*	0.00E+00	*0.00E+00*
23	6.08E-02	*1.75E-01*	0.00E+00	*0.00E+00*	6.40E-01	*5.05E-02*	0.00E+00	*0.00E+00*
24	6.76E-02	*1.77E-01*	0.00E+00	*0.00E+00*	5.75E-01	*1.91E-02*	0.00E+00	*0.00E+00*

Notes:
1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Draft EIR Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust.
3. Exhaust refers to idling emissions from vehicle exhaust.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:
EIR: Environmental Impact Report
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 2c
Summary of Vehicular Diesel TOG Emission Factors, Arterial Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]
1	1.54E-01	*5.50E-01*	0.00E+00	*0.00E+00*	3.54E+00	*6.57E-01*	0.00E+00	*0.00E+00*
2	1.41E-01	*5.92E-01*	0.00E+00	*0.00E+00*	3.60E+00	*4.46E-01*	0.00E+00	*0.00E+00*
3	1.49E-01	*6.95E-01*	0.00E+00	*0.00E+00*	3.69E+00	*0.00E+00*	0.00E+00	*0.00E+00*
4	1.94E-01	*5.71E-01*	0.00E+00	*0.00E+00*	4.14E+00	*6.98E-01*	0.00E+00	*0.00E+00*
5	1.88E-01	*6.25E-01*	0.00E+00	*0.00E+00*	4.04E+00	*2.93E-01*	0.00E+00	*0.00E+00*
6	1.48E-01	*3.57E-01*	0.00E+00	*0.00E+00*	3.69E+00	*2.03E+00*	0.00E+00	*0.00E+00*
7	1.93E-01	*4.13E-01*	0.00E+00	*0.00E+00*	3.55E+00	*2.55E+00*	0.00E+00	*0.00E+00*
8	1.98E-01	*4.56E-01*	0.00E+00	*0.00E+00*	3.38E+00	*1.84E+00*	0.00E+00	*0.00E+00*
9	1.37E-01	*3.03E-01*	0.00E+00	*0.00E+00*	3.56E+00	*2.63E+00*	0.00E+00	*0.00E+00*
10	1.21E-01	*1.67E-01*	0.00E+00	*0.00E+00*	3.60E+00	*3.23E+00*	0.00E+00	*0.00E+00*
11	1.23E-01	*1.84E-01*	0.00E+00	*0.00E+00*	3.59E+00	*3.12E+00*	0.00E+00	*0.00E+00*
12	1.25E-01	*2.13E-01*	0.00E+00	*0.00E+00*	3.57E+00	*2.91E+00*	0.00E+00	*0.00E+00*
13	1.30E-01	*2.62E-01*	0.00E+00	*0.00E+00*	3.55E+00	*2.56E+00*	0.00E+00	*0.00E+00*
14	1.34E-01	*2.92E-01*	0.00E+00	*0.00E+00*	3.53E+00	*2.36E+00*	0.00E+00	*0.00E+00*
15	1.30E-01	*2.68E-01*	0.00E+00	*0.00E+00*	3.54E+00	*2.52E+00*	0.00E+00	*0.00E+00*
16	1.32E-01	*2.71E-01*	0.00E+00	*0.00E+00*	3.55E+00	*2.72E+00*	0.00E+00	*0.00E+00*
17	1.36E-01	*3.06E-01*	0.00E+00	*0.00E+00*	3.53E+00	*2.53E+00*	0.00E+00	*0.00E+00*
18	1.76E-01	*4.53E-01*	0.00E+00	*0.00E+00*	3.31E+00	*1.69E+00*	0.00E+00	*0.00E+00*
19	2.02E-01	*5.20E-01*	0.00E+00	*0.00E+00*	3.08E+00	*7.29E-01*	0.00E+00	*0.00E+00*
20	2.03E-01	*5.29E-01*	0.00E+00	*0.00E+00*	3.09E+00	*6.72E-01*	0.00E+00	*0.00E+00*
21	1.76E-01	*5.01E-01*	0.00E+00	*0.00E+00*	3.27E+00	*8.81E-01*	0.00E+00	*0.00E+00*
22	2.18E-01	*5.55E-01*	0.00E+00	*0.00E+00*	3.02E+00	*4.70E-01*	0.00E+00	*0.00E+00*
23	2.07E-01	*5.99E-01*	0.00E+00	*0.00E+00*	3.21E+00	*2.27E-01*	0.00E+00	*0.00E+00*
24	2.46E-01	*6.13E-01*	0.00E+00	*0.00E+00*	2.96E+00	*8.59E-02*	0.00E+00	*0.00E+00*

Notes:
1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Draft EIR Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust; non-exhaust refers to running evaporative emissions.
3. Exhaust refers to idling emissions from vehicle exhaust; non-exhaust refers to idling evaporative emissions.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:
EIR: Environmental Impact Report
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 2d
Summary of Vehicular Gasoline TOG Emission Factors, Arterial Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]
1	3.93E-02	*3.75E-02*	4.93E-02	*4.80E-02*	1.05E+00	*5.08E-02*	1.48E+00	*1.44E+00*
2	3.82E-02	*3.74E-02*	4.84E-02	*4.80E-02*	1.29E+00	*3.51E-02*	1.45E+00	*1.44E+00*
3	5.22E-02	*3.91E-02*	5.60E-02	*4.92E-02*	6.15E+00	*4.64E-01*	1.68E+00	*1.47E+00*
4	3.65E-02	*3.74E-02*	4.94E-02	*4.80E-02*	1.10E+00	*0.00E+00*	1.48E+00	*1.44E+00*
5	3.64E-02	*3.74E-02*	4.95E-02	*4.79E-02*	1.17E+00	*0.00E+00*	1.49E+00	*1.44E+00*
6	3.75E-02	*3.74E-02*	4.88E-02	*4.80E-02*	6.68E-01	*1.10E-02*	1.47E+00	*1.44E+00*
7	3.75E-02	*3.74E-02*	4.81E-02	*4.80E-02*	1.53E-01	*1.38E-02*	1.44E+00	*1.44E+00*
8	3.75E-02	*3.73E-02*	4.81E-02	*4.79E-02*	1.13E-01	*7.96E-03*	1.44E+00	*1.44E+00*
9	3.83E-02	*3.74E-02*	4.89E-02	*4.80E-02*	7.68E-01	*3.23E-02*	1.47E+00	*1.44E+00*
10	4.25E-02	*3.79E-02*	5.30E-02	*4.83E-02*	3.89E+00	*1.73E-01*	1.59E+00	*1.45E+00*
11	4.03E-02	*3.77E-02*	5.20E-02	*4.82E-02*	3.07E+00	*1.08E-01*	1.56E+00	*1.45E+00*
12	4.05E-02	*3.76E-02*	5.10E-02	*4.81E-02*	2.34E+00	*9.71E-02*	1.53E+00	*1.44E+00*
13	3.89E-02	*3.74E-02*	4.96E-02	*4.80E-02*	1.27E+00	*4.78E-02*	1.49E+00	*1.44E+00*
14	3.87E-02	*3.74E-02*	4.96E-02	*4.80E-02*	1.30E+00	*4.51E-02*	1.49E+00	*1.44E+00*
15	3.88E-02	*3.74E-02*	4.96E-02	*4.80E-02*	1.32E+00	*4.68E-02*	1.49E+00	*1.44E+00*
16	3.94E-02	*3.75E-02*	4.98E-02	*4.81E-02*	1.44E+00	*6.29E-02*	1.49E+00	*1.44E+00*
17	3.87E-02	*3.74E-02*	4.94E-02	*4.80E-02*	1.10E+00	*4.30E-02*	1.48E+00	*1.44E+00*
18	3.87E-02	*3.74E-02*	4.88E-02	*4.80E-02*	6.73E-01	*3.75E-02*	1.46E+00	*1.44E+00*
19	3.89E-02	*3.74E-02*	4.87E-02	*4.80E-02*	6.06E-01	*3.69E-02*	1.46E+00	*1.44E+00*
20	3.84E-02	*3.74E-02*	4.86E-02	*4.80E-02*	5.17E-01	*2.78E-02*	1.46E+00	*1.44E+00*
21	3.79E-02	*3.73E-02*	4.85E-02	*4.79E-02*	4.47E-01	*1.66E-02*	1.45E+00	*1.44E+00*
22	3.72E-02	*3.73E-02*	4.82E-02	*4.79E-02*	2.19E-01	*1.68E-03*	1.45E+00	*1.44E+00*
23	3.76E-02	*3.73E-02*	4.85E-02	*4.79E-02*	4.45E-01	*1.14E-02*	1.45E+00	*1.44E+00*
24	3.73E-02	*3.73E-02*	4.86E-02	*4.79E-02*	5.17E-01	*8.20E-03*	1.46E+00	*1.44E+00*

Notes:
1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Draft EIR Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust; non-exhaust refers to running evaporative emissions.
3. Exhaust refers to idling emissions from vehicle exhaust; non-exhaust refers to idling evaporative emissions.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:
EIR: Environmental Impact Report
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 2e
Summary of Vehicular PM2.5 Emission Factors, Local Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]
1	1.73E-02	*1.57E-02*	7.06E-03	*6.97E-03*	3.01E-02	*1.69E-03*	0.00E+00	*0.00E+00*
2	1.68E-02	*1.57E-02*	7.09E-03	*6.97E-03*	3.24E-02	*1.19E-03*	0.00E+00	*0.00E+00*
3	2.55E-02	*1.77E-02*	7.38E-03	*6.99E-03*	1.42E-01	*1.27E-02*	0.00E+00	*0.00E+00*
4	1.66E-02	*1.59E-02*	7.14E-03	*6.97E-03*	2.40E-02	*5.46E-04*	0.00E+00	*0.00E+00*
5	1.59E-02	*1.57E-02*	7.11E-03	*6.97E-03*	1.97E-02	*1.66E-04*	0.00E+00	*0.00E+00*
6	1.92E-02	*1.60E-02*	7.11E-03	*6.97E-03*	4.70E-02	*2.72E-03*	0.00E+00	*0.00E+00*
7	1.71E-02	*1.60E-02*	7.01E-03	*6.97E-03*	1.69E-02	*3.12E-03*	0.00E+00	*0.00E+00*
8	1.61E-02	*1.55E-02*	6.99E-03	*6.97E-03*	8.79E-03	*1.21E-03*	0.00E+00	*0.00E+00*
9	1.88E-02	*1.58E-02*	7.06E-03	*6.97E-03*	4.37E-02	*3.43E-03*	0.00E+00	*0.00E+00*
10	2.82E-02	*1.71E-02*	7.33E-03	*6.99E-03*	1.66E-01	*1.39E-02*	0.00E+00	*0.00E+00*
11	2.59E-02	*1.67E-02*	7.27E-03	*6.98E-03*	1.36E-01	*1.04E-02*	0.00E+00	*0.00E+00*
12	2.31E-02	*1.63E-02*	7.19E-03	*6.98E-03*	1.00E-01	*7.13E-03*	0.00E+00	*0.00E+00*
13	2.01E-02	*1.59E-02*	7.10E-03	*6.97E-03*	6.14E-02	*3.97E-03*	0.00E+00	*0.00E+00*
14	1.94E-02	*1.58E-02*	7.09E-03	*6.97E-03*	5.39E-02	*3.39E-03*	0.00E+00	*0.00E+00*
15	2.00E-02	*1.59E-02*	7.10E-03	*6.97E-03*	6.03E-02	*3.84E-03*	0.00E+00	*0.00E+00*
16	2.06E-02	*1.60E-02*	7.11E-03	*6.97E-03*	6.66E-02	*4.96E-03*	0.00E+00	*0.00E+00*
17	1.93E-02	*1.59E-02*	7.08E-03	*6.97E-03*	5.09E-02	*3.73E-03*	0.00E+00	*0.00E+00*
18	1.71E-02	*1.57E-02*	7.02E-03	*6.97E-03*	2.24E-02	*1.96E-03*	0.00E+00	*0.00E+00*
19	1.68E-02	*1.55E-02*	7.01E-03	*6.97E-03*	1.84E-02	*1.28E-03*	0.00E+00	*0.00E+00*
20	1.65E-02	*1.55E-02*	7.00E-03	*6.97E-03*	1.54E-02	*1.01E-03*	0.00E+00	*0.00E+00*
21	1.64E-02	*1.55E-02*	7.01E-03	*6.97E-03*	1.46E-02	*8.07E-04*	0.00E+00	*0.00E+00*
22	1.56E-02	*1.54E-02*	6.99E-03	*6.97E-03*	5.77E-03	*2.03E-04*	0.00E+00	*0.00E+00*
23	1.58E-02	*1.55E-02*	7.00E-03	*6.97E-03*	9.77E-03	*3.91E-04*	0.00E+00	*0.00E+00*
24	1.56E-02	*1.54E-02*	7.00E-03	*6.97E-03*	8.36E-03	*2.51E-04*	0.00E+00	*0.00E+00*

Notes:
1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Draft EIR Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust; non-exhaust refers to running emissions from tire and brake wear.
3. Exhaust refers to idling emissions from vehicle exhaust; non-exhaust refers to idling emissions from tire and brake wear.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:
EIR: Environmental Impact Report
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 2f
Summary of Vehicular DPM Emission Factors, Local Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]
1	5.73E-02	*2.02E-01*	0.00E+00	*0.00E+00*	7.27E-01	*1.46E-01*	0.00E+00	*0.00E+00*
2	4.43E-02	*2.11E-01*	0.00E+00	*0.00E+00*	7.46E-01	*9.91E-02*	0.00E+00	*0.00E+00*
3	3.88E-02	*2.35E-01*	0.00E+00	*0.00E+00*	7.27E-01	*0.00E+00*	0.00E+00	*0.00E+00*
4	6.84E-02	*2.09E-01*	0.00E+00	*0.00E+00*	6.36E-01	*1.55E-01*	0.00E+00	*0.00E+00*
5	5.48E-02	*2.19E-01*	0.00E+00	*0.00E+00*	6.45E-01	*6.51E-02*	0.00E+00	*0.00E+00*
6	8.85E-02	*1.65E-01*	0.00E+00	*0.00E+00*	7.48E-01	*4.51E-01*	0.00E+00	*0.00E+00*
7	1.06E-01	*1.79E-01*	0.00E+00	*0.00E+00*	7.27E-01	*5.54E-01*	0.00E+00	*0.00E+00*
8	9.93E-02	*1.84E-01*	0.00E+00	*0.00E+00*	6.96E-01	*4.00E-01*	0.00E+00	*0.00E+00*
9	8.95E-02	*1.54E-01*	0.00E+00	*0.00E+00*	7.79E-01	*5.80E-01*	0.00E+00	*0.00E+00*
10	8.60E-02	*1.27E-01*	0.00E+00	*0.00E+00*	7.99E-01	*7.18E-01*	0.00E+00	*0.00E+00*
11	8.90E-02	*1.31E-01*	0.00E+00	*0.00E+00*	7.97E-01	*6.93E-01*	0.00E+00	*0.00E+00*
12	8.86E-02	*1.36E-01*	0.00E+00	*0.00E+00*	7.94E-01	*6.46E-01*	0.00E+00	*0.00E+00*
13	8.94E-02	*1.45E-01*	0.00E+00	*0.00E+00*	7.86E-01	*5.69E-01*	0.00E+00	*0.00E+00*
14	9.04E-02	*1.51E-01*	0.00E+00	*0.00E+00*	7.80E-01	*5.25E-01*	0.00E+00	*0.00E+00*
15	8.83E-02	*1.46E-01*	0.00E+00	*0.00E+00*	7.85E-01	*5.61E-01*	0.00E+00	*0.00E+00*
16	9.02E-02	*1.48E-01*	0.00E+00	*0.00E+00*	7.87E-01	*6.02E-01*	0.00E+00	*0.00E+00*
17	8.94E-02	*1.55E-01*	0.00E+00	*0.00E+00*	7.81E-01	*5.59E-01*	0.00E+00	*0.00E+00*
18	9.35E-02	*1.84E-01*	0.00E+00	*0.00E+00*	7.25E-01	*3.69E-01*	0.00E+00	*0.00E+00*
19	1.02E-01	*1.94E-01*	0.00E+00	*0.00E+00*	6.65E-01	*1.62E-01*	0.00E+00	*0.00E+00*
20	9.78E-02	*1.96E-01*	0.00E+00	*0.00E+00*	6.63E-01	*1.49E-01*	0.00E+00	*0.00E+00*
21	8.77E-02	*1.91E-01*	0.00E+00	*0.00E+00*	7.04E-01	*1.96E-01*	0.00E+00	*0.00E+00*
22	9.49E-02	*2.01E-01*	0.00E+00	*0.00E+00*	6.33E-01	*1.05E-01*	0.00E+00	*0.00E+00*
23	7.20E-02	*2.10E-01*	0.00E+00	*0.00E+00*	6.40E-01	*5.05E-02*	0.00E+00	*0.00E+00*
24	8.03E-02	*2.12E-01*	0.00E+00	*0.00E+00*	5.75E-01	*1.91E-02*	0.00E+00	*0.00E+00*

Notes:
1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Draft EIR Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust.
3. Exhaust refers to idling emissions from vehicle exhaust.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:
EIR: Environmental Impact Report
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 2g
Summary of Vehicular Diesel TOG Emission Factors, Local Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]	All Vehicles[4]	*No HD Vehicles*[5]
1	1.81E-01	*6.58E-01*	0.00E+00	*0.00E+00*	3.54E+00	*6.57E-01*	0.00E+00	*0.00E+00*
2	1.65E-01	*7.09E-01*	0.00E+00	*0.00E+00*	3.60E+00	*4.46E-01*	0.00E+00	*0.00E+00*
3	1.75E-01	*8.33E-01*	0.00E+00	*0.00E+00*	3.69E+00	*0.00E+00*	0.00E+00	*0.00E+00*
4	2.27E-01	*6.83E-01*	0.00E+00	*0.00E+00*	4.14E+00	*6.98E-01*	0.00E+00	*0.00E+00*
5	2.20E-01	*7.48E-01*	0.00E+00	*0.00E+00*	4.04E+00	*2.93E-01*	0.00E+00	*0.00E+00*
6	1.73E-01	*4.25E-01*	0.00E+00	*0.00E+00*	3.69E+00	*2.03E+00*	0.00E+00	*0.00E+00*
7	2.26E-01	*4.88E-01*	0.00E+00	*0.00E+00*	3.55E+00	*2.55E+00*	0.00E+00	*0.00E+00*
8	2.33E-01	*5.41E-01*	0.00E+00	*0.00E+00*	3.38E+00	*1.84E+00*	0.00E+00	*0.00E+00*
9	1.60E-01	*3.58E-01*	0.00E+00	*0.00E+00*	3.56E+00	*2.63E+00*	0.00E+00	*0.00E+00*
10	1.41E-01	*1.96E-01*	0.00E+00	*0.00E+00*	3.60E+00	*3.23E+00*	0.00E+00	*0.00E+00*
11	1.44E-01	*2.16E-01*	0.00E+00	*0.00E+00*	3.59E+00	*3.12E+00*	0.00E+00	*0.00E+00*
12	1.46E-01	*2.52E-01*	0.00E+00	*0.00E+00*	3.57E+00	*2.91E+00*	0.00E+00	*0.00E+00*
13	1.52E-01	*3.11E-01*	0.00E+00	*0.00E+00*	3.55E+00	*2.56E+00*	0.00E+00	*0.00E+00*
14	1.57E-01	*3.47E-01*	0.00E+00	*0.00E+00*	3.53E+00	*2.36E+00*	0.00E+00	*0.00E+00*
15	1.52E-01	*3.18E-01*	0.00E+00	*0.00E+00*	3.54E+00	*2.52E+00*	0.00E+00	*0.00E+00*
16	1.54E-01	*3.20E-01*	0.00E+00	*0.00E+00*	3.55E+00	*2.72E+00*	0.00E+00	*0.00E+00*
17	1.59E-01	*3.63E-01*	0.00E+00	*0.00E+00*	3.53E+00	*2.53E+00*	0.00E+00	*0.00E+00*
18	2.07E-01	*5.39E-01*	0.00E+00	*0.00E+00*	3.31E+00	*1.69E+00*	0.00E+00	*0.00E+00*
19	2.39E-01	*6.21E-01*	0.00E+00	*0.00E+00*	3.08E+00	*7.29E-01*	0.00E+00	*0.00E+00*
20	2.40E-01	*6.32E-01*	0.00E+00	*0.00E+00*	3.09E+00	*6.72E-01*	0.00E+00	*0.00E+00*
21	2.08E-01	*5.99E-01*	0.00E+00	*0.00E+00*	3.27E+00	*8.81E-01*	0.00E+00	*0.00E+00*
22	2.58E-01	*6.64E-01*	0.00E+00	*0.00E+00*	3.02E+00	*4.70E-01*	0.00E+00	*0.00E+00*
23	2.45E-01	*7.17E-01*	0.00E+00	*0.00E+00*	3.21E+00	*2.27E-01*	0.00E+00	*0.00E+00*
24	2.91E-01	*7.34E-01*	0.00E+00	*0.00E+00*	2.96E+00	*8.59E-02*	0.00E+00	*0.00E+00*

Notes:
1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Draft EIR Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust; non-exhaust refers to running evaporative emissions.
3. Exhaust refers to idling emissions from vehicle exhaust; non-exhaust refers to idling evaporative emissions.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:
EIR: Environmental Impact Report
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 2h
Summary of Vehicular Gasoline TOG Emission Factors, Local Roads
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Hour	Running Emission Factor[1] (grams/vehicle-mile)				Idling Emission Factor[1] (grams/vehicle-idling hour)			
	Exhaust[2]		Non-Exhaust[2]		Exhaust[3]		Non-Exhaust[3]	
	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*	All Vehicles[4]	*No HD Vehicles[5]*
1	4.65E-02	*4.44E-02*	5.92E-02	*5.77E-02*	1.05E+00	*5.08E-02*	1.48E+00	*1.44E+00*
2	4.53E-02	*4.43E-02*	5.96E-02	*5.76E-02*	1.29E+00	*3.51E-02*	1.45E+00	*1.44E+00*
3	6.16E-02	*4.63E-02*	6.72E-02	*5.90E-02*	6.15E+00	*4.64E-01*	1.68E+00	*1.47E+00*
4	4.33E-02	*4.43E-02*	5.93E-02	*5.76E-02*	1.10E+00	*0.00E+00*	1.48E+00	*1.44E+00*
5	4.32E-02	*4.42E-02*	5.94E-02	*5.75E-02*	1.17E+00	*0.00E+00*	1.49E+00	*1.44E+00*
6	4.44E-02	*4.43E-02*	5.86E-02	*5.76E-02*	6.68E-01	*1.10E-02*	1.47E+00	*1.44E+00*
7	4.44E-02	*4.43E-02*	5.78E-02	*5.76E-02*	1.53E-01	*1.38E-02*	1.44E+00	*1.44E+00*
8	4.43E-02	*4.42E-02*	5.77E-02	*5.75E-02*	1.13E-01	*7.96E-03*	1.44E+00	*1.44E+00*
9	4.53E-02	*4.43E-02*	5.87E-02	*5.76E-02*	7.68E-01	*3.23E-02*	1.47E+00	*1.44E+00*
10	5.04E-02	*4.48E-02*	6.36E-02	*5.80E-02*	3.89E+00	*1.73E-01*	1.59E+00	*1.45E+00*
11	4.77E-02	*4.46E-02*	6.23E-02	*5.78E-02*	3.07E+00	*1.08E-01*	1.56E+00	*1.45E+00*
12	4.79E-02	*4.45E-02*	6.12E-02	*5.78E-02*	2.34E+00	*9.71E-02*	1.53E+00	*1.44E+00*
13	4.60E-02	*4.43E-02*	5.95E-02	*5.76E-02*	1.27E+00	*4.78E-02*	1.49E+00	*1.44E+00*
14	4.58E-02	*4.43E-02*	5.95E-02	*5.76E-02*	1.30E+00	*4.51E-02*	1.49E+00	*1.44E+00*
15	4.59E-02	*4.43E-02*	5.96E-02	*5.76E-02*	1.32E+00	*4.68E-02*	1.49E+00	*1.44E+00*
16	4.67E-02	*4.44E-02*	5.98E-02	*5.77E-02*	1.44E+00	*6.29E-02*	1.49E+00	*1.44E+00*
17	4.58E-02	*4.43E-02*	5.92E-02	*5.76E-02*	1.10E+00	*4.30E-02*	1.48E+00	*1.44E+00*
18	4.58E-02	*4.43E-02*	5.85E-02	*5.76E-02*	6.73E-01	*3.75E-02*	1.46E+00	*1.44E+00*
19	4.60E-02	*4.43E-02*	5.84E-02	*5.76E-02*	6.06E-01	*3.69E-02*	1.46E+00	*1.44E+00*
20	4.55E-02	*4.42E-02*	5.83E-02	*5.76E-02*	5.17E-01	*2.78E-02*	1.46E+00	*1.44E+00*
21	4.48E-02	*4.42E-02*	5.82E-02	*5.75E-02*	4.47E-01	*1.66E-02*	1.45E+00	*1.44E+00*
22	4.40E-02	*4.41E-02*	5.78E-02	*5.75E-02*	2.19E-01	*1.68E-03*	1.45E+00	*1.44E+00*
23	4.45E-02	*4.42E-02*	5.82E-02	*5.75E-02*	4.45E-01	*1.14E-02*	1.45E+00	*1.44E+00*
24	4.42E-02	*4.41E-02*	5.83E-02	*5.75E-02*	5.17E-01	*8.20E-03*	1.46E+00	*1.44E+00*

Notes:

1. The emission factors for each vehicle class were extracted from EMFAC2007 and were weighted by default hourly fraction of trip in EMFAC2007 to yield composite hourly emission factors. Detailed discussion of the methodology is presented in Draft EIR Attachment IV section 4.2.
2. Exhaust refers to running emissions from vehicle exhaust; non-exhaust refers to running evaporative emissions.
3. Exhaust refers to idling emissions from vehicle exhaust; non-exhaust refers to idling evaporative emissions.
4. The emission factors for all vehicles are used for road segments with no truck restrictions.
5. The emission factors for all vehicles, excluding heavy-duty vehicles, are used for road segments with truck restrictions which forbid trucks over 14,000 lbs. Those emission factors are shown in *italics.*

Abbreviations:

EIR: Environmental Impact Report
HD: heavy duty vehicle, and refers to vehicles with a gross vehicle rating of 10,001 pounds or more.

Table 3a
Summary of All Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11	Hour 12	Hour 13	Hour 14	Hour 15	Hour 16	Hour 17	Hour 18	Hour 19	Hour 20	Hour 21	Hour 22	Hour 23	Hour 24
Fraction of Trips/Day, All Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.017	0.051	0.055	0.062	0.062	0.080	0.084	0.069	0.074	0.079	0.073	0.073	0.059	0.047	0.031	0.027	0.019	0.016
Fraction of Trips/Day, All but HD Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.019	0.057	0.056	0.048	0.051	0.072	0.083	0.069	0.074	0.078	0.074	0.079	0.064	0.051	0.034	0.030	0.021	0.017
Segment	**Direction**	**Hourly Traffic Volume (Vehicles / Hour)**																							
101 Ramp to 12	Southbound	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101 Ramp to 12	Northbound	164	82	40	34	55	90	356	1,045	1,113	1,275	1,259	1,623	1,708	1,405	1,518	1,616	1,495	1,491	1,198	951	638	544	388	326
12 to 11	Southbound	13	7	3	3	4	7	29	85	90	104	102	132	139	114	123	131	121	121	97	77	52	44	32	27
12 to 11	Northbound	157	79	39	32	53	87	342	1,005	1,070	1,227	1,211	1,561	1,643	1,352	1,460	1,554	1,438	1,434	1,153	915	613	524	373	314
11 to 10	Southbound	164	82	40	34	55	90	356	1,046	1,114	1,276	1,260	1,625	1,710	1,407	1,519	1,618	1,496	1,492	1,200	952	638	545	388	327
11 to 10	Northbound	164	83	40	34	55	90	357	1,050	1,118	1,281	1,265	1,631	1,716	1,412	1,525	1,624	1,502	1,498	1,204	956	641	547	390	328
10 to 9	Southbound	155	78	38	32	52	85	336	988	1,052	1,205	1,190	1,534	1,615	1,328	1,435	1,528	1,413	1,409	1,133	899	603	515	367	309
10 to 9	Northbound	166	83	41	34	56	91	360	1,060	1,128	1,293	1,276	1,645	1,731	1,425	1,539	1,638	1,515	1,511	1,215	964	646	552	393	331
9 to 8	Southbound	180	90	44	37	60	99	391	1,150	1,224	1,402	1,385	1,785	1,878	1,546	1,669	1,777	1,644	1,640	1,318	1,046	701	599	427	359
9 to 8	Northbound	186	93	46	38	62	102	404	1,187	1,264	1,448	1,430	1,844	1,940	1,596	1,724	1,836	1,698	1,694	1,361	1,081	724	618	441	371
8 to 56	Southbound	197	99	48	40	66	108	428	1,258	1,339	1,535	1,515	1,953	2,056	1,691	1,827	1,945	1,799	1,794	1,442	1,145	768	655	467	393
8 to 56	Northbound	196	98	48	40	66	108	426	1,252	1,333	1,527	1,508	1,944	2,045	1,683	1,818	1,935	1,790	1,786	1,435	1,139	764	652	465	391
56 to 7	Southbound	199	100	49	41	67	109	432	1,269	1,351	1,548	1,529	1,971	2,074	1,706	1,843	1,962	1,815	1,810	1,455	1,155	774	661	471	396
56 to 7	Northbound	198	100	49	41	67	109	431	1,266	1,348	1,545	1,525	1,966	2,069	1,702	1,838	1,957	1,810	1,806	1,452	1,152	772	659	470	395
7 to 6	Southbound	209	105	51	43	70	115	454	1,334	1,420	1,627	1,606	2,071	2,179	1,793	1,937	2,062	1,907	1,903	1,529	1,214	814	695	495	417
7 to 6	Northbound	213	107	52	44	72	117	463	1,362	1,450	1,662	1,641	2,115	2,226	1,831	1,978	2,106	1,948	1,943	1,562	1,240	831	709	506	425
6 to 5	Southbound	207	104	51	42	70	114	450	1,324	1,409	1,615	1,594	2,056	2,163	1,780	1,922	2,047	1,893	1,888	1,518	1,205	808	689	491	413
6 to 5	Northbound	206	103	50	42	69	113	447	1,313	1,398	1,602	1,582	2,039	2,146	1,765	1,907	2,030	1,878	1,873	1,505	1,195	801	684	487	410
5 to 57	Southbound	203	102	50	42	68	111	440	1,294	1,378	1,579	1,559	2,010	2,115	1,740	1,879	2,001	1,850	1,846	1,484	1,178	790	674	480	404
5 to 57	Northbound	203	102	50	42	68	112	442	1,300	1,384	1,586	1,566	2,018	2,124	1,748	1,887	2,010	1,858	1,854	1,490	1,183	793	677	482	406
57 to 4	Southbound	198	99	48	40	66	109	429	1,262	1,344	1,540	1,520	1,960	2,063	1,697	1,833	1,952	1,805	1,801	1,447	1,149	770	657	468	394
57 to 4	Northbound	214	108	53	44	72	118	466	1,369	1,458	1,670	1,649	2,126	2,237	1,841	1,988	2,117	1,958	1,953	1,570	1,246	835	713	508	428
4 to 3	Southbound	218	110	54	45	73	120	474	1,394	1,484	1,700	1,679	2,164	2,277	1,874	2,024	2,155	1,993	1,988	1,598	1,269	850	726	517	435
4 to 3	Northbound	208	105	51	43	70	115	453	1,331	1,417	1,624	1,603	2,067	2,175	1,790	1,933	2,058	1,903	1,899	1,526	1,212	812	693	494	416
34 to 9	Eastbound	109	53	20	22	36	58	248	737	732	624	665	939	1,080	898	959	1,013	965	1,022	829	661	442	383	270	227
34 to 9	Westbound	100	49	18	20	33	54	228	679	674	575	612	865	995	828	883	933	889	941	764	609	407	353	249	209
9 to 18	Eastbound	118	59	29	24	40	65	257	755	804	922	910	1,173	1,234	1,016	1,097	1,168	1,080	1,078	866	688	461	393	280	236
9 to 18	Westbound	95	48	23	19	32	52	206	605	644	738	729	940	989	814	879	936	865	863	694	551	369	315	225	189
30 to 54	Eastbound	65	32	12	13	22	35	147	439	436	371	396	559	643	535	571	603	574	608	493	393	263	228	161	135
30 to 54	Westbound	63	31	12	13	21	34	144	427	424	361	385	544	625	520	555	586	559	592	480	383	256	222	156	132
54 to 55	Eastbound	66	32	12	13	22	36	151	449	446	380	405	572	658	547	584	617	588	622	505	402	269	234	164	138
54 to 55	Westbound	68	33	12	14	23	36	154	459	456	388	414	585	672	559	597	630	601	636	516	411	275	239	168	141
55 to 6	Eastbound	71	34	13	14	23	38	161	478	474	404	431	609	700	582	621	656	626	662	537	428	287	249	175	147
55 to 6	Westbound	71	34	13	14	23	38	161	478	475	404	431	609	700	582	622	656	626	662	537	428	287	249	175	147
6 to 5	Southbound	207	104	51	42	70	114	450	1,324	1,409	1,615	1,594	2,056	2,163	1,780	1,922	2,047	1,893	1,888	1,518	1,205	808	689	491	413
6 to 5	Northbound	206	103	50	42	69	113	447	1,313	1,398	1,602	1,582	2,039	2,146	1,765	1,907	2,030	1,878	1,873	1,505	1,195	801	684	487	410
47 to 46	Eastbound	84	42	21	17	28	46	184	540	575	659	650	838	882	726	784	835	772	770	619	491	329	281	200	169
47 to 46	Westbound	108	54	26	22	36	59	234	687	731	838	828	1,067	1,123	924	998	1,062	982	980	788	625	419	358	255	215
46 to 48	Eastbound	94	47	23	19	31	52	204	599	638	731	722	930	979	806	870	926	857	855	687	545	366	312	222	187
46 to 48	Westbound	160	81	39	33	54	88	348	1,024	1,090	1,249	1,233	1,590	1,673	1,377	1,487	1,583	1,464	1,461	1,174	932	625	533	380	320
48 to 4	Eastbound	148	74	36	30	50	81	322	946	1,007	1,154	1,140	1,469	1,546	1,272	1,374	1,463	1,353	1,350	1,085	861	577	493	351	296
48 to 4	Westbound	148	75	36	30	50	82	323	948	1,010	1,157	1,142	1,473	1,550	1,275	1,377	1,466	1,356	1,353	1,087	863	579	494	352	296
4 to 58	Eastbound	76	38	19	16	25	42	165	485	516	591	584	753	792	652	704	749	693	691	556	441	296	252	180	151
4 to 58	Westbound	77	39	19	16	26	43	168	495	527	604	596	768	808	665	718	765	707	706	567	450	302	258	184	155
58 to 16	Southbound	116	58	29	24	39	64	253	743	791	906	895	1,154	1,214	999	1,079	1,149	1,062	1,060	852	676	453	387	276	232
58 to 16	Northbound	171	86	42	35	57	94	371	1,090	1,160	1,329	1,313	1,692	1,781	1,465	1,582	1,685	1,558	1,555	1,249	992	665	567	404	340
29 to 59	Northbound	156	78	38	32	52	86	339	996	1,060	1,215	1,200	1,547	1,628	1,339	1,446	1,540	1,424	1,421	1,142	907	608	519	370	311
29 to 59	Westbound	136	68	33	28	46	75	296	869	925	1,060	1,046	1,349	1,420	1,168	1,261	1,343	1,242	1,239	996	791	530	452	322	271
59 to 60	Eastbound	165	83	40	34	55	91	358	1,052	1,120	1,284	1,268	1,634	1,720	1,415	1,528	1,627	1,505	1,501	1,207	958	642	548	391	329
59 to 60	Westbound	143	72	35	29	48	78	310	911	970	1,111	1,097	1,415	1,489	1,225	1,323	1,408	1,303	1,299	1,044	829	556	474	338	285
60 to 28	Eastbound	206	104	51	42	69	113	448	1,318	1,403	1,608	1,588	2,047	2,154	1,772	1,914	2,038	1,885	1,880	1,511	1,200	804	686	489	412
60 to 28	Westbound	226	114	55	46	76	124	491	1,444	1,537	1,761	1,739	2,242	2,359	1,941	2,097	2,232	2,065	2,060	1,655	1,314	881	752	536	451

Table 3a
Summary of All Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11	Hour 12	Hour 13	Hour 14	Hour 15	Hour 16	Hour 17	Hour 18	Hour 19	Hour 20	Hour 21	Hour 22	Hour 23	Hour 24
Fraction of Trips/Day, All Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.017	0.051	0.055	0.062	0.062	0.080	0.084	0.069	0.074	0.079	0.073	0.073	0.059	0.047	0.031	0.027	0.019	0.016
Fraction of Trips/Day, All but HD Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.019	0.057	0.056	0.048	0.051	0.072	0.083	0.069	0.074	0.078	0.074	0.079	0.064	0.051	0.034	0.030	0.021	0.017
Segment	**Direction**	**Hourly Traffic Volume (Vehicles / Hour)**																							
10 to East	Eastbound	8	4	1	2	3	4	18	52	52	44	47	67	77	64	68	72	68	73	59	47	31	27	19	16
10 to East	Westbound	18	9	3	4	6	10	41	122	121	103	110	155	179	149	159	167	160	169	137	109	73	63	45	38
11 to 29	Eastbound	53	26	10	11	18	29	122	362	359	306	326	461	530	441	470	497	473	501	407	324	217	188	132	111
11 to 29	Westbound	72	35	13	15	24	39	164	489	486	414	441	623	717	596	636	672	640	678	550	438	293	254	179	151
33 to 3rd Street	Eastbound	5	3	1	1	2	3	12	35	37	42	42	54	57	47	50	54	50	50	40	32	21	18	13	11
33 to 3rd Street	Westbound	3	2	1	1	1	2	7	21	23	26	26	33	35	29	31	33	31	31	25	20	13	11	8	7
33 to Project	Eastbound	9	4	2	2	3	5	19	55	59	67	66	86	90	74	80	85	79	79	63	50	34	29	20	17
33 to Project	Westbound	8	4	2	2	3	4	16	48	51	59	58	75	79	65	70	74	69	69	55	44	29	25	18	15
8 to 32	Eastbound	35	18	9	7	12	19	76	224	238	273	270	348	366	301	325	346	320	319	257	204	137	117	83	70
8 to 32	Westbound	44	22	11	9	15	24	95	278	296	339	335	432	454	374	404	430	398	397	319	253	170	145	103	87
32 to Project	Eastbound	83	41	20	17	28	45	179	527	561	643	635	819	862	709	766	815	754	752	605	480	322	275	196	165
32 to Project	Westbound	39	20	10	8	13	22	85	250	267	306	302	389	409	337	364	387	358	357	287	228	153	130	93	78
31 to 3rd Street	Eastbound	9	4	2	2	3	5	19	55	59	67	66	86	90	74	80	85	79	79	63	50	34	29	20	17
31 to 3rd Street	Westbound	11	6	3	2	4	6	25	73	77	89	87	113	119	98	105	112	104	104	83	66	44	38	27	23
31 to Project	Eastbound	40	20	10	8	13	22	87	256	272	312	308	397	418	344	371	395	366	365	293	233	156	133	95	80
31 to Project	Westbound	42	21	10	9	14	23	92	271	288	330	326	421	443	364	393	419	387	386	310	246	165	141	101	85
56 to East	Eastbound	31	16	8	6	11	17	68	200	213	245	241	311	328	270	291	310	287	286	230	182	122	104	74	63
56 to East	Westbound	25	12	6	5	8	14	54	157	168	192	190	245	257	212	229	243	225	225	181	143	96	82	58	49
34 to 29	Northbound	96	48	23	20	32	53	208	610	650	744	735	948	997	820	886	943	873	870	700	555	372	318	226	191
34 to 29	Southbound	104	52	25	21	35	57	226	664	706	809	799	1,030	1,084	892	964	1,026	949	947	761	604	405	346	246	207
34 to North	Northbound	98	49	24	20	33	54	214	629	669	767	757	976	1,027	845	913	972	899	897	721	572	384	327	233	196
34 to North	Southbound	95	48	23	19	32	52	206	606	645	740	730	941	991	815	880	937	867	865	695	552	370	316	225	189
54 to 31	Northbound	31	15	7	6	10	17	66	195	208	238	235	303	319	263	284	302	279	279	224	178	119	102	72	61
54 to 31	Southbound	32	16	8	7	11	18	69	203	217	248	245	316	332	273	295	314	291	290	233	185	124	106	75	64
31 to 32	Northbound	70	35	17	14	23	38	152	446	475	544	537	692	729	600	647	689	638	636	511	406	272	232	165	139
31 to 32	Southbound	66	33	16	14	22	36	144	423	450	516	510	657	691	569	614	654	605	604	485	385	258	220	157	132
32 to 33	Northbound	24	12	6	5	8	13	52	153	163	187	185	238	251	206	223	237	219	219	176	140	94	80	57	48
32 to 33	Southbound	24	12	6	5	8	13	53	154	164	188	186	240	252	208	224	239	221	220	177	141	94	80	57	48
7 to East	Eastbound	26	13	5	5	9	14	59	175	174	148	158	223	257	214	228	241	230	243	197	157	105	91	64	54
7 to East	Westbound	27	13	5	5	9	14	61	182	181	154	165	232	267	222	237	251	239	253	205	163	109	95	67	56
34 to Project	Eastbound	23	11	4	5	8	13	53	159	158	134	143	202	233	193	206	218	208	220	179	142	95	83	58	49
34 to Project	Westbound	13	6	2	3	4	7	29	86	85	73	78	110	126	105	112	118	113	119	97	77	52	45	31	27

Table 3b
Summary of Diesel Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11	Hour 12	Hour 13	Hour 14	Hour 15	Hour 16	Hour 17	Hour 18	Hour 19	Hour 20	Hour 21	Hour 22	Hour 23	Hour 24
Fraction of Trips/Day, All Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.017	0.051	0.055	0.062	0.062	0.080	0.084	0.069	0.074	0.079	0.073	0.073	0.059	0.047	0.031	0.027	0.019	0.016
Fraction of Trips/Day, All but HD Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.019	0.057	0.056	0.048	0.051	0.072	0.083	0.069	0.074	0.078	0.074	0.079	0.064	0.051	0.034	0.030	0.021	0.017
Diesel Scaling Factor, All Vehicles		0.030	0.047	0.062	0.040	0.032	0.072	0.027	0.014	0.055	0.190	0.159	0.108	0.071	0.058	0.069	0.073	0.059	0.018	0.010	0.010	0.015	0.009	0.011	0.007
Diesel Scaling Factor, All but HD Vehicles		0.003	0.003	0.005	0.005	0.003	0.007	0.006	0.003	0.006	0.017	0.014	0.009	0.006	0.006	0.006	0.007	0.006	0.003	0.002	0.002	0.002	0.002	0.002	0.002
Segment	**Direction**	**Hourly Traffic Volume (Vehicles / Hour)**																							
101 Ramp to 12	Southbound	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101 Ramp to 12	Northbound	5	4	2	1	2	7	10	15	61	242	200	175	121	82	105	118	88	27	12	10	10	5	4	2
12 to 11	Southbound	0	0	0	0	0	1	1	1	5	20	16	14	10	7	9	10	7	2	1	1	1	0	0	0
12 to 11	Northbound	5	4	2	1	2	6	9	14	59	233	193	168	117	79	101	114	84	26	12	10	9	5	4	2
11 to 10	Southbound	5	4	2	1	2	7	10	15	61	243	201	175	121	82	105	118	88	27	12	10	10	5	4	2
11 to 10	Northbound	5	4	3	1	2	7	10	15	62	244	201	176	122	82	106	119	88	27	12	10	10	5	4	2
10 to 9	Southbound	5	4	2	1	2	6	9	14	58	229	189	165	115	77	100	112	83	25	12	9	9	4	4	2
10 to 9	Northbound	5	4	3	1	2	7	10	15	62	246	203	177	123	83	107	120	89	27	13	10	10	5	4	2
9 to 8	Southbound	5	4	3	1	2	7	11	16	67	267	220	192	133	90	116	130	96	29	14	11	11	5	5	3
9 to 8	Northbound	5	4	3	2	2	7	11	17	70	275	228	199	138	93	120	134	100	30	14	11	11	5	5	3
8 to 56	Southbound	6	5	3	2	2	8	12	18	74	292	241	210	146	98	127	142	105	32	15	12	12	6	5	3
8 to 56	Northbound	6	5	3	2	2	8	12	18	73	290	240	209	145	98	126	142	105	32	15	12	12	6	5	3
56 to 7	Southbound	6	5	3	2	2	8	12	18	74	294	243	212	147	99	128	144	106	32	15	12	12	6	5	3
56 to 7	Northbound	6	5	3	2	2	8	12	18	74	294	243	212	147	99	128	143	106	32	15	12	12	6	5	3
7 to 6	Southbound	6	5	3	2	2	8	12	19	78	309	256	223	155	104	134	151	112	34	16	13	12	6	5	3
7 to 6	Northbound	6	5	3	2	2	8	13	19	80	316	261	228	158	107	137	154	114	35	16	13	13	6	5	3
6 to 5	Southbound	6	5	3	2	2	8	12	19	78	307	254	221	153	104	133	150	111	34	16	13	12	6	5	3
6 to 5	Northbound	6	5	3	2	2	8	12	19	77	304	252	220	152	103	132	149	110	33	16	13	12	6	5	3
5 to 57	Southbound	6	5	3	2	2	8	12	18	76	300	248	216	150	101	130	146	108	33	15	12	12	6	5	3
5 to 57	Northbound	6	5	3	2	2	8	12	18	76	301	249	217	151	102	131	147	109	33	15	12	12	6	5	3
57 to 4	Southbound	6	5	3	2	2	8	12	18	74	293	242	211	146	99	127	143	106	32	15	12	12	6	5	3
57 to 4	Northbound	6	5	3	2	2	9	13	19	80	317	262	229	159	107	138	155	115	35	16	13	13	6	6	3
4 to 3	Southbound	6	5	3	2	2	9	13	20	82	323	267	233	162	109	140	158	117	36	17	13	13	6	6	3
4 to 3	Northbound	6	5	3	2	2	8	12	19	78	309	255	223	154	104	134	151	112	34	16	13	12	6	5	3
34 to 9	Eastbound	0	0	0	0	0	0	2	2	4	11	10	9	7	5	6	7	6	3	2	1	1	1	1	0
34 to 9	Westbound	0	0	0	0	0	0	1	2	4	10	9	8	6	5	5	7	5	3	2	1	1	1	1	0
9 to 18	Eastbound	3	3	2	1	1	5	7	11	44	175	145	126	88	59	76	86	63	19	9	7	7	3	3	2
9 to 18	Westbound	3	2	1	1	1	4	6	9	36	140	116	101	70	47	61	69	51	15	7	6	6	3	2	1
30 to 54	Eastbound	0	0	0	0	0	0	1	1	3	6	6	5	4	3	4	4	3	2	1	1	1	0	0	0
30 to 54	Westbound	0	0	0	0	0	0	1	1	2	6	6	5	4	3	3	4	3	2	1	1	1	0	0	0
54 to 55	Eastbound	0	0	0	0	0	0	1	1	3	7	6	5	4	3	4	4	4	2	1	1	1	0	0	0
54 to 55	Westbound	0	0	0	0	0	0	1	1	3	7	6	5	4	3	4	5	4	2	1	1	1	0	0	0
55 to 6	Eastbound	0	0	0	0	0	0	1	2	3	7	6	6	4	3	4	5	4	2	1	1	1	1	0	0
55 to 6	Westbound	0	0	0	0	0	0	1	2	3	7	6	6	4	3	4	5	4	2	1	1	1	1	0	0
6 to 5	Southbound	6	5	3	2	2	8	12	19	78	307	254	221	153	104	133	150	111	34	16	13	12	6	5	3
6 to 5	Northbound	6	5	3	2	2	8	12	19	77	304	252	220	152	103	132	149	110	33	16	13	12	6	5	3
47 to 46	Eastbound	2	2	1	1	1	3	5	8	32	125	103	90	63	42	54	61	45	14	6	5	5	2	2	1
47 to 46	Westbound	3	3	2	1	1	4	6	10	40	159	132	115	80	54	69	78	58	18	8	7	6	3	3	2
46 to 48	Eastbound	3	2	1	1	1	4	6	8	35	139	115	100	69	47	60	68	50	15	7	6	6	3	2	1
46 to 48	Westbound	5	4	2	1	2	6	9	14	60	237	196	171	119	80	103	116	86	26	12	10	10	5	4	2
48 to 4	Eastbound	4	3	2	1	2	6	9	13	56	219	181	158	110	74	95	107	79	24	11	9	9	4	4	2
48 to 4	Westbound	4	3	2	1	2	6	9	13	56	220	182	159	110	74	96	107	80	24	11	9	9	4	4	2
4 to 58	Eastbound	2	2	1	1	1	3	4	7	28	112	93	81	56	38	49	55	41	12	6	5	5	2	2	1
4 to 58	Westbound	2	2	1	1	1	3	5	7	29	115	95	83	57	39	50	56	41	13	6	5	5	2	2	1
58 to 16	Southbound	3	3	2	1	1	5	7	10	44	172	142	124	86	58	75	84	62	19	9	7	7	3	3	2
58 to 16	Northbound	5	4	3	1	2	7	10	15	64	253	209	182	126	85	110	123	91	28	13	10	10	5	4	2
29 to 59	Northbound	5	4	2	1	2	6	9	14	58	231	191	167	115	78	100	113	83	25	12	10	9	5	4	2
29 to 59	Westbound	4	3	2	1	1	5	8	12	51	201	167	145	101	68	88	98	73	22	10	8	8	4	4	2
59 to 60	Eastbound	5	4	3	1	2	7	10	15	62	244	202	176	122	82	106	119	88	27	12	10	10	5	4	2
59 to 60	Westbound	4	3	2	1	2	6	8	13	53	211	175	152	106	71	92	103	76	23	11	9	9	4	4	2

Table 3b
Summary of Diesel Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11	Hour 12	Hour 13	Hour 14	Hour 15	Hour 16	Hour 17	Hour 18	Hour 19	Hour 20	Hour 21	Hour 22	Hour 23	Hour 24
Fraction of Trips/Day, All Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.017	0.051	0.055	0.062	0.062	0.080	0.084	0.069	0.074	0.079	0.073	0.073	0.059	0.047	0.031	0.027	0.019	0.016
Fraction of Trips/Day, All but HD Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.019	0.057	0.056	0.048	0.051	0.072	0.083	0.069	0.074	0.078	0.074	0.079	0.064	0.051	0.034	0.030	0.021	0.017
Diesel Scaling Factor, All Vehicles		0.030	0.047	0.062	0.040	0.032	0.072	0.027	0.014	0.055	0.190	0.159	0.108	0.071	0.058	0.069	0.073	0.059	0.018	0.010	0.010	0.015	0.009	0.011	0.007
Diesel Scaling Factor, All but HD Vehicles		0.003	0.003	0.005	0.005	0.003	0.007	0.006	0.003	0.006	0.017	0.014	0.009	0.006	0.006	0.006	0.007	0.006	0.003	0.002	0.002	0.002	0.002	0.002	0.002
Segment	**Direction**	**Hourly Traffic Volume (Vehicles / Hour)**																							
60 to 28	Eastbound	6	5	3	2	2	8	12	19	77	306	253	220	153	103	133	149	110	34	16	13	12	6	5	3
60 to 28	Westbound	7	5	3	2	2	9	13	20	85	335	277	241	167	113	146	163	121	37	17	14	13	7	6	3
10 to East	Eastbound	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0
10 to East	Westbound	0	0	0	0	0	0	0	0	1	2	2	1	1	1	1	1	1	1	0	0	0	0	0	0
11 to 29	Eastbound	0	0	0	0	0	0	1	1	2	5	5	4	3	2	3	4	3	2	1	1	1	0	0	0
11 to 29	Westbound	0	0	0	0	0	0	1	2	3	7	6	6	5	3	4	5	4	2	1	1	1	1	0	0
33 to 3rd Street	Eastbound	0	0	0	0	0	0	0	0	2	8	7	6	4	3	4	4	3	1	0	0	0	0	0	0
33 to 3rd Street	Westbound	0	0	0	0	0	0	0	0	1	5	4	4	2	2	2	2	2	1	0	0	0	0	0	0
33 to Project	Eastbound	0	0	0	0	0	0	1	1	3	13	11	9	6	4	6	6	5	1	1	1	1	0	0	0
33 to Project	Westbound	0	0	0	0	0	0	0	1	3	11	9	8	6	4	5	5	4	1	1	0	0	0	0	0
8 to 32	Eastbound	1	1	1	0	0	1	2	3	13	52	43	37	26	18	23	25	19	6	3	2	2	1	1	0
8 to 32	Westbound	1	1	1	0	0	2	3	4	16	64	53	47	32	22	28	31	23	7	3	3	3	1	1	1
32 to Project	Eastbound	2	2	1	1	1	3	5	7	31	122	101	88	61	41	53	60	44	13	6	5	5	2	2	1
32 to Project	Westbound	1	1	1	0	0	2	2	4	15	58	48	42	29	20	25	28	21	6	3	2	2	1	1	1
31 to 3rd Street	Eastbound	0	0	0	0	0	0	1	1	3	13	11	9	6	4	6	6	5	1	1	1	1	0	0	0
31 to 3rd Street	Westbound	0	0	0	0	0	0	1	1	4	17	14	12	8	6	7	8	6	2	1	1	1	0	0	0
31 to Project	Eastbound	1	1	1	0	0	2	2	4	15	59	49	43	30	20	26	29	21	7	3	2	2	1	1	1
31 to Project	Westbound	1	1	1	0	0	2	2	4	16	63	52	45	31	21	27	31	23	7	3	3	3	1	1	1
56 to East	Eastbound	1	1	0	0	0	1	2	3	12	46	38	34	23	16	20	23	17	5	2	2	2	1	1	0
56 to East	Westbound	1	1	0	0	0	1	1	2	9	37	30	26	18	12	16	18	13	4	2	2	1	1	1	0
34 to 29	Northbound	3	2	1	1	1	4	6	9	36	141	117	102	71	48	62	69	51	16	7	6	6	3	2	1
34 to 29	Southbound	3	2	2	1	1	4	6	9	39	154	127	111	77	52	67	75	56	17	8	6	6	3	3	1
34 to North	Northbound	3	2	1	1	1	4	6	9	37	146	121	105	73	49	63	71	53	16	7	6	6	3	3	1
34 to North	Southbound	3	2	1	1	1	4	6	9	36	141	116	101	70	47	61	69	51	15	7	6	6	3	2	1
54 to 31	Northbound	1	1	0	0	0	1	2	3	11	45	37	33	23	15	20	22	16	5	2	2	2	1	1	0
54 to 31	Southbound	1	1	0	0	0	1	2	3	12	47	39	34	24	16	21	23	17	5	2	2	2	1	1	0
31 to 32	Northbound	2	2	1	1	1	3	4	6	26	103	85	75	52	35	45	50	37	11	5	4	4	2	2	1
31 to 32	Southbound	2	2	1	1	1	3	4	6	25	98	81	71	49	33	43	48	35	11	5	4	4	2	2	1
32 to 33	Northbound	1	1	0	0	0	1	1	2	9	36	29	26	18	12	15	17	13	4	2	1	1	1	1	0
32 to 33	Southbound	1	1	0	0	0	1	1	2	9	36	30	26	18	12	16	17	13	4	2	1	1	1	1	0
7 to East	Eastbound	0	0	0	0	0	0	0	1	1	3	2	2	2	1	1	2	1	1	0	0	0	0	0	0
7 to East	Westbound	0	0	0	0	0	0	0	1	1	3	2	2	2	1	1	2	1	1	0	0	0	0	0	0
34 to Project	Eastbound	0	0	0	0	0	0	0	1	1	2	2	2	1	1	1	2	1	1	0	0	0	0	0	0
34 to Project	Westbound	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0

Table 3c
Summary of Gasoline Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11	Hour 12	Hour 13	Hour 14	Hour 15	Hour 16	Hour 17	Hour 18	Hour 19	Hour 20	Hour 21	Hour 22	Hour 23	Hour 24
Fraction of Trips/Day, All Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.017	0.051	0.055	0.062	0.062	0.080	0.084	0.069	0.074	0.079	0.073	0.073	0.059	0.047	0.031	0.027	0.019	0.016
Fraction of Trips/Day, All but HD Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.019	0.057	0.056	0.048	0.051	0.072	0.083	0.069	0.074	0.078	0.074	0.079	0.064	0.051	0.034	0.030	0.021	0.017
Gasoline Scaling Factor, All Vehicles		0.956	0.939	0.927	0.946	0.954	0.914	0.958	0.971	0.931	0.800	0.830	0.880	0.915	0.928	0.917	0.913	0.927	0.967	0.975	0.974	0.970	0.976	0.974	0.978
Gasoline Scaling Factor, All but HD Vehicles		0.982	0.981	0.979	0.980	0.981	0.977	0.978	0.981	0.979	0.967	0.970	0.975	0.978	0.979	0.978	0.977	0.978	0.981	0.982	0.982	0.982	0.982	0.982	0.982
Segment	**Direction**	**Hourly Traffic Volume (Vehicles / Hour)**																							
101 Ramp to 12	Southbound	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101 Ramp to 12	Northbound	156	77	37	32	52	82	341	1,015	1,035	1,020	1,044	1,428	1,563	1,304	1,392	1,476	1,386	1,442	1,168	927	618	531	378	319
12 to 11	Southbound	13	6	3	3	4	7	28	82	84	83	85	116	127	106	113	120	113	117	95	75	50	43	31	26
12 to 11	Northbound	150	74	36	30	50	79	328	976	996	981	1,005	1,374	1,504	1,254	1,339	1,420	1,333	1,387	1,123	892	595	511	363	307
11 to 10	Southbound	157	77	37	32	52	82	341	1,015	1,036	1,021	1,045	1,430	1,565	1,305	1,393	1,477	1,387	1,443	1,169	928	619	532	378	320
11 to 10	Northbound	157	78	37	32	53	83	342	1,019	1,041	1,025	1,049	1,435	1,571	1,310	1,398	1,483	1,393	1,449	1,174	932	621	534	380	321
10 to 9	Southbound	148	73	35	30	50	78	322	959	979	964	987	1,350	1,478	1,233	1,316	1,395	1,310	1,363	1,104	876	585	502	357	302
10 to 9	Northbound	159	78	38	32	53	83	345	1,028	1,050	1,033	1,059	1,448	1,585	1,322	1,411	1,496	1,405	1,462	1,184	940	627	538	383	324
9 to 8	Southbound	172	85	41	35	58	90	375	1,116	1,139	1,121	1,149	1,571	1,719	1,434	1,531	1,623	1,524	1,586	1,284	1,020	680	584	416	351
9 to 8	Northbound	178	88	42	36	60	93	387	1,152	1,176	1,158	1,186	1,622	1,776	1,481	1,581	1,676	1,574	1,638	1,327	1,053	702	603	429	363
8 to 56	Southbound	188	93	45	38	63	99	410	1,221	1,246	1,227	1,257	1,719	1,882	1,569	1,675	1,776	1,668	1,736	1,406	1,116	744	639	455	384
8 to 56	Northbound	187	92	45	38	63	98	408	1,215	1,240	1,221	1,251	1,710	1,872	1,562	1,667	1,767	1,660	1,727	1,399	1,110	741	636	452	382
56 to 7	Southbound	190	94	45	38	64	100	414	1,232	1,257	1,238	1,268	1,734	1,898	1,583	1,690	1,792	1,683	1,751	1,418	1,126	751	645	459	388
56 to 7	Northbound	189	94	45	38	63	100	413	1,229	1,254	1,235	1,265	1,730	1,894	1,580	1,686	1,788	1,679	1,747	1,415	1,123	749	643	458	387
7 to 6	Southbound	200	99	47	40	67	105	435	1,294	1,321	1,301	1,333	1,822	1,995	1,664	1,776	1,883	1,769	1,840	1,490	1,183	789	678	482	407
7 to 6	Northbound	204	101	49	41	68	107	444	1,322	1,349	1,329	1,361	1,861	2,037	1,699	1,814	1,923	1,806	1,879	1,522	1,208	806	692	492	416
6 to 5	Southbound	198	98	47	40	66	104	431	1,285	1,311	1,291	1,323	1,809	1,980	1,651	1,762	1,869	1,755	1,826	1,479	1,174	783	673	478	404
6 to 5	Northbound	196	97	47	40	66	103	428	1,274	1,301	1,281	1,312	1,794	1,964	1,638	1,748	1,854	1,741	1,812	1,467	1,165	777	667	475	401
5 to 57	Southbound	194	96	46	39	65	102	422	1,256	1,282	1,262	1,293	1,768	1,936	1,614	1,723	1,827	1,716	1,785	1,446	1,148	766	658	468	395
5 to 57	Northbound	194	96	46	39	65	102	424	1,262	1,288	1,268	1,299	1,776	1,944	1,622	1,731	1,835	1,723	1,793	1,452	1,153	769	661	470	397
57 to 4	Southbound	189	93	45	38	63	99	411	1,225	1,250	1,231	1,261	1,725	1,888	1,575	1,681	1,782	1,674	1,742	1,410	1,120	747	642	456	386
57 to 4	Northbound	205	101	49	42	69	108	446	1,329	1,356	1,336	1,368	1,871	2,048	1,708	1,823	1,933	1,816	1,889	1,530	1,214	810	696	495	418
4 to 3	Southbound	209	103	50	42	70	110	454	1,353	1,381	1,359	1,392	1,904	2,084	1,739	1,856	1,968	1,848	1,923	1,557	1,236	824	708	504	426
4 to 3	Northbound	199	98	47	40	67	105	434	1,292	1,319	1,298	1,330	1,819	1,991	1,661	1,772	1,879	1,765	1,836	1,487	1,180	787	676	481	407
34 to 9	Eastbound	107	52	19	22	36	57	242	723	716	603	645	916	1,056	879	938	990	944	1,002	814	649	434	377	265	223
34 to 9	Westbound	98	48	18	20	33	53	223	666	660	556	594	844	973	810	864	912	870	923	750	598	400	347	244	206
9 to 18	Eastbound	113	56	27	23	38	59	246	733	748	737	755	1,032	1,130	943	1,006	1,067	1,002	1,042	844	670	447	384	273	231
9 to 18	Westbound	91	45	22	18	30	48	197	587	600	590	605	827	905	755	806	855	803	835	676	537	358	308	219	185
30 to 54	Eastbound	64	31	12	13	21	34	144	430	426	359	384	545	629	523	558	589	562	596	485	386	258	224	158	133
30 to 54	Westbound	62	30	11	12	21	33	140	419	415	350	374	530	612	509	543	573	547	581	472	376	251	218	154	129
54 to 55	Eastbound	65	32	12	13	22	35	148	440	436	368	393	558	643	536	571	603	575	610	496	395	264	229	161	136
54 to 55	Westbound	66	32	12	13	22	36	151	450	446	376	401	570	657	547	584	616	588	624	507	404	270	234	165	139
55 to 6	Eastbound	69	34	13	14	23	37	157	469	464	391	418	594	685	570	608	641	612	650	528	421	281	244	172	145
55 to 6	Westbound	69	34	13	14	23	37	157	469	464	391	418	594	685	570	608	642	612	650	528	421	281	244	172	145
6 to 5	Southbound	198	98	47	40	66	104	431	1,285	1,311	1,291	1,323	1,809	1,980	1,651	1,762	1,869	1,755	1,826	1,479	1,174	783	673	478	404
6 to 5	Northbound	196	97	47	40	66	103	428	1,274	1,301	1,281	1,312	1,794	1,964	1,638	1,748	1,854	1,741	1,812	1,467	1,165	777	667	475	401
47 to 46	Eastbound	81	40	19	16	27	42	176	524	535	527	539	738	808	674	719	762	716	745	603	479	319	274	195	165
47 to 46	Westbound	103	51	24	21	34	54	224	667	681	670	686	939	1,028	857	915	970	911	948	768	609	406	349	248	210
46 to 48	Eastbound	90	44	21	18	30	47	195	581	593	584	599	819	896	747	798	846	794	827	669	531	354	304	217	183
46 to 48	Westbound	153	76	36	31	51	81	334	994	1,014	999	1,023	1,399	1,532	1,278	1,363	1,446	1,358	1,413	1,144	908	606	520	370	313
48 to 4	Eastbound	142	70	34	29	47	74	308	918	937	923	945	1,293	1,415	1,181	1,260	1,336	1,255	1,305	1,057	839	560	481	342	289
48 to 4	Westbound	142	70	34	29	48	75	309	921	940	925	948	1,296	1,419	1,183	1,263	1,339	1,258	1,309	1,060	841	561	482	343	290
4 to 58	Eastbound	73	36	17	15	24	38	158	470	480	473	484	662	725	605	645	684	643	669	542	430	287	246	175	148
4 to 58	Westbound	74	37	18	15	25	39	161	480	490	483	494	676	740	617	659	699	656	683	553	439	293	251	179	151
58 to 16	Southbound	111	55	26	23	37	58	242	721	736	725	742	1,015	1,111	927	989	1,049	985	1,025	830	659	439	378	269	227
58 to 16	Northbound	163	80	39	33	55	86	355	1,058	1,080	1,063	1,089	1,489	1,630	1,360	1,451	1,539	1,445	1,504	1,218	967	645	554	394	333
29 to 59	Northbound	149	74	35	30	50	78	325	967	987	972	995	1,361	1,490	1,243	1,326	1,406	1,321	1,374	1,113	883	589	506	360	304
29 to 59	Westbound	130	64	31	26	44	68	283	843	861	847	868	1,187	1,299	1,084	1,157	1,227	1,152	1,199	971	770	514	441	314	265
59 to 60	Eastbound	157	78	37	32	53	83	343	1,021	1,043	1,027	1,052	1,438	1,574	1,313	1,401	1,486	1,396	1,452	1,176	933	623	535	380	321
59 to 60	Westbound	136	67	32	28	46	72	297	884	902	889	910	1,245	1,363	1,137	1,213	1,286	1,208	1,257	1,018	808	539	463	329	278
60 to 28	Eastbound	197	97	47	40	66	104	429	1,279	1,306	1,286	1,317	1,801	1,972	1,644	1,755	1,861	1,748	1,819	1,473	1,169	780	670	476	403
60 to 28	Westbound	216	107	51	44	72	114	470	1,401	1,430	1,408	1,443	1,973	2,160	1,801	1,922	2,039	1,915	1,992	1,613	1,281	854	734	522	441
10 to East	Eastbound	8	4	1	2	3	4	17	51	51	43	46	65	75	62	67	70	67	71	58	46	31	27	19	16
10 to East	Westbound	18	9	3	4	6	9	40	120	118	100	107	152	175	145	155	164	156	166	135	107	72	62	44	37
11 to 29	Eastbound	52	26	10	11	17	28	119	355	351	296	316	449	518	431	460	486	463	492	400	318	213	185	130	110

Table 3c
Summary of Gasoline Traffic Volumes by Modeled Road Segment
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

		Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11	Hour 12	Hour 13	Hour 14	Hour 15	Hour 16	Hour 17	Hour 18	Hour 19	Hour 20	Hour 21	Hour 22	Hour 23	Hour 24
Fraction of Trips/Day, All Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.017	0.051	0.055	0.062	0.062	0.080	0.084	0.069	0.074	0.079	0.073	0.073	0.059	0.047	0.031	0.027	0.019	0.016
Fraction of Trips/Day, All but HD Vehicles		0.008	0.004	0.002	0.002	0.003	0.004	0.019	0.057	0.056	0.048	0.051	0.072	0.083	0.069	0.074	0.078	0.074	0.079	0.064	0.051	0.034	0.030	0.021	0.017
Gasoline Scaling Factor, All Vehicles		0.956	0.939	0.927	0.946	0.954	0.914	0.958	0.971	0.931	0.800	0.830	0.880	0.915	0.928	0.917	0.913	0.927	0.967	0.975	0.974	0.970	0.976	0.974	0.978
Gasoline Scaling Factor, All but HD Vehicles		0.982	0.981	0.979	0.980	0.981	0.977	0.978	0.981	0.979	0.967	0.970	0.975	0.978	0.979	0.978	0.977	0.978	0.981	0.982	0.982	0.982	0.982	0.982	0.982
Segment	**Direction**	**Hourly Traffic Volume (Vehicles / Hour)**																							
11 to 29	Westbound	71	35	13	14	24	38	161	480	475	401	428	608	701	584	623	657	627	665	540	431	288	250	176	148
33 to 3rd Street	Eastbound	5	3	1	1	2	3	11	34	34	34	35	47	52	43	46	49	46	48	39	31	21	18	13	11
33 to 3rd Street	Westbound	3	2	1	1	1	2	7	21	21	21	21	29	32	27	29	30	28	30	24	19	13	11	8	7
33 to Project	Eastbound	8	4	2	2	3	4	18	54	55	54	55	75	83	69	73	78	73	76	62	49	33	28	20	17
33 to Project	Westbound	7	4	2	1	2	4	16	47	48	47	48	66	72	60	64	68	64	66	54	43	28	24	17	15
8 to 32	Eastbound	33	17	8	7	11	18	73	217	222	218	224	306	335	279	298	316	297	309	250	199	132	114	81	68
8 to 32	Westbound	42	21	10	8	14	22	91	270	276	271	278	380	416	347	370	393	369	384	311	247	165	141	101	85
32 to Project	Eastbound	79	39	19	16	26	41	172	512	522	514	527	720	789	658	702	745	699	728	589	468	312	268	191	161
32 to Project	Westbound	37	18	9	8	13	20	82	243	248	244	250	342	375	313	334	354	332	346	280	222	148	127	91	77
31 to 3rd Street	Eastbound	8	4	2	2	3	4	18	54	55	54	55	75	83	69	73	78	73	76	62	49	33	28	20	17
31 to 3rd Street	Westbound	11	5	3	2	4	6	24	70	72	71	73	99	109	91	97	102	96	100	81	64	43	37	26	22
31 to Project	Eastbound	38	19	9	8	13	20	83	248	253	249	255	349	382	319	340	361	339	353	286	227	151	130	92	78
31 to Project	Westbound	41	20	10	8	14	21	88	263	268	264	271	370	405	338	361	382	359	374	303	240	160	138	98	83
56 to East	Eastbound	30	15	7	6	10	16	65	195	199	196	200	274	300	250	267	283	266	277	224	178	119	102	72	61
56 to East	Westbound	24	12	6	5	8	12	51	153	156	154	157	215	236	196	210	222	209	217	176	140	93	80	57	48
34 to 29	Northbound	91	45	22	19	31	48	199	592	604	595	610	834	913	761	812	862	809	842	682	541	361	310	221	186
34 to 29	Southbound	99	49	24	20	33	52	216	644	657	647	663	907	992	828	883	937	880	915	741	588	393	337	240	203
34 to North	Northbound	94	46	22	19	32	49	205	610	623	613	628	859	940	784	837	888	834	867	702	558	372	319	227	192
34 to North	Southbound	91	45	22	18	30	48	198	588	601	591	606	828	907	756	807	856	804	836	677	538	359	308	219	185
54 to 31	Northbound	29	14	7	6	10	15	64	190	193	190	195	267	292	244	260	276	259	269	218	173	116	99	71	60
54 to 31	Southbound	30	15	7	6	10	16	66	197	201	198	203	278	304	254	271	287	270	281	227	180	120	103	74	62
31 to 32	Northbound	67	33	16	14	22	35	145	433	442	435	446	609	667	556	594	630	591	615	498	395	264	227	161	136
31 to 32	Southbound	63	31	15	13	21	33	138	411	419	413	423	578	633	528	563	597	561	584	473	375	250	215	153	129
32 to 33	Northbound	23	11	5	5	8	12	50	149	152	150	153	210	229	191	204	217	203	212	171	136	91	78	55	47
32 to 33	Southbound	23	11	5	5	8	12	50	150	153	151	154	211	231	193	206	218	205	213	172	137	91	78	56	47
7 to East	Eastbound	25	12	5	5	8	14	58	172	170	144	153	218	251	209	223	235	225	238	194	154	103	90	63	53
7 to East	Westbound	26	13	5	5	9	14	60	179	177	149	160	227	261	218	232	245	234	248	202	161	107	93	66	55
34 to Project	Eastbound	23	11	4	5	8	12	52	156	154	130	139	197	227	189	202	213	203	216	175	140	93	81	57	48
34 to Project	Westbound	12	6	2	3	4	7	28	84	84	70	75	107	123	103	109	115	110	117	95	76	51	44	31	26

Table 4
CAL3QHCR Source Parameters, Running Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
10 to 9 Northbound	Link_106	Above ground	553,238	4,175,107	553,211	4,175,027	0	15
	Link_23	Above ground	553,267	4,175,189	553,238	4,175,107	-2	14
10 to 9 Southbound	Link_62	Above ground	553,229	4,175,112	553,200	4,175,030	1	15
	Link_78	Above ground	553,255	4,175,192	553,229	4,175,112	-3	12
10 to East Westbound	Link_163	Above ground	553,213	4,175,015	553,237	4,175,003	1	10
	Link_164	Above ground	553,237	4,175,003	553,661	4,174,706	8	10
	Link_165	Above ground	553,661	4,174,706	553,672	4,174,696	10	10
	Link_166	Above ground	553,672	4,174,696	553,932	4,174,505	3	10
	Link_167	Above ground	553,239	4,175,007	553,214	4,175,019	1	10
	Link_168	Above ground	553,664	4,174,709	553,239	4,175,007	8	10
	Link_169	Above ground	553,675	4,174,699	553,664	4,174,709	10	10
	Link_170	Above ground	553,935	4,174,508	553,675	4,174,699	2	10
101 Ramp to 12 Northbound	Link_9	Above ground	553,106	4,174,787	553,058	4,174,718	10	12
11 to 10 Northbound	Link_91	Above ground	553,211	4,175,027	553,181	4,174,941	3	14
11 to 10 Southbound	Link_77	Above ground	553,200	4,175,030	553,189	4,175,003	1	15
	Link_83	Above ground	553,189	4,175,003	553,170	4,174,947	5	12
11 to 29 Eastbound	Link_171	Above ground	553,182	4,174,936	553,430	4,174,766	10	10
	Link_172	Above ground	553,430	4,174,766	553,452	4,174,749	10	10
	Link_173	Above ground	553,452	4,174,749	553,528	4,174,697	10	10
	Link_174	Above ground	553,528	4,174,697	553,573	4,174,670	10	10
	Link_175	Above ground	553,573	4,174,670	553,632	4,174,639	10	10
	Link_176	Above ground	553,632	4,174,639	553,662	4,174,616	10	10
	Link_177	Above ground	553,662	4,174,616	553,685	4,174,592	10	10
	Link_178	Above ground	553,685	4,174,592	553,712	4,174,559	10	10
	Link_179	Above ground	553,712	4,174,559	553,745	4,174,516	10	10
	Link_180	Above ground	553,745	4,174,516	553,773	4,174,477	10	10
	Link_181	Above ground	553,773	4,174,477	553,809	4,174,429	10	10
	Link_182	Above ground	553,809	4,174,429	553,841	4,174,380	10	10
	Link_183	Above ground	553,841	4,174,380	553,889	4,174,301	10	10
	Link_184	Above ground	553,889	4,174,301	553,912	4,174,257	10	10
	Link_185	Above ground	553,912	4,174,257	553,929	4,174,208	10	10
	Link_186	Above ground	553,929	4,174,208	553,940	4,174,158	10	10
	Link_187	Above ground	553,940	4,174,158	553,946	4,174,122	10	10
	Link_188	Above ground	553,946	4,174,122	553,956	4,174,079	10	10
	Link_189	Above ground	553,956	4,174,079	553,972	4,174,051	10	10
	Link_190	Above ground	553,972	4,174,051	554,057	4,173,967	10	10

Table 4
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San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
11 to 29 Westbound	Link_191	Above ground	553,432	4,174,770	553,185	4,174,941	10	10
	Link_192	Above ground	553,456	4,174,754	553,432	4,174,770	10	10
	Link_193	Above ground	553,531	4,174,702	553,456	4,174,754	10	10
	Link_194	Above ground	553,578	4,174,678	553,531	4,174,702	10	10
	Link_195	Above ground	553,637	4,174,646	553,578	4,174,678	10	10
	Link_196	Above ground	553,669	4,174,624	553,637	4,174,646	10	10
	Link_197	Above ground	553,690	4,174,600	553,669	4,174,624	10	10
	Link_198	Above ground	553,717	4,174,566	553,690	4,174,600	10	10
	Link_199	Above ground	553,749	4,174,523	553,717	4,174,566	10	10
	Link_200	Above ground	553,780	4,174,482	553,749	4,174,523	10	10
	Link_201	Above ground	553,816	4,174,434	553,780	4,174,482	10	10
	Link_202	Above ground	553,848	4,174,385	553,816	4,174,434	10	10
	Link_203	Above ground	553,897	4,174,303	553,848	4,174,385	10	10
	Link_204	Above ground	553,921	4,174,257	553,897	4,174,303	10	10
	Link_205	Above ground	553,937	4,174,209	553,921	4,174,257	10	10
	Link_206	Above ground	553,948	4,174,158	553,937	4,174,209	10	10
	Link_207	Above ground	553,953	4,174,122	553,948	4,174,158	10	10
	Link_208	Above ground	553,966	4,174,081	553,953	4,174,122	10	10
	Link_209	Above ground	553,982	4,174,056	553,966	4,174,081	10	10
	Link_210	Above ground	554,023	4,174,013	553,982	4,174,056	10	10
12 to 11 Northbound	Link_29	Above ground	553,181	4,174,941	553,152	4,174,858	8	13
	Link_8	Above ground	553,152	4,174,858	553,106	4,174,787	10	12
12 to 11 Southbound	Link_103	Above ground	553,142	4,174,864	553,095	4,174,794	10	13
	Link_84	Above ground	553,170	4,174,947	553,142	4,174,864	7	12
29 to 59 Northbound	Link_155	Above ground	553,545	4,173,721	553,652	4,173,828	-6	16
	Link_156	Above ground	553,652	4,173,828	553,692	4,173,849	-7	15

Table 4
CAL3QHCR Source Parameters, Running Emissions
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San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
59 to 60 Eastbound	Link_157	Above ground	553,692	4,173,849	553,871	4,173,865	-6	15
	Link_158	Above ground	553,871	4,173,865	554,079	4,173,943	-6	14
29 to 59 Westbound	Link_159	Above ground	553,539	4,173,727	553,646	4,173,835	-6	16
	Link_160	Above ground	553,646	4,173,835	553,688	4,173,857	-7	15
59 to 60 Westbound	Link_161	Above ground	553,688	4,173,857	553,868	4,173,873	-6	15
	Link_162	Above ground	553,868	4,173,873	554,074	4,173,951	-6	15
30 to 54 Eastbound	Link_25	Above ground	554,659	4,175,772	554,633	4,175,790	-5	14
	Link_26	Above ground	554,633	4,175,790	554,494	4,175,888	-4	14
	Link_88	Above ground	554,494	4,175,888	554,329	4,176,005	3	14
30 to 54 Westbound	Link_141	Above ground	554,498	4,175,893	554,332	4,176,010	3	14
	Link_142	Above ground	554,663	4,175,777	554,637	4,175,795	-5	13
	Link_143	Above ground	554,637	4,175,795	554,498	4,175,893	-4	14
31 to 32 Northbound	Link_229	Above ground	553,795	4,175,243	554,138	4,175,733	-9	12
31 to 32 Southbound	Link_230	Above ground	554,134	4,175,736	553,791	4,175,246	-9	12
31 to 3rd Street Eastbound	Link_219	Above ground	553,574	4,176,118	554,133	4,175,728	0	11
31 to 3rd Street Westbound	Link_220	Above ground	554,136	4,175,734	553,574	4,176,126	0	11
31 to Project Eastbound	Link_221	Above ground	554,133	4,175,728	554,462	4,175,492	-6	11
31 to Project Westbound	Link_222	Above ground	554,465	4,175,500	554,136	4,175,734	-6	11
32 to 33 Northbound	Link_231	Above ground	553,694	4,175,102	553,795	4,175,243	-10	10
32 to 33 Southbound	Link_232	Above ground	553,791	4,175,246	553,691	4,175,104	-10	10
32 to Project Eastbound	Link_217	Above ground	553,789	4,175,238	554,277	4,174,895	-7	12
32 to Project Westbound	Link_218	Above ground	554,279	4,174,901	553,792	4,175,245	-7	12

Table 4
CAL3QHCR Source Parameters, Running Emissions
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San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
33 to 3rd Street Eastbound	Link_211	Above ground	553,325	4,175,353	553,688	4,175,101	-9	10
33 to 3rd Street Westbound	Link_212	Above ground	553,689	4,175,104	553,328	4,175,359	-9	10
33 to Project Eastbound	Link_213	Above ground	553,688	4,175,101	553,857	4,174,983	-6	10
33 to Project Westbound	Link_214	Above ground	553,861	4,174,988	553,689	4,175,104	-6	10
34 to 29 Northbound	Link_239	Above ground	554,080	4,173,949	554,039	4,174,038	-4	12
	Link_240	Above ground	554,039	4,174,038	554,002	4,174,127	-4	12
	Link_241	Above ground	554,002	4,174,127	553,984	4,174,261	-4	12
	Link_242	Above ground	553,984	4,174,261	553,995	4,174,400	-4	12
	Link_243	Above ground	553,995	4,174,400	554,036	4,174,505	-4	12
	Link_244	Above ground	554,036	4,174,505	554,088	4,174,609	-4	12
34 to 29 Southbound	Link_233	Above ground	554,084	4,174,612	554,037	4,174,529	-4	12
	Link_234	Above ground	554,037	4,174,529	553,985	4,174,401	-4	12
	Link_235	Above ground	553,985	4,174,401	553,978	4,174,260	-4	12
	Link_236	Above ground	553,978	4,174,260	553,990	4,174,133	-4	12
	Link_237	Above ground	553,990	4,174,133	554,025	4,174,040	-4	12
	Link_238	Above ground	554,025	4,174,040	554,073	4,173,947	-4	12
34 to 9 Eastbound	Link_20	Above ground	554,088	4,174,609	554,036	4,174,646	-8	15
	Link_21	Above ground	554,036	4,174,646	553,922	4,174,725	-8	14
	Link_22	Above ground	553,922	4,174,725	553,755	4,174,842	-7	12
	Link_24	Above ground	553,592	4,174,958	553,426	4,175,074	-5	12
	Link_28	Above ground	553,755	4,174,842	553,592	4,174,958	-4	12
	Link_7	Above ground	553,426	4,175,074	553,259	4,175,187	-5	12

Table 4
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San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
34 to 9 Westbound	Link_122	Above ground	554,040	4,174,651	553,926	4,174,730	-8	16
	Link_123	Above ground	553,926	4,174,730	553,759	4,174,847	-7	16
	Link_124	Above ground	553,759	4,174,847	553,595	4,174,963	-4	16
	Link_126	Above ground	553,430	4,175,079	553,260	4,175,193	-5	15
	Link_129	Above ground	553,595	4,174,963	553,430	4,175,079	-5	15
	Link_133	Above ground	554,091	4,174,614	554,040	4,174,651	-8	18
34 to Project Eastbound	Link_18	Above ground	554,419	4,174,377	554,253	4,174,490	-8	16
	Link_19	Above ground	554,253	4,174,490	554,088	4,174,609	-8	16
34 to Project Westbound	Link_125	Above ground	554,423	4,174,382	554,256	4,174,495	-8	15
	Link_130	Above ground	554,256	4,174,495	554,091	4,174,614	-8	16
34 to North Northbound	Link_225	Above ground	554,088	4,174,609	554,898	4,175,740	-9	12
34 to North Southbound	Link_226	Above ground	554,894	4,175,741	554,084	4,174,612	-9	12
4 to 3 Northbound	Link_92	Above ground	553,980	4,177,616	553,958	4,177,533	-10	15
	Link_99	Above ground	553,958	4,177,533	553,931	4,177,442	-10	12
4 to 3 Southbound	Link_105	Above ground	553,962	4,177,595	553,946	4,177,539	-10	13
	Link_121	Above ground	553,946	4,177,539	553,921	4,177,447	-10	12
4 to 58 Eastbound	Link_115	Above ground	553,925	4,177,439	553,877	4,177,473	-10	12
	Link_116	Above ground	553,877	4,177,473	553,197	4,177,952	-10	15
4 to 58 Westbound	Link_119	Above ground	553,881	4,177,478	553,204	4,177,954	-10	15
	Link_120	Above ground	553,927	4,177,451	553,881	4,177,478	-10	15
46 to 48 Eastbound	Link_10	Above ground	554,854	4,176,783	554,703	4,176,889	-3	13
	Link_11	Above ground	554,905	4,176,539	554,913	4,176,630	1	14
	Link_12	Above ground	554,913	4,176,630	554,907	4,176,666	1	14
	Link_13	Above ground	554,907	4,176,666	554,854	4,176,783	1	14
	Link_14	Above ground	554,894	4,176,440	554,905	4,176,539	2	15
	Link_15	Above ground	554,924	4,176,316	554,898	4,176,346	-1	15
	Link_16	Above ground	554,898	4,176,346	554,888	4,176,389	-1	15
	Link_17	Above ground	554,888	4,176,389	554,894	4,176,440	-1	15
	Link_5	Above ground	555,002	4,176,261	554,924	4,176,316	-2	14
	Link_6	Above ground	555,168	4,176,145	555,002	4,176,261	-3	14

Table 4
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San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
46 to 48 Westbound	Link_144	Above ground	555,172	4,176,151	555,007	4,176,268	-4	16
	Link_145	Above ground	554,930	4,176,322	554,905	4,176,350	-2	14
	Link_146	Above ground	554,905	4,176,350	554,896	4,176,389	-2	14
	Link_147	Above ground	554,896	4,176,389	554,902	4,176,439	-2	14
	Link_148	Above ground	555,007	4,176,268	554,929	4,176,323	-2	14
	Link_149	Above ground	554,902	4,176,439	554,912	4,176,537	2	14
	Link_151	Above ground	554,913	4,176,538	554,921	4,176,631	1	14
	Link_152	Above ground	554,921	4,176,631	554,915	4,176,668	1	14
	Link_153	Above ground	554,915	4,176,668	554,858	4,176,790	1	14
	Link_154	Above ground	554,858	4,176,790	554,709	4,176,896	-3	15
47 to 46 Eastbound	Link_104	Above ground	555,334	4,176,028	555,168	4,176,145	-3	15
47 to 46 Westbound	Link_150	Above ground	555,339	4,176,034	555,172	4,176,151	-3	16
48 to 4 Eastbound	Link_31	Above ground	554,042	4,177,355	553,925	4,177,439	-9	13
	Link_34	Above ground	554,206	4,177,240	554,042	4,177,355	-8	13
	Link_4	Above ground	554,703	4,176,889	554,539	4,177,004	-6	13
	Link_93	Above ground	554,539	4,177,004	554,206	4,177,240	-7	16
48 to 4 Westbound	Link_1	Above ground	554,709	4,176,896	554,618	4,176,961	-6	13
	Link_100	Above ground	554,215	4,177,253	554,051	4,177,368	-8	16
	Link_2	Above ground	554,618	4,176,961	554,595	4,176,986	-6	13
	Link_3	Above ground	554,595	4,176,986	554,548	4,177,018	-6	13
	Link_85	Above ground	554,548	4,177,018	554,215	4,177,253	-7	16
	Link_98	Above ground	554,051	4,177,368	553,927	4,177,451	-9	18
5 to 57 Northbound	Link_108	Above ground	553,812	4,177,001	553,788	4,176,913	-4	13
	Link_40	Above ground	553,788	4,176,913	553,764	4,176,826	-1	15
	Link_43	Above ground	553,764	4,176,826	553,740	4,176,739	2	15
	Link_46	Above ground	553,740	4,176,739	553,716	4,176,649	3	15
	Link_47	Above ground	553,716	4,176,649	553,693	4,176,563	6	15

Table 4
CAL3QHCR Source Parameters, Running Emissions
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San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
5 to 57 Southbound	Link_109	Above ground	553,801	4,177,007	553,778	4,176,920	-4	13
	Link_41	Above ground	553,778	4,176,920	553,754	4,176,832	-1	15
	Link_42	Above ground	553,754	4,176,832	553,730	4,176,745	1	15
	Link_45	Above ground	553,730	4,176,745	553,706	4,176,656	3	15
	Link_48	Above ground	553,706	4,176,656	553,683	4,176,569	6	15
54 to 31 Southbound	Link_227	Above ground	554,326	4,176,006	554,134	4,175,736	-1	10
54 to 31 Northbound	Link_228	Above ground	554,138	4,175,733	554,330	4,176,004	-1	10
54 to 55 Eastbound	Link_89	Above ground	554,329	4,176,005	554,165	4,176,121	10	14
	Link_90	Above ground	554,165	4,176,121	553,998	4,176,238	10	14
54 to 55 Westbound	Link_139	Above ground	554,168	4,176,126	554,002	4,176,243	10	14
	Link_140	Above ground	554,332	4,176,010	554,168	4,176,126	10	13
55 to 6 Eastbound	Link_96	Above ground	553,833	4,176,355	553,662	4,176,475	10	12
	Link_97	Above ground	553,998	4,176,238	553,833	4,176,355	10	13
55 to 6 Westbound	Link_137	Above ground	553,836	4,176,360	553,665	4,176,480	10	14
	Link_138	Above ground	554,002	4,176,243	553,836	4,176,360	10	15
56 to 7 Northbound	Link_44	Above ground	553,550	4,176,037	553,526	4,175,948	5	12
	Link_54	Above ground	553,622	4,176,300	553,598	4,176,213	10	15
	Link_58	Above ground	553,598	4,176,213	553,574	4,176,126	10	15
	Link_59	Above ground	553,574	4,176,126	553,567	4,176,103	9	15
	Link_60	Above ground	553,567	4,176,103	553,550	4,176,037	7	15
56 to 7 Southbound	Link_55	Above ground	553,611	4,176,304	553,587	4,176,216	10	15
	Link_56	Above ground	553,587	4,176,216	553,563	4,176,129	10	15
	Link_57	Above ground	553,563	4,176,129	553,557	4,176,105	8	15
	Link_63	Above ground	553,540	4,176,041	553,515	4,175,951	4	12
	Link_64	Above ground	553,557	4,176,105	553,540	4,176,041	8	15
56 to East Eastbound	Link_223	Above ground	553,525	4,175,944	554,188	4,175,475	-6	12
56 to East Westbound	Link_224	Above ground	554,190	4,175,481	553,528	4,175,951	-6	12
57 to 4 Northbound	Link_30	Above ground	553,907	4,177,351	553,884	4,177,264	-8	14
	Link_32	Above ground	553,931	4,177,442	553,907	4,177,351	-9	12
	Link_36	Above ground	553,884	4,177,264	553,860	4,177,176	-7	13
	Link_38	Above ground	553,860	4,177,176	553,836	4,177,089	-6	12
	Link_94	Above ground	553,836	4,177,089	553,824	4,177,045	-6	12
	Link_95	Above ground	553,824	4,177,045	553,812	4,177,001	-5	14

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Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
57 to 4 Southbound	Link_107	Above ground	553,825	4,177,095	553,801	4,177,007	-5	12
	Link_33	Above ground	553,921	4,177,447	553,897	4,177,356	-9	12
	Link_35	Above ground	553,897	4,177,356	553,873	4,177,270	-8	14
	Link_37	Above ground	553,873	4,177,270	553,849	4,177,182	-7	13
	Link_39	Above ground	553,849	4,177,182	553,825	4,177,095	-6	14
58 to 16 Northbound	Link_117	Above ground	553,204	4,177,954	553,102	4,178,207	-6	15
58 to 16 Southbound	Link_118	Above ground	553,197	4,177,952	553,096	4,178,204	-6	15
6 to 5 Northbound	Link_50	Above ground	553,693	4,176,563	553,669	4,176,475	8	16
6 to 5 Southbound	Link_49	Above ground	553,683	4,176,569	553,659	4,176,482	8	15
7 to 6 Northbound	Link_101	Above ground	553,646	4,176,388	553,622	4,176,300	10	15
	Link_51	Above ground	553,669	4,176,475	553,646	4,176,388	10	15
7 to 6 Southbound	Link_52	Above ground	553,659	4,176,482	553,635	4,176,394	9	15
	Link_53	Above ground	553,635	4,176,394	553,611	4,176,304	10	15
7 to East Eastbound	Link_245	Above ground	553,624	4,176,295	554,716	4,175,525	1	12
7 to East Westbound	Link_246	Above ground	554,719	4,175,531	553,626	4,176,300	1	12
8 to 32 Eastbound	Link_215	Above ground	553,386	4,175,518	553,789	4,175,238	-10	12
8 to 32 Westbound	Link_216	Above ground	553,792	4,175,245	553,386	4,175,526	-10	12
8 to 56 Northbound	Link_113	Above ground	553,526	4,175,948	553,515	4,175,906	1	13
	Link_114	Above ground	553,515	4,175,906	553,504	4,175,862	-1	12
	Link_65	Above ground	553,504	4,175,862	553,475	4,175,777	-3	15
	Link_69	Above ground	553,475	4,175,777	553,446	4,175,693	-6	15
	Link_70	Above ground	553,446	4,175,693	553,417	4,175,612	-7	15
	Link_71	Above ground	553,417	4,175,612	553,386	4,175,526	-8	12
8 to 56 Southbound	Link_110	Above ground	553,435	4,175,700	553,406	4,175,616	-7	13
	Link_66	Above ground	553,515	4,175,951	553,493	4,175,869	0	12
	Link_67	Above ground	553,493	4,175,869	553,464	4,175,783	-3	12
	Link_68	Above ground	553,464	4,175,783	553,435	4,175,700	-5	15
	Link_72	Above ground	553,406	4,175,616	553,376	4,175,533	-8	12
9 to 18 Eastbound	Link_61	Above ground	553,019	4,175,252	552,942	4,175,275	5	11
	Link_75	Above ground	553,259	4,175,187	553,171	4,175,208	-3	11
	Link_76	Above ground	552,866	4,175,297	552,804	4,175,315	6	11
	Link_79	Above ground	553,171	4,175,208	553,079	4,175,235	-4	10
	Link_80	Above ground	553,079	4,175,235	553,019	4,175,252	0	11
	Link_81	Above ground	552,942	4,175,275	552,866	4,175,297	5	11
	Link_82	Above ground	552,804	4,175,315	552,691	4,175,348	6	16
9 to 18 Westbound	Link_127	Above ground	553,260	4,175,193	553,172	4,175,214	-3	13
	Link_128	Above ground	553,020	4,175,258	552,944	4,175,280	5	13
	Link_131	Above ground	552,805	4,175,321	552,693	4,175,354	6	12
	Link_132	Above ground	552,868	4,175,303	552,805	4,175,321	6	13
	Link_134	Above ground	553,172	4,175,214	553,080	4,175,240	-4	13
	Link_135	Above ground	552,944	4,175,280	552,868	4,175,303	5	13
	Link_136	Above ground	553,080	4,175,240	553,020	4,175,258	0	13

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Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
9 to 8 Northbound	Link_111	Above ground	553,386	4,175,526	553,357	4,175,442	-9	12
	Link_112	Above ground	553,357	4,175,442	553,328	4,175,359	-8	15
	Link_27	Above ground	553,328	4,175,359	553,298	4,175,276	-6	14
	Link_86	Above ground	553,281	4,175,227	553,267	4,175,189	-4	13
	Link_87	Above ground	553,298	4,175,276	553,281	4,175,227	-5	13
9 to 8 Southbound	Link_102	Above ground	553,376	4,175,533	553,315	4,175,363	-8	12
	Link_73	Above ground	553,286	4,175,280	553,255	4,175,192	-4	12
	Link_74	Above ground	553,315	4,175,363	553,286	4,175,280	-7	15

Notes:

1. Segments are identified by the bounding intersections, using the intersection numbering developed in Figure 26A of the Traffic Report, and by the direction of traffic flow.

2. CAL3QHCR limits relative elevations to a range of -10 meters to +10 meters. All roads have 13.3 meters subtracted from their elevations to allow the lowest road to be at -10 meters.

3. As defined in CAL3QHCR, mixing zone width for a given free flow link is calculated by adding 6 meters to the width of the road. The width of the road is obtained by visual observation of high-resolution aeiral photograph.

Abbreviations:

CAL3QHCR: a steady-state Gaussian dispersion model
UTMx: X coordinate in Universal Transverse Mercator coordinate system, zone 10N
UTMy: Y coordinate in Universal Transverse Mercator coordinate system, zone 10N

Sources:

CHS Consulting Group et al. 2009. Bayview Waterfront Project Transportation Study: Preliminary Draft 1 Report.

Table 5
CAL3QHCR Source Parameters, Queuing Emissions
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Segment[1]	Link	Type	$UTMx_{start}$ (meters)	$UTMy_{start}$ (meters)	$UTMx_{end}$ (meters)	$UTMy_{end}$ (meters)	Relative Elevation[2] (meters)	Mixing Zone Width[3] (meters)
11 to 29 Eastbound	Link_190	Above ground	554,031	4,173,992	554,057	4,173,967	10	4
29 to 59 Northbound	Link_158	Above ground	554,040	4,173,928	554,079	4,173,943	-6	8
29 to 59 Westbound	Link_162	Above ground	553,893	4,173,883	553,868	4,173,873	-6	9
30 to 54 Eastbound	Link_25	Above ground	554,633	4,175,790	554,828	4,175,653	-5	8
31 to 32 Southbound	Link_230	Above ground	553,852	4,175,333	553,791	4,175,246	-9	6
32 to 33 Northbound	Link_231	Above ground	553,716	4,175,133	553,795	4,175,243	-10	4
32 to 33 Southbound	Link_232	Above ground	553,696	4,175,112	553,692	4,175,106	-10	4
32 to Project Westbound	Link_218	Above ground	553,880	4,175,183	553,792	4,175,245	-7	6
33 to 3rd Street Eastbound	Link_211	Above ground	553,680	4,175,106	553,685	4,175,103	-9	4
33 to Project Westbound	Link_214	Above ground	553,697	4,175,099	553,692	4,175,102	-6	4
34 to 29 Northbound	Link_244	Above ground	554,078	4,174,589	554,088	4,174,609	-4	6
34 to 29 Southbound	Link_238	Above ground	554,039	4,174,014	554,071	4,173,950	-4	6
34 to 9 Eastbound	Link_20	Above ground	554,060	4,174,627	554,080	4,174,614	-8	9
34 to Project Westbound	Link_1	Above ground	554,152	4,174,570	554,091	4,174,614	-8	10
34 to North Southbound	Link_226	Above ground	554,109	4,174,646	554,084	4,174,612	-9	6
46 to 48 Eastbound	Link_6	Above ground	555,150	4,176,157	555,168	4,176,145	-3	8
47 to 46 Westbound	Link_150	Above ground	555,194	4,176,136	555,172	4,176,151	-3	10
8 to 32 Eastbound	Link_215	Above ground	553,762	4,175,257	553,789	4,175,238	-10	6

Notes:
1. Segments are identified by the bounding intersections, using the intersection numbering developed in Figure 26A of the Traffic Report, and by the direction of traffic flow.
2. CAL3QHCR limits relative elevations to a range of -10 meters to +10 meters. All roads have 13.3 meters subtracted from their elevations to allow the lowest road to be at -10 meters.
3. As defined in CAL3QHCR, mixing zone width for a given queue link is equal to the width of the road. The width of the road is obtained by visual observation of high-resolution aeiral photograph.

Abbreviations:
CAL3QHCR: a steady-state Gaussian dispersion model
UTMx: X coordinate in Universal Transverse Mercator coordinate system, zone 10N
UTMy: Y coordinate in Universal Transverse Mercator coordinate system, zone 10N

Sources:
CHS Consulting Group et al. 2009. Bayview Waterfront Project Transportation Study: Preliminary Draft 1 Report.

Table 6
Residential Exposure Assumptions for Carcinogens
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Parameter Symbol	Parameter Definition	Units	Average Exposure		High End Exposure	
IR	Inhalation Rate	L/kg-day	271	a	302	b
		m^3/day	17		19	
F	Fraction of Day Exposed	unitless	1	c	1	c
EF	Exposure frequency	days/year	350	a	350	a
ED	Exposure duration	years	70	b	70	b
T	Modeling Adjustment Factor	unitless	1	d	1	d
A	Inhalation Absorption Factor	unitless	1		1	
BW	Body Weight	kg	63	a	63	a
AT	Averaging time	days	25,550		25,550	

Notes:
L = Liter
kg = kilogram
m^3 = cubic meter

[a] Cal/EPA 2003.
[b] BAAQMD 2005.
[c] Residents are assumed to be exposed 24 hours per day, thus a value of 1 is used for the fraction of the day exposed.
[d] Modeling adjustment not necessary for residential receptors.

Source:
Bay Area Air Quality Management District (BAAQMD). 2005. *BAAQMD Air Toxics NSR Program Health Risk Screening Analysis (HRSA) Guidelines.* June.
California Environmental Protection Agency (Cal/EPA). 2003. *Air Toxics Hot Spots Program Risk Assessment Guidelines: The Air Toxics Hot Spots Program Guidance* Manual for Preparation of Health Risk Assessments. Office of Environmental Health Hazard Assessment. August.

Table 7
Carcinogenic and Noncarcinogenic Toxicity Values
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Chemical	Cancer Potency Factor[a]	Chronic Reference Exposure Level[b]	Acute Reference Exposure Level[b]
	($[mg/kg\text{-}day]^{-1}$)	ug/m^3	ug/m^3
1,3-Butadiene	6.00E-01	2.00E+01	----
Acetaldehyde	1.00E-02	1.40E+02	4.70E+02
Acrolein	----	3.50E-01	2.50E+00
Benzene	1.00E-01	6.00E+01	1.30E+03
Formaldehyde	2.10E-02	9.00E+00	5.50E+01
Diesel PM	1.10E+00	5.00E+00	----

Notes:
---- = Value not available.
ug/m^3 = microgram per cubic meter
$[mg/kg\text{-}day]^{-1}$ = per milligram per kilogram-day

[a] Cal/EPA 2009.
[b] Cal/EPA 2008.

Sources:
California Environmental Protection Agency (CalEPA). 2008. *OEHHA Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary.* Office of Environmental Health Hazard Assessment. December 18.
California Environmental Protection Agency (Cal EPA). 2009. Toxicity *Criteria Database.* July 21.

Table 8
Summary of Estimated Cancer Risks, Noncancer Hazard Indices (HIs), and PM2.5 at the Onsite Maximally Exposed Individual Resident (MEIR)
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Sources	Cancer Risk[a]		Noncancer HIs		PM2.5
	Average Exposure	High End Exposure	Chronic HI	Acute HI	$\mu g/m^3$
Existing Scenario[b]	133	148	0.1	0.23	0.5
Scenario with ATCM[c]	39	43	0.06	0.23	0.4
Proposed BAAQMD Thresholds of Significance for Cumulative Analysis	100		1.0	1.0	0.8

Notes
[a] Cancer risks presented as number of estimated cases per million.
[b] The existing scenario assumes current emissions from Bay-View Greenwaste Management facility.
[c] The scenario with ATCM assumes diesel generator located at the Bay-View Greenwaste Management facility is replaced with a new unit which meets the emissions limits specified in the California Air Resources Board Air Toxic Control Measure for Stationary Diesel Engines.

HI = Hazard index
ATCM = Airborne Toxic Control Measure

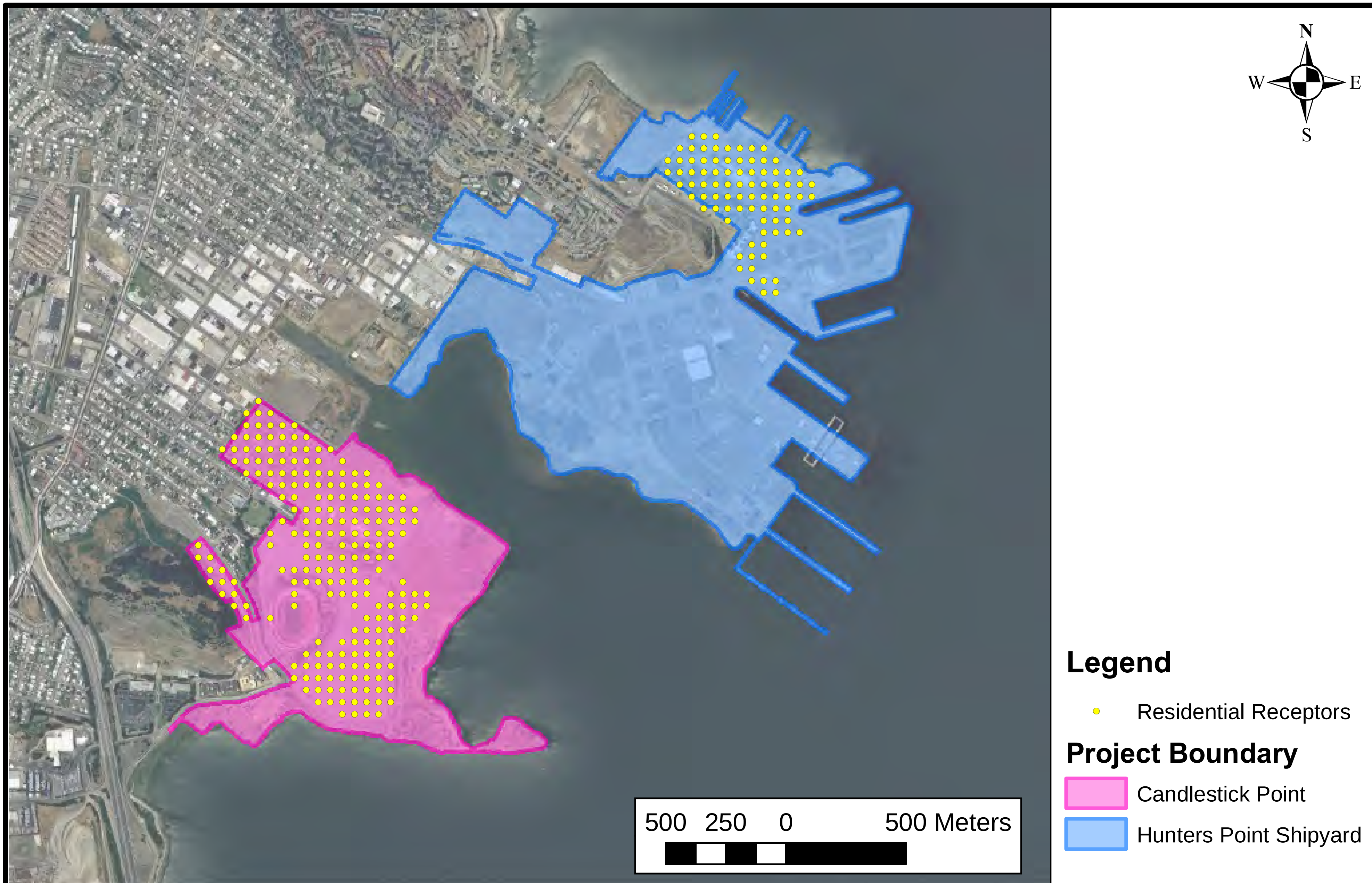
Table 9
Summary of Estimated Cancer Risks, Noncancer Hazard Indices (HIs), and PM2.5 at the Offsite Maximally Exposed Individual Resident (MEIR)
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Sources	Cancer Risk[a]		Noncancer HIs		PM2.5
	Average Exposure	High End Exposure	Chronic HI	Acute HI	$\mu g/m^3$
Existing Scenario[b]	79	88	0.11	0.31	0.74
Scenario with ATCM[c]	72	80	0.11	0.31	0.72
Proposed BAAQMD Thresholds of Significance for Cumulative Analysis	100		1.0	1.0	0.8

Notes
[a] Cancer risks presented as number of estimated cases per million.
[b] The existing scenario assumes current emissions from Bay-View Greenwaste Management facility.
[c] The scenario with ATCM assumes diesel generator located at the Bay-View Greenwaste Management facility is replaced with a new unit which meets the emissions limits specified in the California Air Resources Board Air Toxic Control Measure for Stationary Diesel Engines.

HI = Hazard index
ATCM = Airborne Toxic Control Measure

FIGURES



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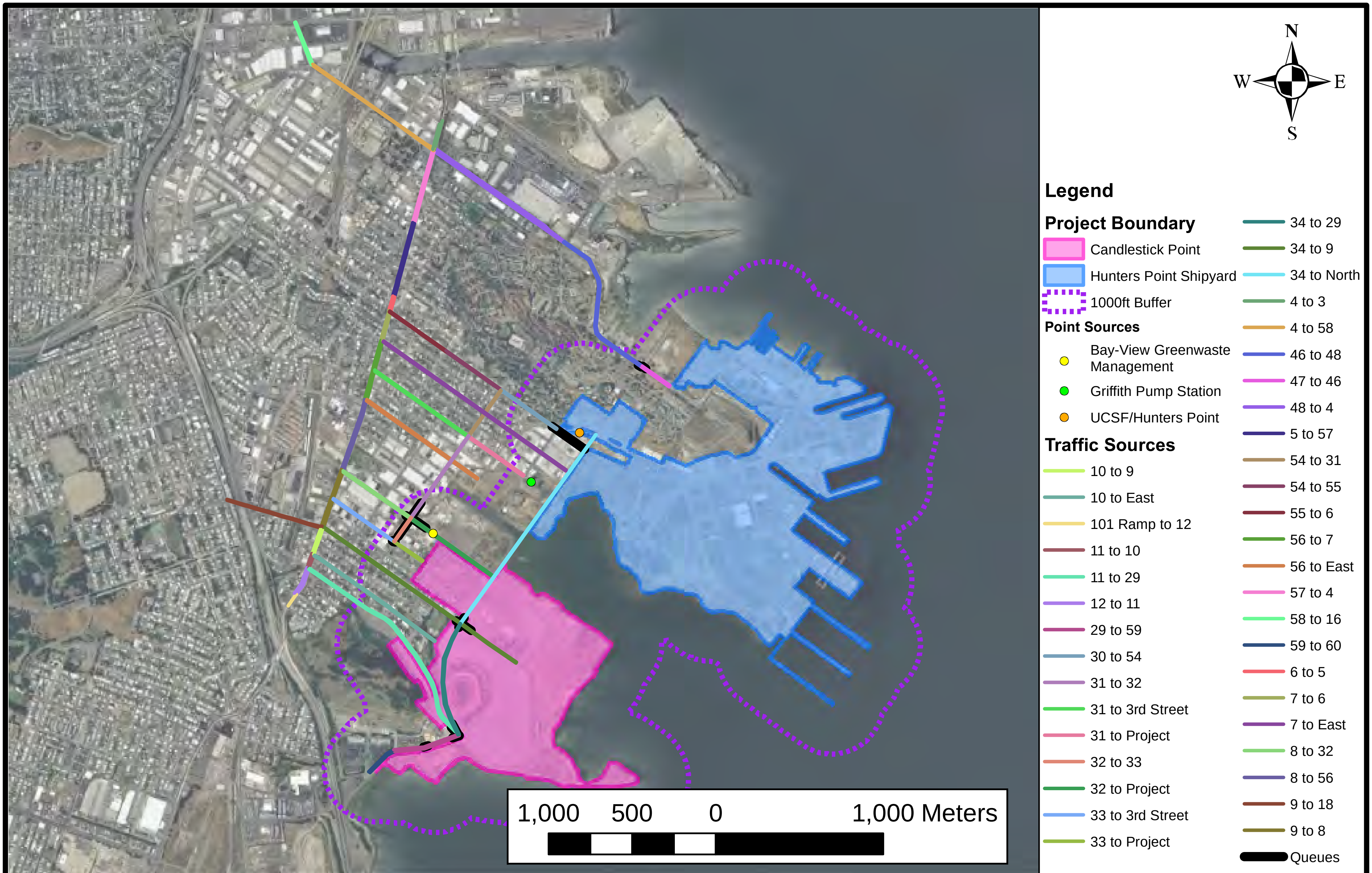
Onsite Residential Receptors for Cumulative Analysis
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure
1

Drafter: Date: Contract Number: Approved: Revised:



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Sources Modeled in Cumulative Analysis
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure
2

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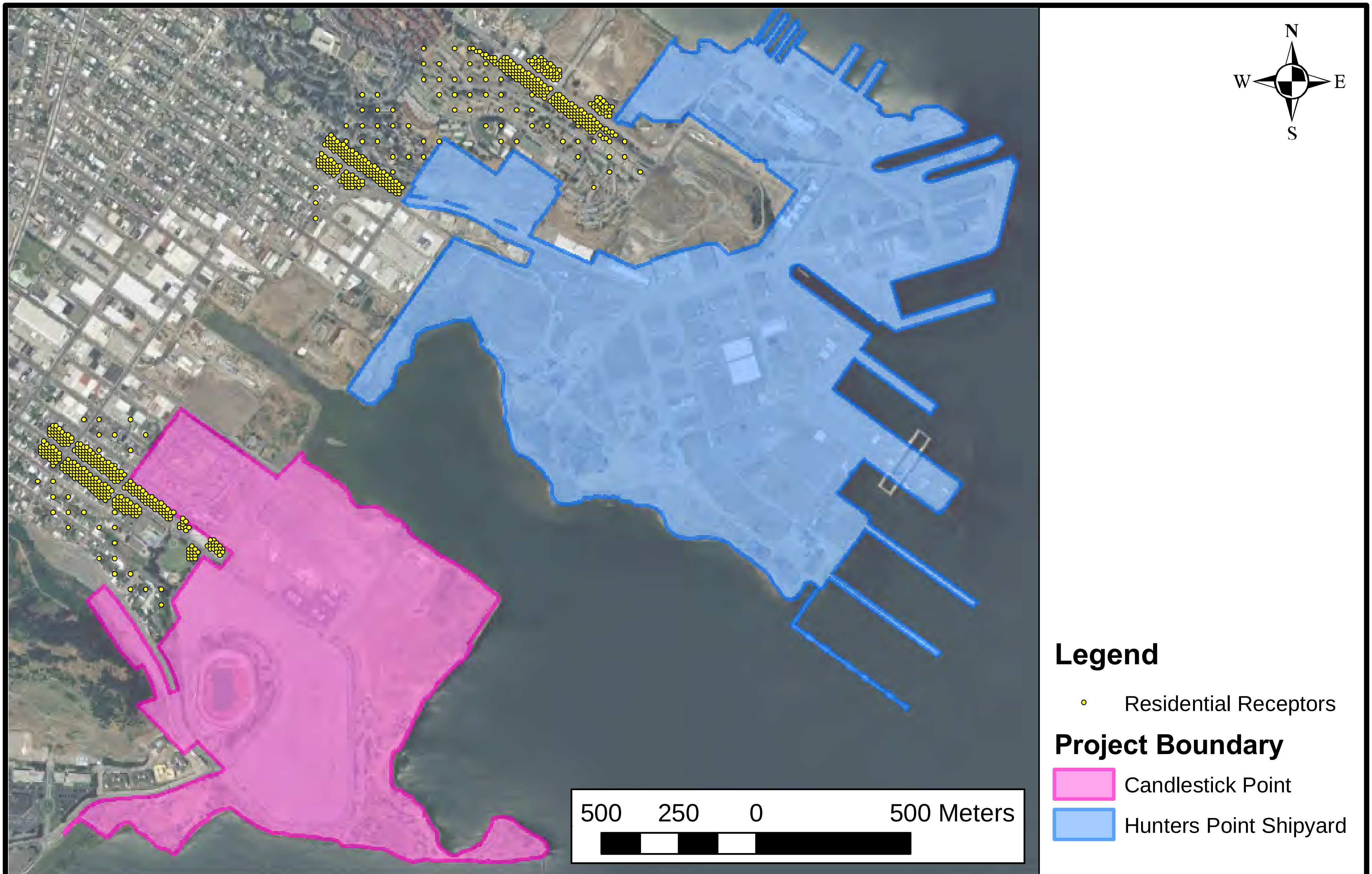

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Offsite Residential Receptors for Cumulative Analysis
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure
3

Drafter: Date: Contract Number: Approved: Revised:

Appendix I1 Wilson Ihrig San Francisco 49ers Stadium Operational Noise Study, October 15, 2009

WILSON, IHRIG & ASSOCIATES, INC.
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BAYVIEW WATERFRONT DEIR

SAN FRANCISCO 49ers STADIUM

OPERATIONAL NOISE STUDY

15 October 2009

Prepared By:

Wilson, Ihrig & Associates
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1.0 Executive Summary

Wilson, Ihrig & Associates (WIA) has conducted a noise study and mitigation evaluation for the Bayview Waterfront EIR Project. The study is limited to operational noise impacts from the San Francisco 49ers stadium proposed to be constructed in the Hunter's Point neighborhood of San Francisco to replace the Candlestick Park stadium now used for 49ers NFL football games. The impact evaluation presented herein includes assessment of noise from two types of events, which are unrelated: football games and large venue popular music concerts. As a result of this study, it was determined that there is a potential for significant noise impacts from both types of events. Potential noise mitigation has been evaluated to determine if these impacts could be sufficiently reduced to a level that is less than significant.

2.0 Introduction

This report presents the results and findings of a noise study conducted by WIA for a proposed San Francisco 49ers stadium (Stadium) option of the Bayview Waterfront Development Project (Project). This option of the Project proposes to construct a new stadium in the Hunter's Point neighborhood for the San Francisco 49ers National Football League (NFL) team. The current location for the 49ers football games is Candlestick Park located approximately 1.25 miles from the proposed site for the new stadium. On certain occasions, the Stadium may also be used for music concerts.

In the study reported herein, WIA evaluated potential operational noise impacts associated with the proposed siting of the Stadium which would be used for football games and could be used for occasional music concerts. The results of the study indicated potentially significant noise impacts. Investigated were various possible noise mitigation options to lessen impacts to the surrounding community for both types of events.

This noise study is being performed to support the Draft Environmental Impact Report (DEIR) for the Project prepared by PBS&J for the City of San Francisco, the Lead Agency. The noise study addresses operational noise impacts associated with 49ers National Football League (NFL) football games of which there are approximately eight (8) every year and the noise impacts associated with music concerts held within the Stadium. The study does not evaluate noise impacts that may occur for other types of events that might be conducted in the proposed Stadium.

The purpose of this noise study is to identify potential noise impacts and noise mitigation for the Stadium.

The steps taken to determine impacts and mitigation were:

- Identify potentially significant sources of environmental noise for the Stadium associated with football games and music concerts
- Evaluate the need for mitigation based on individual source noise emission, multiple source emission, and proximity to adjacent sensitive land uses (e.g., residences)
- Determine if there are appropriate noise mitigation measures and strategies that would lessen impacts

The potentially significant sources of Stadium noise were determined by reviewing the Project description, Stadium configuration plans and the proximity of the site to sensitive receptors, discussions with PBS&J concerning the operational plans for the Stadium, and WIA experience with other similar sports facilities.

There are two sources of noise during football games in the Stadium that could produce audible noise in the surrounding community:

- The spectators at the game
- Amplified speech and music broadcast over the Stadium's sound system.

Both of these sources will be intermittent. Consequently noise intensity and its duration are important with regard to determining impact.

There are two sources of noise during music concerts held in the Stadium that could produce audible noise in the surrounding community:

- The concert audience
- Amplified music broadcast over a concert sound system.

Both of these sources will be intermittent. Consequently noise intensity and its duration are important with regard to determining impact.

WIA reviewed the proposed Stadium site layout, the surrounding topography, and the location of noise sensitive receptors (residences) in the area. Based on its previous experience with large sports facilities and sound system equipment with the guidance of the acoustical consulting firm and sound system designer Rosen, Goldberg, Der and Lewitz (RGDL), WIA developed input parameters to be used in the community noise prediction computer model SoundPLAN®.

Using field measured noise data from its in-house database and other sources, WIA developed reference noise levels for the audience. The Stadium's "house" sound system would be used during football games whereas a band or other musical performer would normally provide their own sound system for a concert. The house sound system will be a fixed public address (PA) system. The concert sound system is a portable system typically set up at field level and in the vicinity of the performer's stage.

For the house sound system, WIA used the Stadium sound system specifications to develop a maximum sound power level output for this source. For the concert sound system, WIA used a typical configuration of loudspeakers for this type of event. The typical details for these two types of sound systems (e.g., type, number of speakers, size, sound radiation patterns) were provided by Joel Lewitz of RGDL. The sound emission characteristics of the sound systems were used in the SoundPLAN® models to project noise levels in the community and evaluate whether noise impacts would potentially occur. The SoundPLAN® noise projection results were used to determine the possible need for mitigation and the preliminary details of such mitigation.

Contained herein are the findings of the study based on WIA's noise analysis and mitigation evaluation. Possible mitigation has been evaluated and preliminary design details were analyzed to determine specific noise reduction benefits. The mitigation presented here will be reviewed by the City of San Francisco for reasonableness and feasibility of implementation. Depending on the result of these reviews, certain mitigation or aspects thereof may be developed further, modified by additional analysis, or even eliminated from further consideration based on conclusions regarding feasibility, and/or cost effectiveness.

3.0 Description of Facility

The site for the proposed 49ers Stadium is shown in Figure 3-1 as is the proximity of nearby land use that might be affected by Project noise. This site is adjacent to San Francisco Bay (on the east) and bounded directly to the north by land proposed for development of R&D facilities. Beyond the R&D development is land proposed for residences. For the purpose of modeling noise source locations in this study, the site and Stadium details contained in project drawings (Ref. 1) were used.

3.1 General Details

The proposed Stadium option would provide a new 69,000-seat NFL stadium for the San Francisco 49ers. The Stadium footprint is on 17.4 acres. The Stadium proper would include seating, ramps and stairs, office and administrative facilities, food service and retail areas, and access facilities for stadium visitors, players and staff. The top row seating would be at an elevation of approximately 156 feet above the playing field. The parking area surrounding the Stadium would serve stadium-related events.

3.2 Operational Details

The Stadium would primarily be used for football games. It also may be used occasionally for popular music concerts. The following is discussion of the general Stadium details and the sound system details relevant to the SoundPLAN® noise prediction models.

3.2.1 Football Games

It is planned that the 49ers Stadium will be used for the team's home football games on weekends and Monday nights, and also during the NFL playoffs should the team advance to that stage. There are expected to be approximately eight 49ers home games at the Stadium during the normal football season.

The following narrative on the Stadium sound system is excerpted from the Project Description.

***Overview of Systems** – All of the electronic systems considered in this outline are related to game operations or fan entertainment. The specific football operations issues listed are based in information from 49'ers game and stadium operations staff. The systems are best considered as parts of an overall whole, rather than independently operating entities.*

<u>Audio Systems – Main Seating Bowl</u>

***Bowl Loudspeaker Options** – The main seating bowl system is requested to be a point source, or "single cluster" loudspeaker type. Due to the asymmetrical seating bowl geometry and the lack of structure in the end zone center lines, a side line cluster system, such as that installed at Soldier Field may be the most appropriate solution. The seating bowl loudspeaker system is to achieve:*

- *Frequency response of 60 to 8,500 Hz minimum*
- *Uniformity of loudness - +/- 3 dBA; +/- 3 dB at 4000 Hz*
- *Ratio of first/direct arrival sound to reverberant or indirect sound - +6 dB.*
- *Maximum continuous loudness of 105 dBA*

3.2.2 Music Concerts

It is proposed that the Stadium may be used occasionally as a venue for popular music concerts performed in front of a large audience. In such a venue (e.g., football stadium), the musicians perform on a large, elevated stage situated on the stadium field. The sound system used by the performers would be one that is specifically designed for touring bands. “Tour” type sound systems generally have the following basic elements.

The sound system would consist of four line arrays at the front of house (FOH) composed of twelve full-size elements such as JBL VerTec VT4889 above four full-size arrayable subwoofers integrated into each full-range speaker array such as JBL VerTec VT4880. Two towers with delayed signals are added at the 50-yard line to fulfill the back of the Stadium audio needs. Each tower has a pair of eight (8) box arrays, an example of which are JBL VT 4889 full-size line array elements. The polar or directivity pattern of the source is included based either on the manufacturer’s published data or the pattern for a typical loudspeakers array used in a concert of this magnitude. To calibrate the sound system source strength inside the stadium, the level was set at 105 dBA at the “mixing position,” which is the typical level observed during a concert.

The typical stage configuration during concerts would likely have the stage in the end zone for large events or at the 50-yard line for smaller shows. The noise impacts associated with large events were analyzed since this represents a worst-case condition. Although the stage could be located at either end of the field (north or south), for the purpose of this study it was assumed the stage is in the northern end field pointing south. In this way most of the sound would be projected towards the Bay and away from residences.

Noise levels from a music concert will fluctuate greatly depending on the type of music being performed (e.g., rock, pop, hip-hop, etc.) and on the performers’ preferred style of loudness. The latter affects the sound power settings used for the event. The loudness is also related to the size of the venue and to some degree the size of the audience. To address the variable range of music genre possible, recorded music samples were used to obtain sound spectra for rock and hip-hop music as two different styles of music that might use the Stadium as a concert venue. Other styles of music would generally be less percussive and therefore presumably have less of an impact on the surrounding community.

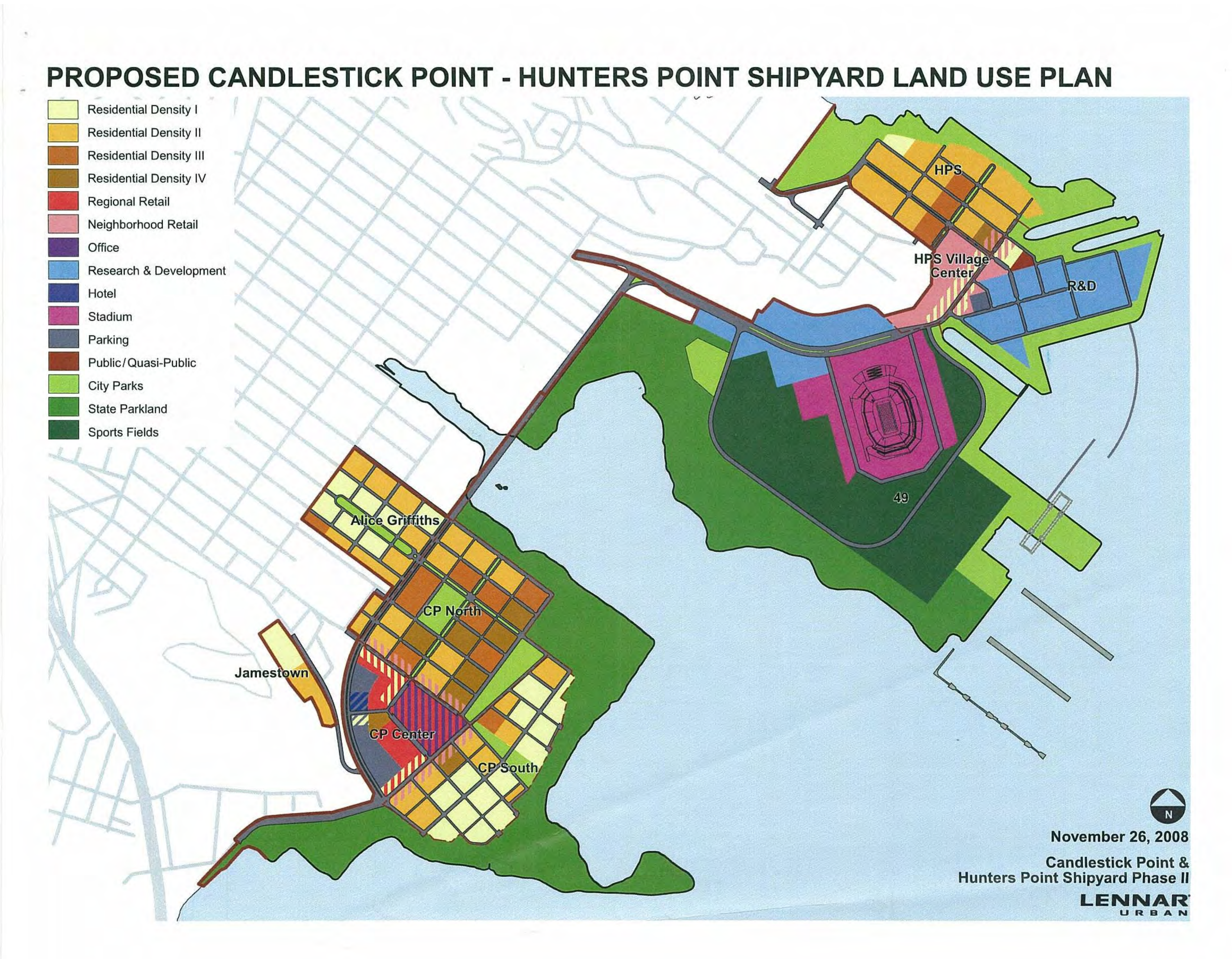

Figure 3-1 Site Plan for Stadium and Proposed Local Surrounding Land Use

4.0 Noise Sensitive Receptors and Noise Criteria

Figure 3-1 indicates the land use designations for areas in the near vicinity of the proposed Stadium building site. Land use in the immediate area of the proposed Stadium site is proposed as part of the Project to be a mixture of R&D, commercial and residential. The residential land, as shown in **Error! Reference source not found.** has the highest degree of sensitivity to noise.

Unlike most community noise, which is typically dominated by transportation sources and occurs throughout the day, the noise during football games associated with sources inside the Stadium although possibly much louder in the immediate vicinity of the Stadium than other noise sources, only affect the environment occasionally.

The primary sources within the Stadium are cheering fans and the Stadium's sound system. In terms of typical community noise sources, these sources of noise are infrequent (i.e., occurring only on days that football games are held). The noise that occurs during a game is also limited in its duration. A typical game lasts for about three hours, although the time the ball is in play is only one hour.

Therefore it is necessary to select appropriate noise criteria, which address the unique nature of the Stadium noise. To arrive at appropriate noise impact criteria we consider the Initial Study Checklist and the associated local standards of the community.

4.1 Initial Study Checklist

There are two or three topics in the Initial Study Checklist that could cause a potentially significant noise impact to occur when the Stadium is used either for an NFL football game or a popular music concert.

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.
- Project may be located within an airport land use plan area (SFIA). Project may expose people residing in immediate area to excessive noise levels.

4.2 Local Noise Criteria

The criteria cited in Environmental Protection Element of the City and County of San Francisco General Plan and the criteria cited in San Francisco Police Code are reviewed to determine which could be applicable to a noise impact evaluation of the Stadium.

4.2.1 Local General Plan

The Environmental Protection Element of the General Plan contains a Transportation Noise (TN) section. Objective 10 of the TN section is to *Minimize The Impact Of Noise On Affected Areas.* Although typically used to evaluate proposed new residential developments, the "Land Use

Compatibility Chart for Community Noise" contained under Objective 11 (***Promote Land Uses That Are Compatible With Various Transportation Noise Levels***) of the TN section, it is proposed that the guidelines the Chart provides can be used to evaluate projected increases in noise and their impact on existing residence based on current ambient levels of community noise.

- For residential developments, an L_{dn} of 60 or less is considered satisfactory with no special noise insulation requirements.

- Where the L_{dn} is between 60 and 70, new construction would be undertaken only after a detailed analysis.

- Where the L_{dn} is over 65, new construction is generally discouraged.

From these general guidelines, we are inclined to conclude that where existing ambient levels in the residential community exceed 65 L_{dn}, increases in community noise, even temporary or periodic increases, could be potentially significant.

4.2.2 San Francisco Noise Ordinance

Article 29 of the San Francisco Police Code regulates the creation of noise in the community by defining noise, how it is measured, and establishing when a noise level is in violation of the Police Code. Some of Article 29 pertains to transportation and construction noise sources. There are three sections of Article 29 that appear to be relevant to the proposed Stadium project. Note that the language of the Code has been paraphrased below and what appears to be relevant to the Project was included.

- Sec. 2901. Definitions

  To address general community noise sources, "ambient" means the lowest sound level repeating itself during a minimum ten-minute period as measured with a type 1, precision sound level meter, using slow response and A-weighting. For the purpose of this chapter, in no case shall the ambient be considered to be less than Forty-five dBA for exterior noise.

  To address music from entertainment venues, "low frequency ambient" means the lowest sound level repeating itself during a ten-minute period as measured with a sound level meter, using slow response and C-weighting. For the purpose of this chapter, in no case shall the local ambient be considered to be less than Fifty-five dBC for exterior noise.

- Sec. 2909 Noise Limits

  (b) Commercial and Industrial Noise Limits

  No person shall produce or allow to be produced by any machine, or device, music or entertainment or a combination of same, on commercial or industrial property a noise level more than eight dBA above the local ambient at any point outside the property plane. With respect to noise generated by a licensed Place of Entertainment, in addition to the dBA criteria a secondary low frequency dBC criterion shall apply to the definition above. No noise or music associated with a licensed Place of Entertainment shall exceed the low frequency ambient noise level defined by Section 2901 (f) by more than eight dBC.

- Sec. 2910 Variances

  The Directors of Public Health, Public Works, Building Inspection, or the Entertainment Commission, or the Chief of Police may grant variances to noise regulations, over which they have jurisdiction pursuant to Section 2916. All administrative decisions granting or denying variances are appealable to the San Francisco Board of Appeals.

Although not explicitly stated, it would appear that the ambient noise levels defined by Section 2901 would be consistent with what is called the L_{90} (level exceeded 90% of the time) or the background noise level, since the operative words are the “lowest repeating sound level.” If this is in fact the intent of Article 29 and it appears that it is then the noise limits are L_{90} + 8 dBA for general community noise and L_{90} + 8 dBC for low frequency noise such as might be produced by amplified music.

The Article 29 noise limits are quite restrictive, in particular for events that are infrequent, generate transient noises and last for a limited duration. Article 29 noise limits have more relevance to noises that are permanent and continuous. The noise produced during a football game is very transient in nature. Cumulatively the noises would last for less than 1 hour and occur eight times a year. The very transient nature of football game noises are such that each noise event typically lasts for 1 minute or less except of course during the halftime show when the a music program is performed. The halftime show may last for approximately 20 minutes.

In the case of a music concert, the noise producing portion may cumulatively last approximately 2 to 3 hours and occur once or twice a year. However, unlike football game noise (crowd cheering and PA announcements), music concert noises would typically last for periods of 10 minutes each followed by short pauses. This would typically repeat for an hour until the performers took a break.

Section 2910 allows for variances from the noise regulations. It would appear that in the case of the Stadium the Entertainment Commission would have jurisdiction. Section 2910 seems to indicate that under certain circumstances discretion is applied to enforce the noise limits.

Although they are exempted, common community noise sources such as automobiles, buses and trucks routinely generate levels that exceed the Article 29 noise limits. There are also yearly events that occur in San Francisco, which produce noise levels in excess of Article 29 noise limits, examples of which are the Blue Angels flying showing the occurs during Fleet Week and there are fireworks on the 4th of July.

Under the circumstances and with all due consideration, applying the Article 29 noise limits as thresholds for significant impacts would appear to be inconsistent with the intent of CEQA. However, the noise projections for a football game and for a music concert are compared to Article 29 noise limits and discussed.

4.2.3 L_{max} Criterion

It is common to apply a limit to the maximum noise level (L_{max}) when noise is transient or even continuous but of short duration. The maximum noise level that would interfere with normal speech indoors is commonly used as a criterion. Noise levels that exceed 60 dBA would generally be considered to cause interference with normal speech or interference with listing to television, whereas noise levels that are less than 55 dBA would generally not interfere. The amount of sound reduction typically obtained from residential structures with windows closed ranges from 15 to 20 dBA. Consequently, an exterior noise level that did not exceed 75 dBA would not be expected to substantially interfere with normal speech indoors. Exterior levels that exceeded 75 dBA might be expected to interfere with speech indoors or comfortably listening to television. We propose that a reasonable outdoor L_{max} criterion is 75 dBA.

4.2.4 Audibility of Game Sounds at Greater Distances from the Stadium

It may be possible for individuals in the noise study area at times and under the right weather conditions to hear sounds from NFL football games and music concerts even though the noise levels associated with these sounds do not necessarily exceed local standards such as Article 29. Sometimes this may occur at distances removed from the Stadium (e.g., greater than 1 mile) and in particular in neighborhoods where there is low background ambient noise.

Audibility of Stadium sounds might be cause for concern among certain individuals in the community bothered by such sounds. However, in the case of the proposed Stadium, this is not expected to cause a significant noise impact, because Candlestick Park currently exists and is used for the 49ers games. Presumably under the right weather conditions current 49ers game sounds from Candlestick Park can be heard over a wide area. Consequently this phenomenon is already part of the existing ambient condition.

4.3 Proposed Significance Thresholds for Noise Impacts

WIA proposes the following steps in determining whether a significant noise impact is projected to occur:

a) Evaluate the change in L_{dn} on a typical football day due to operational noise. Minor changes of less than 1 dBA would be considered less than significant regardless of the existing ambient. Greater changes of more than 1 dBA could be considered potentially significant if the existing ambient L_{dn} exceeds 65 or the change in the L_{dn} would exceed 65.

b) Evaluate whether projected maximum operational noise levels (L_{max}) exceed 75 dBA.

4.4 Noise Sensitive Receptors Potentially Affected by the Project

The proposed Stadium site is on the land that was the former Hunters Point Shipyard (HPS). The land is now vacant except for a couple of large, unoccupied buildings. There are currently four residential neighborhoods to the north and west of the HPS site. Most of the residences in these neighborhoods are single-family homes, but there are apartments as well.

WIA conducted long-term ambient noise measurements at six locations in these neighborhoods. The locations of these measurements are indicated as N1 through N6 on the aerial photo in **Error! Reference source not found.**. As discussed further below, there are additional noise sensitive receptor locations which WIA has modeled as part of this analysis in order to address the range of community environments affected. All ten noise sensitive receptors studied are shown on the aerial photo in Figure 4-2 where R1 through R6 represent the same locations as N1 through N6. The long-term ambient noise measurements were conducted first by recording A-weighted community noise levels in January 2009 and then C-weighted community noise levels in July 2009.

The topography of the area surrounding the Stadium site is somewhat complex. Directly to the north there is a bluff that forms the end of a ridge extending to the northwest almost to Third Street. The bluff is currently being developed as residential land by Lennar (Phase I). The ridge shields the residential portion of the Hunters Point neighborhood from the Stadium site. To the southwest is Candlestick Point and above that to the west is the Bayview Heights neighborhood which elevated above the surrounding terrain. To the northwest of the Stadium site the land is generally flat and rising to the Silver Terrace neighborhood.

The noise study area, for the Stadium option of the Project, extended out to approximately 1½ miles away from the site. The reason for having such a large study area was to include receivers that while not normally affected by Project noise associated with the Stadium, under certain metrological conditions might experience higher levels of noise than usual. Such conditions occur only infrequently.

4.4.1 Hunters Point Neighborhood

There are existing residences relatively near the Stadium site and there also new residential areas proposed for the Project. Lennar Corporation is also currently developing land under the Hunters Point Shipyard Phase I (Phase I) redevelopment plan, which will include residences just to the north of the Project site. The closest existing residential land to the proposed Stadium site is located just north of Donahue Street.

Receptor location N3 (located near the corner of Donahue Street and Kirkwood Avenue) is generally characteristic of the quieter portions of this neighborhood. However this may change depending on traffic patterns once the Phase I Lennar development is completed. The ambient noise in this part of the Hunters Point neighborhood was measured to be L_{dn} 58 to 62 (Saturday through Monday). The noise levels on the Saturday (1/10/09) when measurements were obtained may have been elevated somewhat by construction grading work occurring on the Lennar property directly across Donahue Street. The normal ambient noise is due to a combination of motor vehicles on local and distant streets.

Receptor location N4 (located on Kirkwood Avenue near its intersection with Ingalls Street) has slightly more traffic than does N3. The ambient noise in this part of the Hunters Point neighborhood was measured to be L_{dn} 62 to 65 (Saturday through Monday) with higher levels on Saturday than on the other two days. The ambient noise is due to a combination of noise from motor vehicles on local traffic streets, but primarily on Hunters Point Boulevard.

Receptor location N5 (located near the intersection of Hunters Point Boulevard and Hawes Street) has more traffic than does N3. The ambient noise in this part of the Hunters Point neighborhood was measured to be L_{dn} 62 to 65 (Saturday through Monday) with higher levels on Saturday than on the other two days. The ambient noise is due to a combination of noise from motor vehicles on local traffic streets, but primarily on Hunters Point Boulevard.

In addition to these receptor locations, two other locations were included in the study. Receptor location R7 (at what used to be the intersection of Jerrold Avenue and Coleman Street) is in the area currently being developed by Lennar as Phase I. This is at the closest residential land in this area. Receptor location R8 (on what used to be Robinson Street near Horne Avenue) is representative of the new residential land proposed as part of the Project. No ambient measurements were obtained for these receptors, since they are yet to be developed. However, the ambient conditions will be somewhat like those at N3 and N4 with an L_{dn} probably between 58 and 63 depending on local traffic conditions.

4.4.2 Bayview Neighborhood

This neighborhood is bounded by US101 on the west, Cesar Chavez Street on the north, Gilman Avenue on the south and the Hunters Point neighborhood on the east. It is primarily a residential neighborhood, but also with commercial land in particular along Third Street. Third Street runs through the center of this neighborhood and is a major noise source in addition to US101. The closest homes to the Stadium site in this neighborhood are approximately 3,965 feet away.

Receptor Location N1 (located on Carroll Avenue Walker Drive) is characteristic of the generally noisier portion of this neighborhood, since it is along a truck route. The ambient noise in this part of the Bayview neighborhood was measured to be L_{dn} 63 to 67 (Saturday through Monday) with higher levels on Saturday and Monday than on Sunday. The ambient noise is primarily to traffic on Carroll Avenue.

Receptor location N2 (located on Revere Avenue near Ingalls Street) is characteristic of the somewhat quieter portions of this neighborhood. The ambient noise in this part of the Bayview neighborhood was measured to be L_{dn} 63 to 65 (Saturday through Monday) with higher levels on Monday than on the other two days. The ambient noise is due to a combination of noise from motor vehicles on local traffic streets, but primarily on Ingalls Street.

Additional receiver locations were used to project operational noise levels for the Stadium. They include R9 (located on Palou Avenue near Lane Street) and R10 (located on Bayview Circle near Newhall Street). No ambient measurements were obtained for these receptors. However, it is reasonable to assume that the ambient conditions at R9 will be somewhat like those at N2, with an L_{dn} probably between 63 and 65 depending on local traffic conditions. The ambient conditions at N10 will be somewhat like those at N4, with an L_{dn} probably between 58 and 62 depending on local traffic conditions.

4.4.3 Bayview Heights Neighborhood

This neighborhood is bounded by Gilman Avenue, the San Francisco Bay and US101. It is primarily a residential neighborhood, but also includes Candlestick Park. The closest homes to the Stadium site in this neighborhood are approximately 6,400 feet away. Receptor Location N6 (located at the corner of Jamestown Avenue and Hawes Street) is characteristic of the generally quieter portion of this neighborhood, since it is shielded from US101 and is removed somewhat from Third Street.

The ambient noise in this part of the Bayview Heights neighborhood was measured to be L_{dn} 59 to 60 (Saturday through Monday). The ambient noise is due to a combination of noise from motor vehicles on Gilman Street and some local traffic on Jamestown Avenue. However, on football game days, Jamestown is a major access route to Candlestick Park.

4.4.4 Silver Terrace Neighborhood

Somewhat beyond the study area is the neighborhood of Silver Terrace, which is bounded on the west by US101 and Industrial Street on the north. Silver Avenue bisects the neighborhood. This neighborhood is approximately 2 miles from the Stadium site and therefore was considered to be sufficiently far enough away as to not be significantly impacted.

4.4.5 Nearby Non-residential Land Uses

There are R&D facilities proposed directly adjacent to the Stadium site. These uses would normally be occupied during the daytime work hours on weekdays, but not on the weekend or at night when football games would be held. Consequently, these future facilities were not considered to be noise sensitive for the purpose of this study. There are also existing light industry and warehouse land use to the west and northwest of the Stadium site. This type of receptor is not generally considered to be noise sensitive.

4.5 Ambient Noise Survey

WIA first conducted A-weighted, ambient noise measurements over the course of three days in January 2009. Long-term ambient noise data were obtained between Saturday and Monday, January 10 to 12. **Error! Reference source not found.** indicates the location of the long-term ambient noise measurement locations. WIA also conducted another set of the ambient noise measurements in July 2009 by logging C-weighted levels at the same locations used in January 2009. Both sets of noise data were obtained using Larson Davis digital, sound level meter, logging instruments at six locations. The loggers were mounted to utility poles approximately 12 ft above the ground.

4.5.1 A-weighted Ambient Noise Levels

Hourly data were recorded for the energy average (L_{eq}) and statistical noise levels (L_n, where n=90, 50, 10, and 1) also known as the level exceeded n% of the time. The full hourly data for each of the six measurement locations for the three days are contained in Appendix A. Table 4-1 contains a summary of the L_{dn} measurements by location for each full day of the survey.

Table 4-1 Existing Day-Night Noise Levels (Ldn)

Location ID	Description	Saturday 10 Jan 2009	Sunday 11 Jan 2009	Monday 12 Jan 2009
N1	Carroll Avenue north of Walker Drive	67	63	67
N2	Revere Avenue between Ingalls Street and Jennings Street	64	63	65
N3	Donahue Street between Kirkwood Avenue and Jerrold Avenue	62	58	59
N4	Kiska Road between Reardon Road and Ingalls Street	65	65	66
N5	Hawes Street near Hunters Point Boulevard	65	62	64
N6	Jamestown Avenue at Hawes Street	60	59	60

Table 4-2 contains a summary of the range of A-weighted L_{90} levels), at times when a football game might occur: afternoon (3pm to 6pm) on the weekend and evening on Monday (6pm to 9pm).

Table 4-2 Existing A-weighted Background Noise Levels (L_{90})

Location ID	Description	Saturday[1] 10 Jan 2009	Sunday[1] 11 Jan 2009	Monday[2] 12 Jan 2009
N1	Carroll Avenue north of Walker Drive	45 to 46	45 to 49	43 to 47
N2	Revere Avenue between Ingalls Street and Jennings Street	48 to 49	47 to 50	45 to 49
N3	Donahue Street between Kirkwood Avenue and Jerrold Avenue	42 to 45	43 to 45	41 to 43
N4	Kiska Road between Reardon Road and Ingalls Street	45 to 48	42 to 43	44 to 45
N5	Hawes Street near Hunters Point Boulevard	47 to 50	44 to 46	43 to 48
N6	Jamestown Avenue at Hawes Street	47 to 50	49 to 50	46 to 48

1 Afternoon 3pm to 6pm
2 Evening 6pm to 9pm

4.5.2 C-Weighted Ambient Noise Levels

Hourly data were recorded for the energy average (L_{eq}) and statistical noise levels (L_n, where n=90, 50, 10, and 1) also known as the level exceeded n% of the time. Table 4-3 contains a summary of the C-weighted L_{90} levels at night during the time a concert might occur (7pm to midnight).

Table 4-3 Existing C-weighted Background Noise Levels (L_{90}) at Night

Location ID	Description	Range	Median
N1	Carroll Avenue north of Walker Drive	58 to 63	60
N2	Revere Avenue between Ingalls Street and Jennings Street	55 to 62	58
N3	Donahue Street between Kirkwood Avenue and Jerrold Avenue	53 to 60	56
N4	Kiska Road between Reardon Road and Ingalls Street	55 to 64	59
N5	Hawes Street near Hunters Point Boulevard	56 to 64	60
N6	Jamestown Avenue at Hawes Street	--	--

1 Location of Long-term Ambient Noise Measurement

Location of All Noise Study Receptors

4.6 General Conclusion on Existing Ambient Noise

The existing ambient noise measurement data indicate variable conditions within the noise study area, as would be expected, with some areas which are quieter than others. From Table 4-1 it can be seen that the measured L_{dn} ranges from 58 to 67, with the highest level measured at N1, which is due to a higher level of truck traffic there than elsewhere. Noise levels on the weekend, as would be expected were lower (from 1 to 4 dBA) on Sunday than on Saturday and Monday's noise levels were generally similar to Saturday's.

The ambient noise conditions in the study area can be characterized as being generally noisy with L_{dn} values that, except in two locations (N3 and N6) approach or are greater then than 65. An L_{dn} of 65 can be considered the threshold of unacceptable for new residential development. It was observed that N3 and N6 had less traffic than the other locations measured, which would explain why these locations are quieter than the others.

Background A-weighted noise levels at the six measurement locations indicate a range of 42 to 50 dBA taking into account all locations. At quieter locations (N3 and N4), a median L_{90} is about 44 dBA. At the rest of the locations (N1, N2, N5 and N6) a median L_{90} is about 48 dBA.

Background C-weighted noise levels at night range from 53 to 63 taking into account all six locations. For quieter locations (e.g., N3) the median L90 is about 56 dBC. For the other locations, the median L_{90} is about 59.

5.0 Project Noise Sources and Prediction Model for Football Games

During football games, the noise sources that will likely have the most potential to affect the stadium surroundings will be: a) noise from the crowd and b) amplified speech, music and/or sound effects from the sound system. The intensity of the crowd noise is not controllable nor would that be desirable and will vary depending on the number of people and their reactions to what is happening on the field. Further there are no feasible physical changes other than proximity to receptors that can be made to lessen crowd noise with an open stadium design. In general, the Stadium sound system noise sources is the easier of the two noise sources to control. This can be accomplished through the selection of the loudspeakers and their orientation.

5.1 Crowd Noise

WIA modeled the noise from the audience in the Stadium as an area source with uniform sound power distribution. The model assumes the exposed seating areas contain a total of approximately 65,000 seats (i.e., all seats except the enclosed suites).[1] Figure 5-1 illustrates the extent of the crowd area based on the outline of the seating sections angled from the top seating row down to the field level.

The noise spectrum (i.e., frequency content) is based on 1/3 octave band data that WIA obtained from measurements for another stadium project. WIA has adjusted the 1/3 octave band data to represent the total sound power for a full capacity crowd at the 49ers Stadium. The underlying metric for the sound power derivation is the L_1 (levels exceeded only 1% of the original measurement period). Refer to Figure 5-2 which shows the reference spectrum. While use of the L_1 is more conservative than other metrics such as an L_{eq} or a set duration, WIA believes this is more appropriate as a starting point for this study. The crowd noise projections are thus representative of anticipated relative maximum noise levels. However as the duration of event noise levels is also important with respect to community noise standards and proposed impact criteria, WIA also made projections that account for anticipated duration of event noise levels for a typical game as described in Section 6.

[1] Based on the number of seats listed in “Areas and Seat Counts etc 11-20-2006.xls” for the Lower, Mid, and Upper Bowl general seating sections (57,834 seats) adjusted to included club seats in the Red Zone, Main, and Mezzanine sections for a total of approximately 65,000 seats. Assumes approximately 5.38 ft^2 (0.5 m^2) per seat.

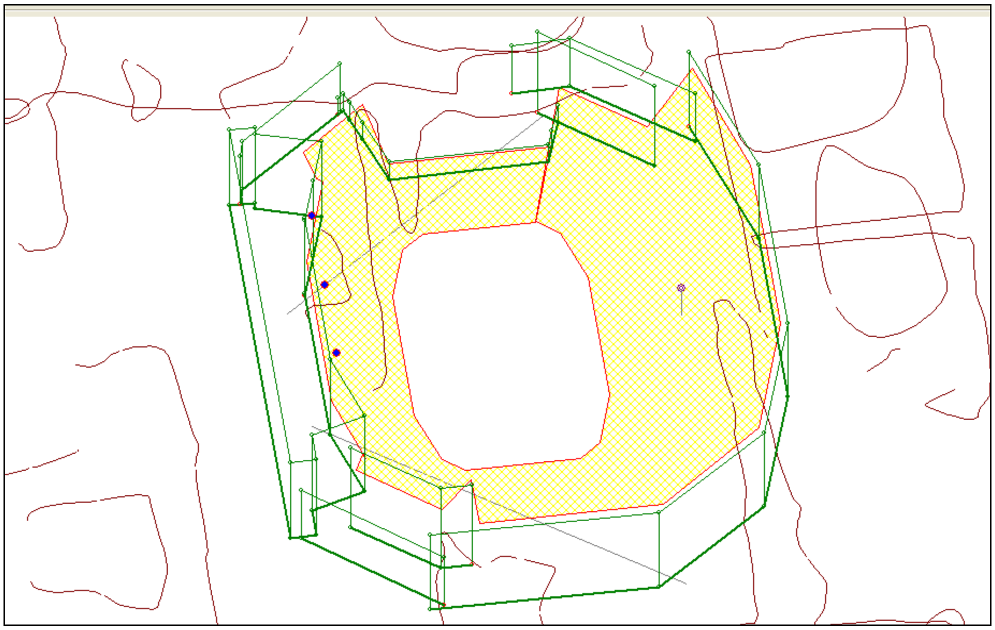

Figure 5-1 Computer Model Representation of Crowd Noise Area Source

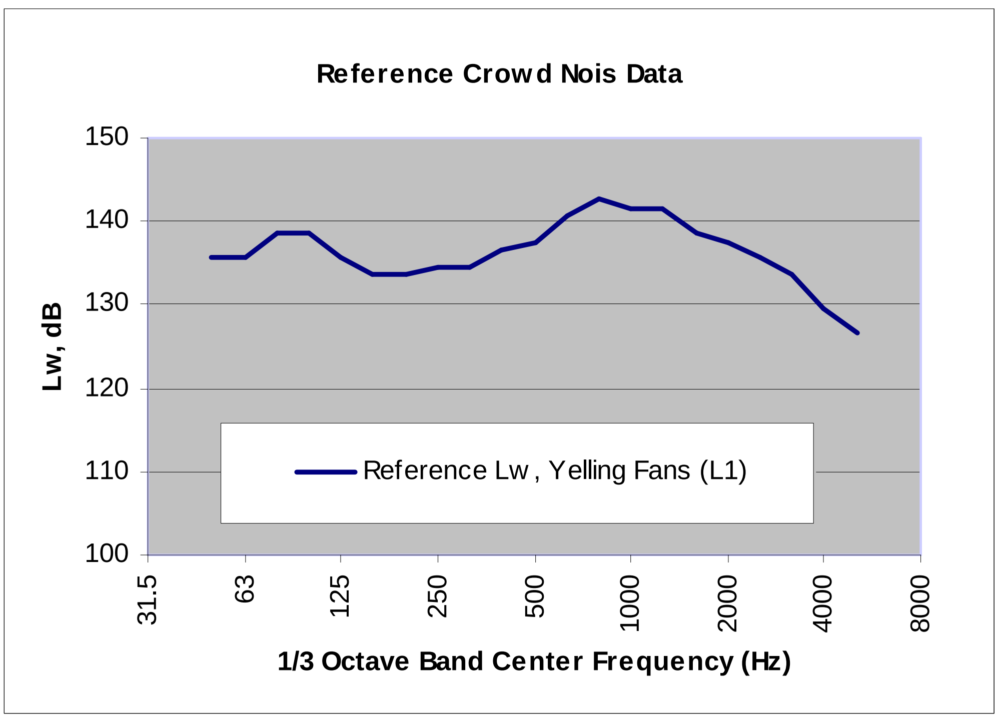

Figure 5-2 49ers Crowd Noise Reference Sound Power Levels

5.2 Stadium Sound System Noise

The Stadium will have a sound system which WIA anticipates would be similar to that which is currently installed at Soldier Field in Chicago. Consequently a similar sound system design concept served as the basis for developing the Stadium model. Figure 5-3 shows part of the sound system at Soldier Field.

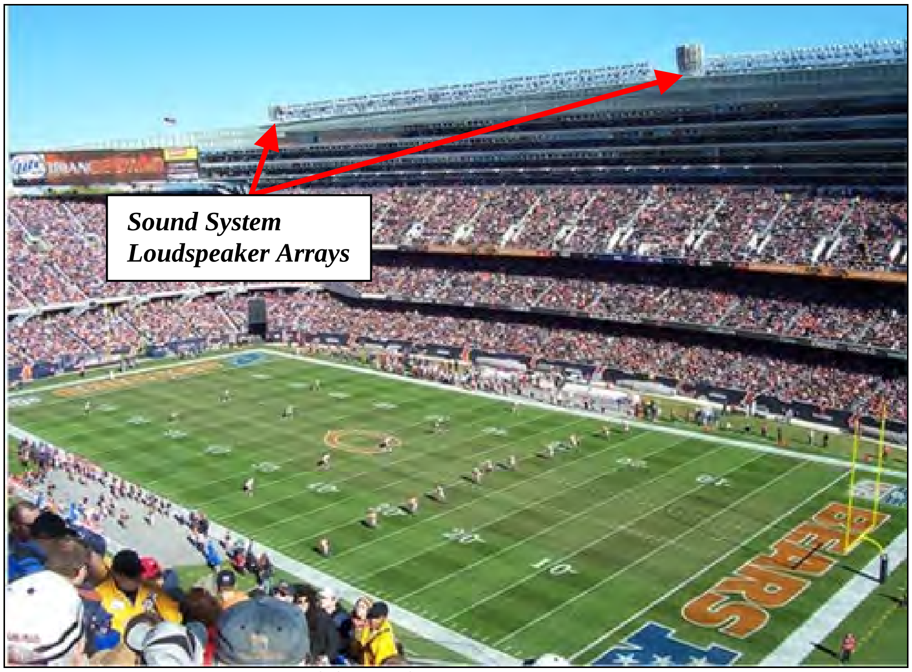

Photo Source: http://www.stadiumsofnfl.com/nfc/images/soldmain08.jpg

Figure 5-3 Soldier Field in Chicago, Illinois

The Stadium sound system would likely use JBL VLA or similar type series arrays with a sideline (as opposed to end-zone) cluster configuration for the following reasons:

1. The configuration of the suites along one sideline is a good place to locate the side cluster, especially since there are no loudspeaker mounting opportunities on the opposite side.

2. The difference between an end-zone cluster and side line cluster is that in the side cluster the three arrays would be “distributed” with the center array on the roof of the suites at the 50 yard line covering all the seats on the opposite side between the 10 yard lines. The other two clusters will also be on opposite ends of the roof at the 10 yard lines covering the remaining seats from the 10 yard lines around through the end zones.

Figure 5-4 and Figure 5-5 illustrate the general concept configuration in plan and section, respectively. The greatest potential noise impact would likely be from three large arrays on the roof of the suites pointing across the field out toward the opposite seats. As shown in the section view, the center array assumes a throw on axis of about 504 ft from the roof top to the seating plane.

Each of the three arrays is assumed to have a horizontal coverage of about 60 degrees and a vertical coverage of about 30 degrees. These are the 6 dB down points of the loudspeaker array coverage. The horizontal coverage is determined by the type of device used in the array, in this case JBL VLA601H. The vertical coverage is controlled by the number of individual components in the array (it will be probably be about six, as shown), and by the “splay” of the array (the angle between components).

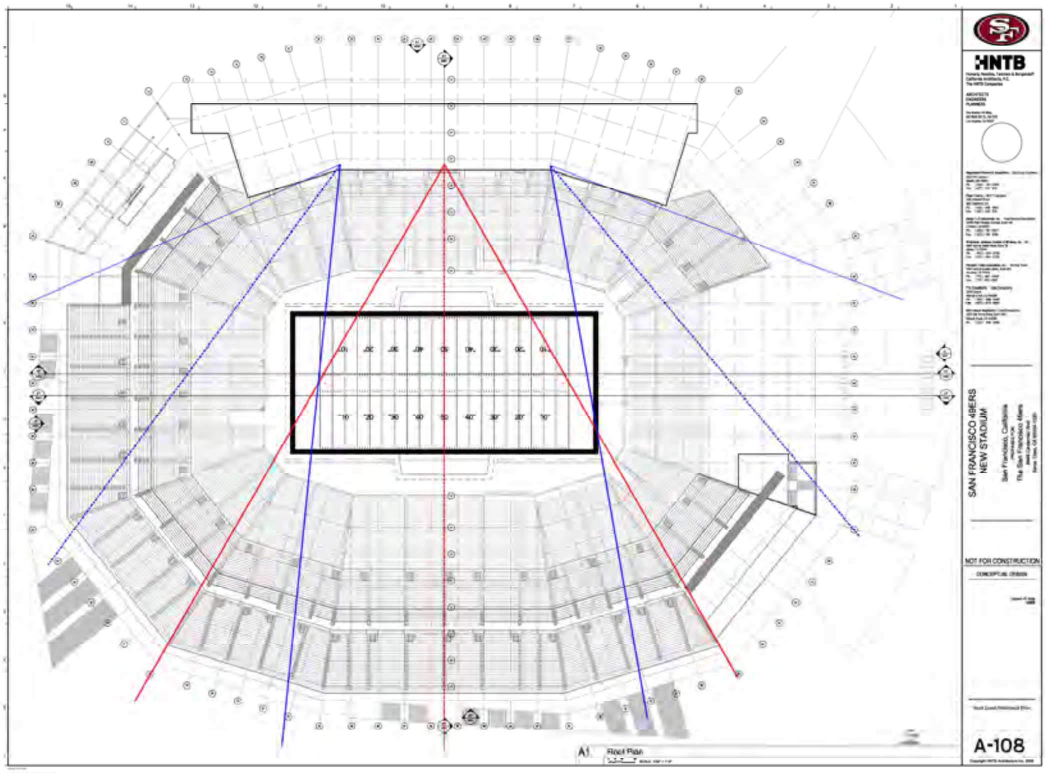

Figure 5-4 Plan View of Sideline Cluster Sound System Configuration Concept

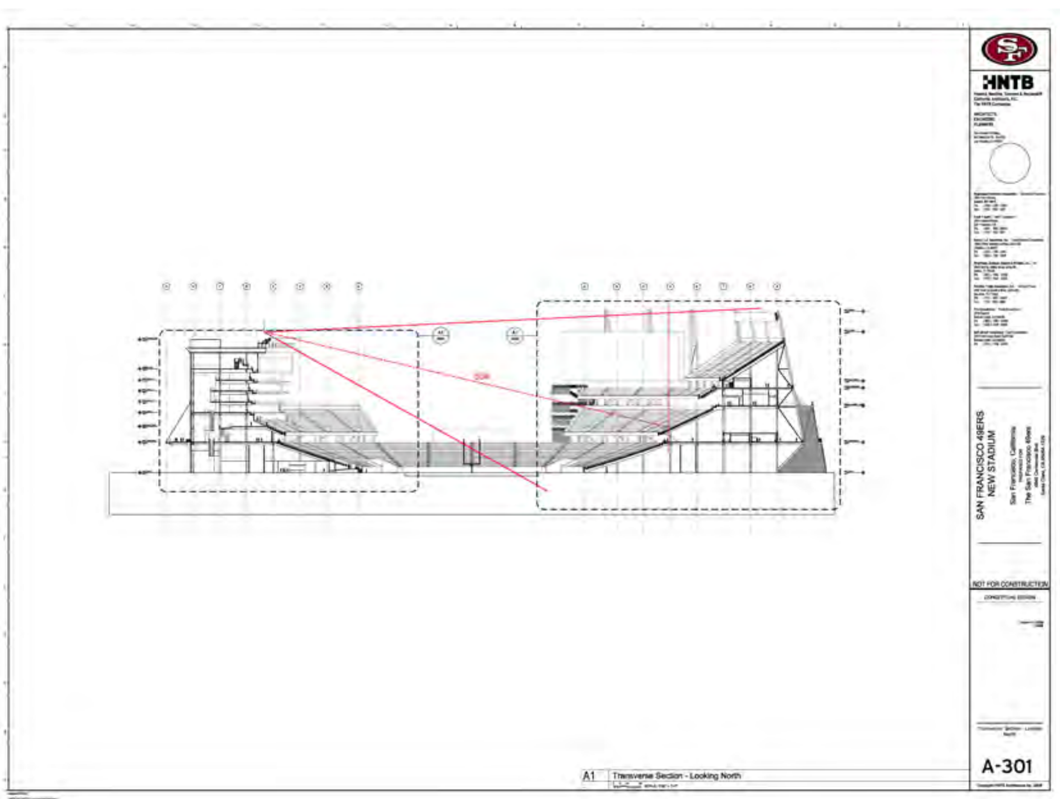

Figure 5-5 Section View of Sideline Cluster Sound System Configuration Concept

Figure 5-6 shows the location of the three line array clusters with respect to the Stadium in the computer model. In modeling the sound system noise source, WIA has assumed:

- The sound system achieves a sound pressure level of 105 dBA at the seats,
- Sound power levels based on pink noise (equal sound power per 1/3-octave band)[2],
- Point source attenuation for each cluster positioned at a height of 169 ft (51.5 m),
- 6-box line array built using EASE[3] software to create 500 Hz and 1 kHz directivity polar plots in horizontal and vertical directions,
- 500 Hz directivity pattern assigned to octave bands 500 Hz and below and 1 kHz directivity pattern assigned to octave bands 1 kHz and above.

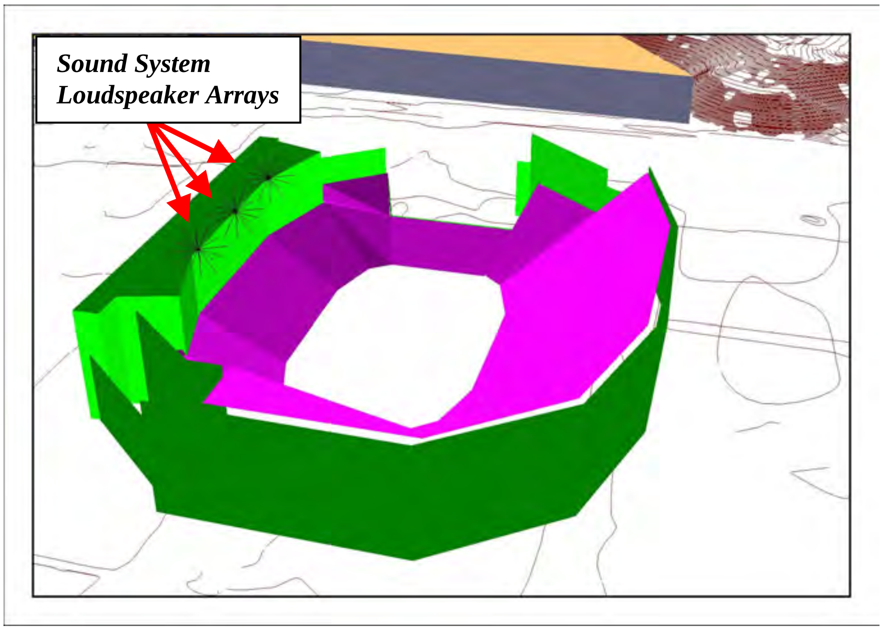

Figure 5-6 Computer Model of Stadium Sound System

The system will likely include other loudspeaker components (not currently in the model), such as small distributed loudspeakers covering under balcony seating opposite the suites which do not have line of sight to the clusters. The seats on the suites side of the field would be covered by distributed loudspeakers mounted on and under the suites. This study does not include any distributed loudspeakers since these would be small and pointing down toward the zones of coverage. Since these loudspeakers would be close to the seats and pointing towards them, the sound energy would be well contained within the seating bowl. Representing the maximum sound power with just the line arrays is therefore a conservative assumption.

5.3 Noise Projection Computer Model for Football Game

WIA developed a 3-D computer noise model using SoundPLAN® to project Stadium operational noise levels to the surrounding community for football games.
Figure 5-6 shows the model in plan view and the location of the Stadium with respect to the ten model receivers. Figure 5-7 shows the model in perspective view illustrating the site topography.

[2] The pink noise assumption is somewhat conservative and may warrant further refinement.
[3] Enhanced Acoustic Simulator for Engineers (EASE), version 4.2,using JBL_VLA_V1p5.dll.

For the purpose of this study which involves sound propagation over large distances, WIA evaluated results using the ISO 9613-2 1996 methodology which is a widely used industry standard and generally considered to be fairly reliable. The model accounts for geometrical spreading losses, air absorption, ground effects and acoustical shielding from buildings or topography that may block line-of-sight conditions between noise sources and receivers.

<u>Model Receivers</u>
All model receivers are 5 ft above the local terrain elevation. As indicated above, receivers R1 through R6 are located at the 6 long-term noise measurement locations (N1 through N6). As described above in Section 4, the additional study receivers include:

Two receivers east of long-term measurement location N3:

- R7 is on Coleman Street, representative of the new residential development, (it as at the closest point extending out from the long axis of the stadium).
- R8 is at the closest point in the proposed Project HPS Residential Density III area (next to the HPS Village Retail Center).

Two receivers in the Bayview Neighborhood:

- R9 is on Palou Avenue and Lane Street
- R10 is on Bayview Circle near Newhall Street

<u>Stadium Shell</u>
The model represents the outer shell of the Stadium as noise walls with different heights, depending on the highest elevation of the stadium structure (e.g., suite tower roof, top row of seating, top of scoreboard). Noise generated from within the Stadium will project out over the stadium structure. As shown on the conceptual design drawings, the main concourse (36.5 ft high) is open on the north end, leaving less acoustical shielding in that direction.

<u>Topography/Terrain/Attenuation</u>
The site terrain data are based on an import of the CitySF_Topo drawings scaled to metric units (a SoundPLAN® convention). The entire project area assumes a ground absorption of 0.30 (0 = hard; 1 = soft) assuming the majority of it will be developed land, except for State Park Land (0.50) and water (0.00).

Building data are based on an import of the x-Korve-topo layer and conversion to building objects in SoundPLAN®. Buildings directly east of Location N3 have been deleted due to current redevelopment occurring there. Building 199959 (east of N3) will not be in the future scenario and has been replaced with one 100 ft tall and the same size as the proposed R&D area shown on the building's elevation plan view drawing provided by PBS&J. The purpose of this step was to study potential acoustical shielding effects this may have on nearby receivers.

<u>Meteorological Effects</u>
For all calculations, the model assumes average conditions for the area: 71.5% humidity, 29.36 in Hg, and 56.6 ºF [4]. For evaluating potential worst case wind conditions (i.e., receiver downwind of noise source), WIA assumed a maximum expected wind speed and potential worst case direction for each receiver. Though very infrequent since the general prevailing winds blow from west to east, high winds may achieve 24 mph occasionally in the direction of the neighborhoods. Section 6 below

[4] www.wunderground.com

further discusses the noise levels associated with the worst case wind conditions for each receiver and likelihood that such conditions would occur.

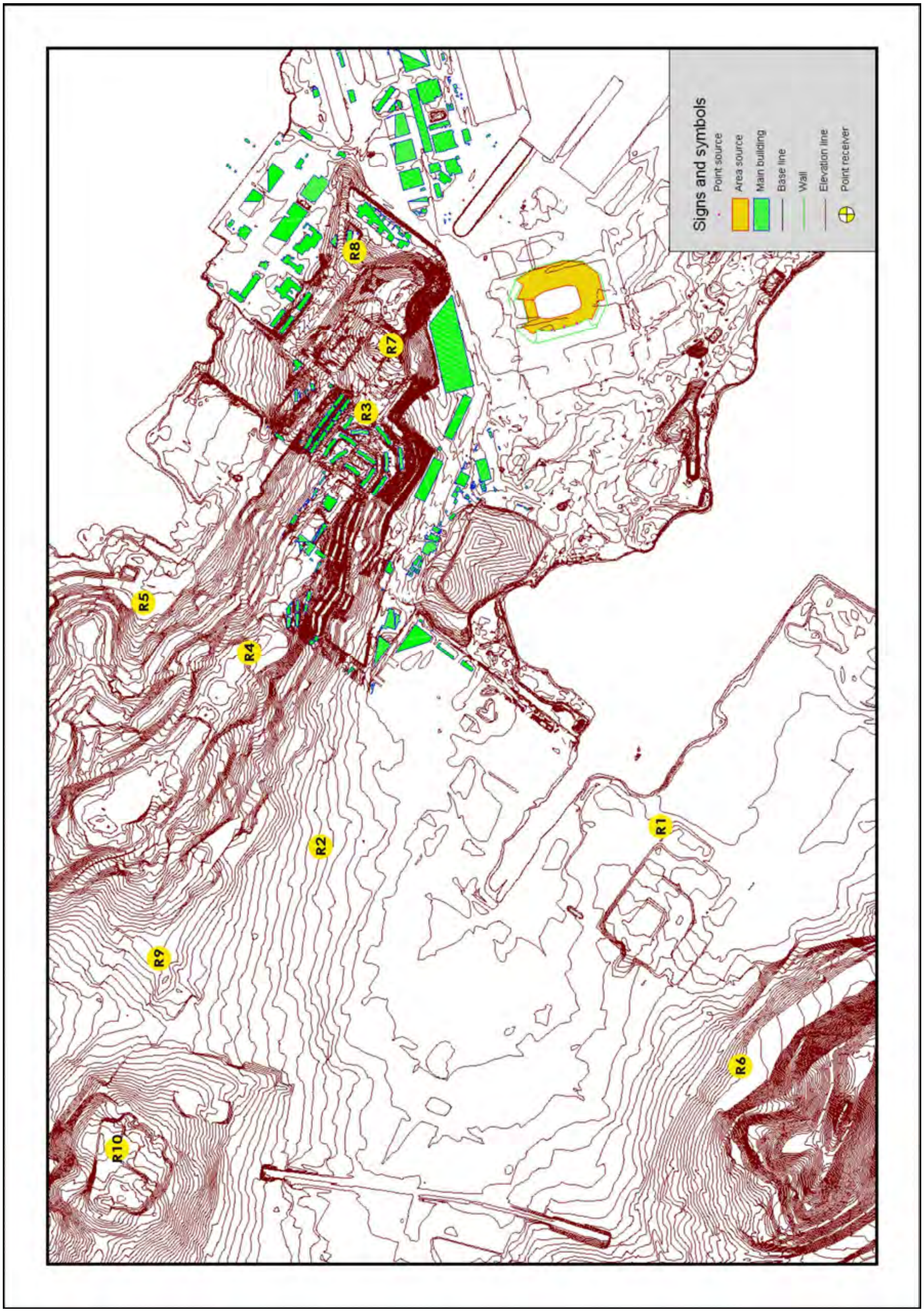

Figure 5-7 3-D Computer Noise Model (Plan View)

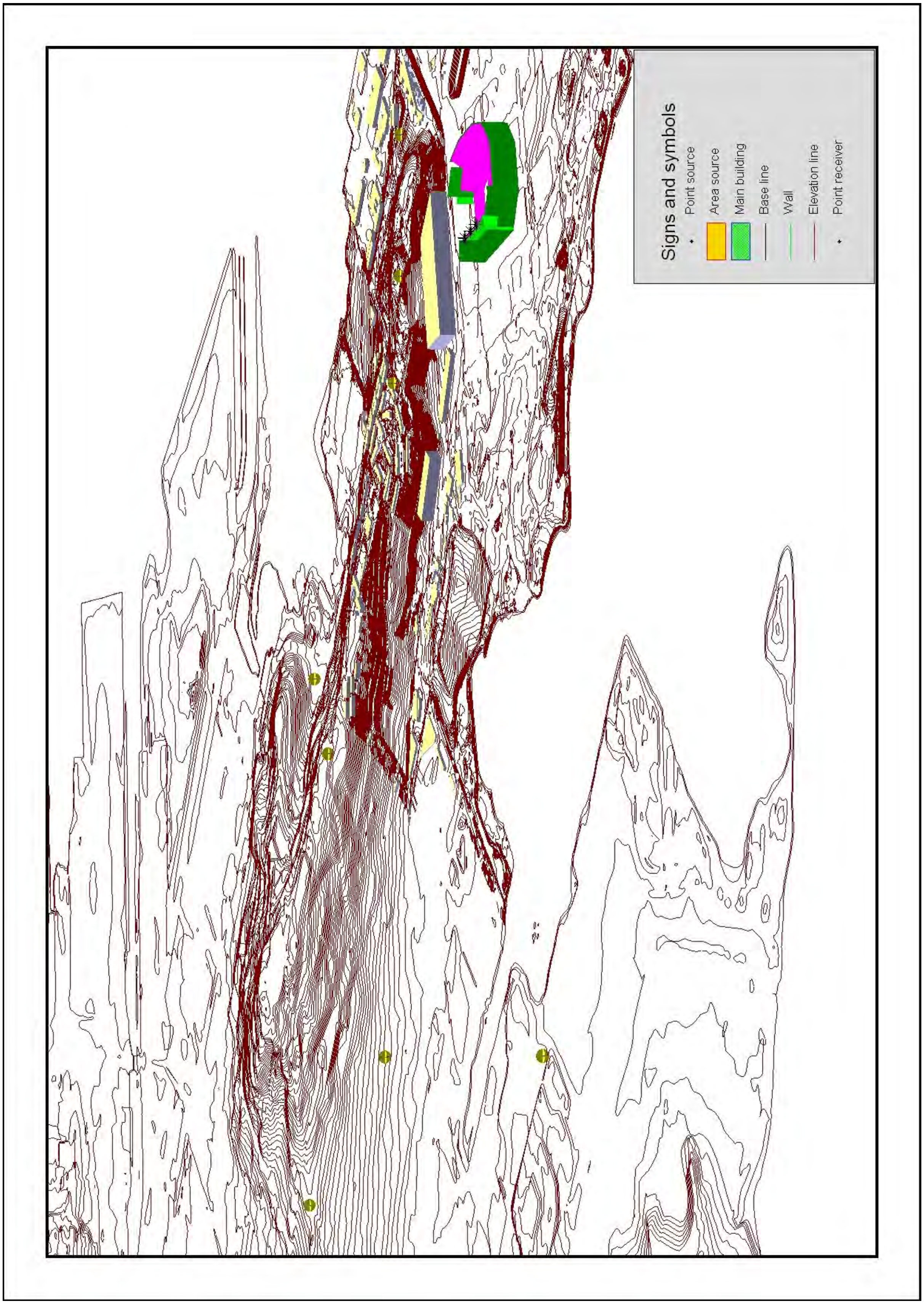

Figure 5-8 3-D Computer Noise Model (Perspective View)

6.0 Project Noise Sources and Prediction Model for Music Concerts

During music concerts, there is primarily only one noise source that needs to be considered and that is the performer's sound system. The audience will produce some noise, but it is reasonable to assume that it will be of a lesser intensity than the crowd noise at a football game. In general, the performer's sound system can be controlled to some degree. This can be accomplished through the selection of the loudspeakers and their orientation.

6.1 Music Concert Sound System

The performer's sound system would be similar to that which is typically seen at many large outdoor music concerts.

Figure 6-1 illustrates what such a sound system could look like.

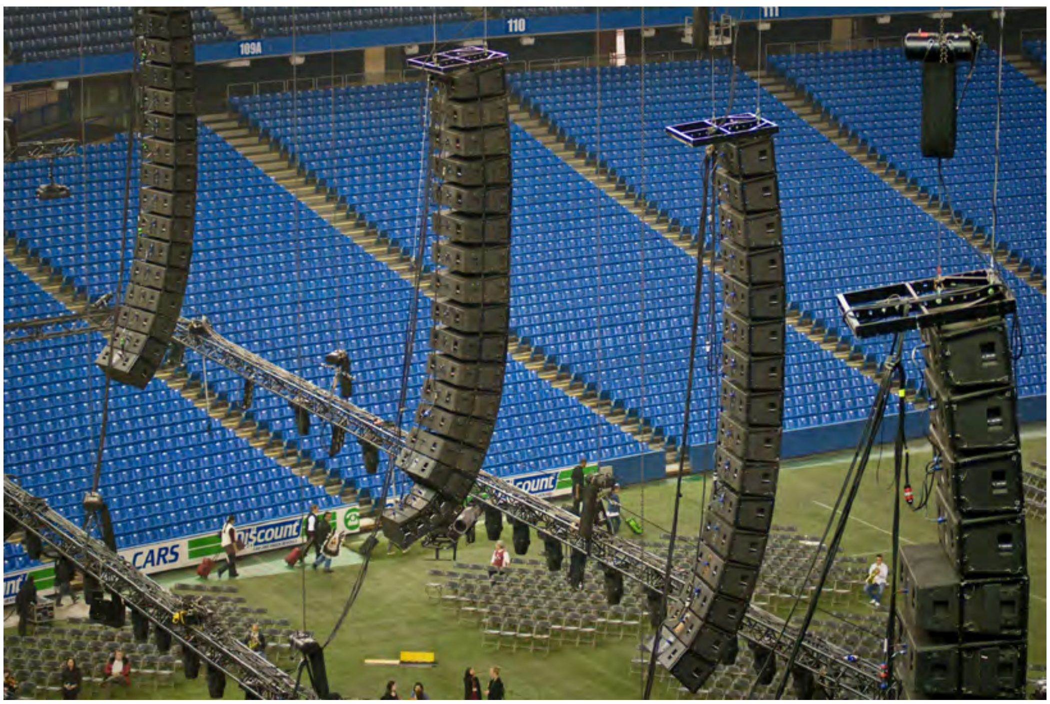

Figure 6-1 Example of Sound System for Touring Concerts

The performer's sound system would likely use JBL or similar type line series arrays composed of full-size components:

1. At the performance stage there would be four line arrays serving as FOH and composed of twelve full-size elements such as JBL VerTec VT4880 above four full-size arrayable subwoofers integrated into each full-range speaker array such as JBL VerTec VT4880.

2. Two towers with delayed signals would be positioned at the 50-yard line to fulfill the back of the Stadium audio needs. Each tower has a pair of eight box arrays, an example of which is a JBL Vertec 4889 full-size array with multiple elements.

Figure 6-2 shows the location of the line arrays with respect to the Stadium in the computer model. In modeling the performer's sound system as a noise source, WIA has assumed:

- Stage layout for large venue is either at north end of field or at 50-yard line,
- Towers (end field and delay) are directed south towards Bay,
- The sound system achieves a sound pressure level of 105 dBA at the mixing panel on the field in front of the stage,
- Sound power levels were based on three different samples of music including one rock sample and two hip-hop samples,
- Point source attenuation for each cluster positioned at a height of 36.5 ft (11.1 m),
- 16-box line array (Vertec VT4880) built using JBL Calculator[5] to create angle and coverage of array and EASE[6] software to create directivity polar plots in horizontal and vertical directions for 100 Hz to 2 kHz,
- For Vertec VT 4880 line arrays 100 Hz directivity pattern assigned to octave bands form 25 to 200 Hz, 500 Hz directivity pattern assigned to octave bands from 250 to 8000 Hz, and 1 kHz directivity pattern assigned to octave bands 1 kHz and above,
- Four arrayable subwoofers (Vertec VT 4889) built using JBL Calculator to create angle and coverage of array and EASE software to create directivity polar plots in horizontal and vertical directions for 25 to 160 Hz,
- For Vertec VT 4889 subwoofer line arrays 100 Hz directivity pattern assigned to octave bands form 25 to 160 Hz.

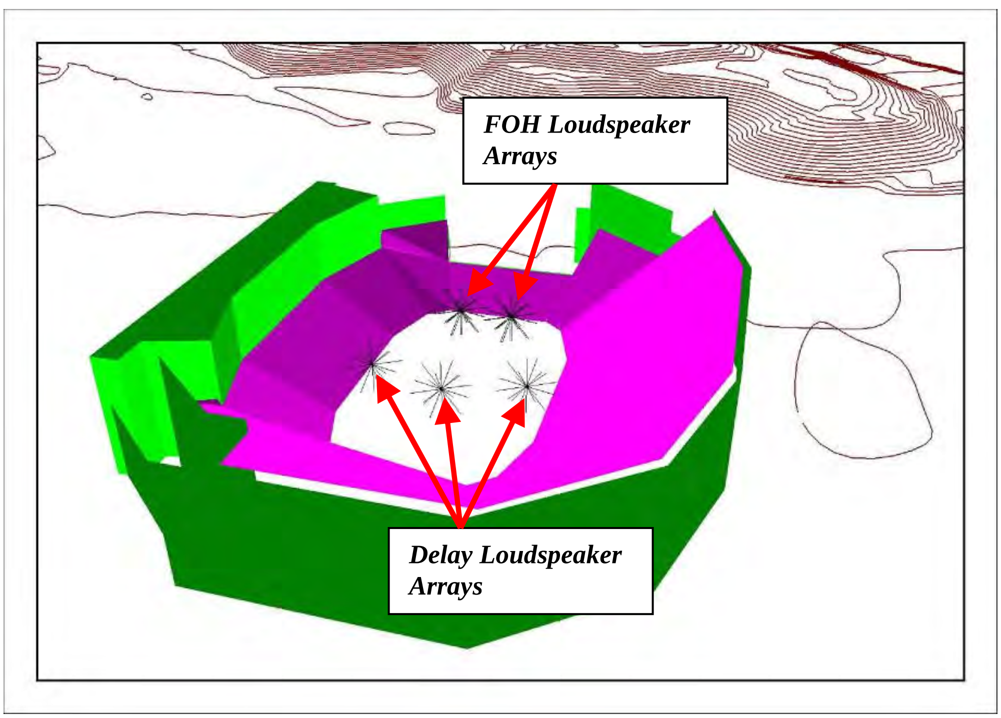

Figure 6-2 Computer Model of Concert Sound Systems

[5] JBL Vertec Line Array Calculator Version 2.10
[6] Enhanced Acoustic Simulator for Engineers (EASE)

The sound pressure levels at the mixing console for each of the three music samples are shown in Figure 6-3.

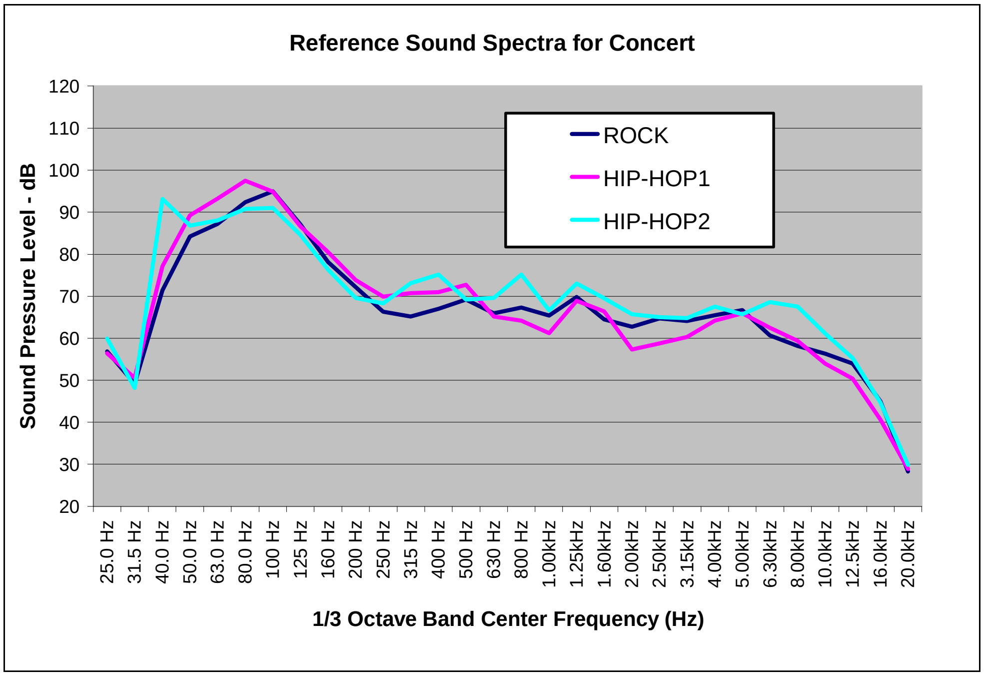

Figure 6-3 Concert Music Sound Pressure Levels

6.2 Noise Projection Computer Model for Concert

The same computer model used for football game noise projections was used to project concert noise outside the Stadium, except for the different sound system being used as described above. Consequently, Figure 5-7 shows the basic geometry of the noise projection model as modeled in SoundPLAN®.

7.0 Potential Noise Impacts

7.1 Football Games

WIA has evaluated the potential noise impacts associated with both the crowd and sound system for a typical full capacity football game. As is standard practice, the noise analyses conducted by WIA to determine noise impact levels assume noise sensitive receptors that are located five feet above the ground and at the setback or nearest building façade to the noise source.

Projections assume a typical game is on the order of three hours with crowd and/or PA noise sustained at typical maximum levels for an aggregate 45 minutes over the three hour period. This is a conservative assumption in that crowd noise probably is less than 45 minutes and not necessarily would occur at maximum levels. Furthermore, it is also assumed that crowd noise consists of people cheering continuously during this 45 minute aggregate. The assumption was also made that all of the football fans in the stadium are cheering at maximum level they are capable of when they do cheer. These are also conservative assumptions.

For the two noise sources (fans cheering and PA), WIA presents the projections for maximum noise levels (L_{max}), and the day night level (L_{dn}) for a game day with the conservative assumptions of level and duration of sound. The game day L_{dn} calculations are based on a noise energy summation of the existing ambient hourly L_{eq} noise levels at each location (i.e., measured or assumed from measured data) and the projected game noise levels at that location. The L_{dn} calculations assume typical games would be during evening hours and game operational noise would not occur between 10 p.m. and 7 a.m. which could substantially affect the L_{dn}. Doubleheaders, game delays, or other potential reasons for game operations occurring past 10 p.m. would increase the potential for noise impacts.

7.1.1 Impacts Associated with Individual Noise Sources at Football Games

It should be noted that the noise levels projected in detail herein are for a “no wind” condition. The presence of a wind blowing to the south or east would greatly reduce the noise levels occurring in the local residential community. Consequently, the operational impact analysis is based on a conservative assumption.

7.1.1.1 Football Crowd Noise

WIA evaluated the impact of noise from fans cheering in the Stadium during a “no wind” condition. This is a conservative assumption in that often the local wind is either blowing to the south or east away from the residential community and towards the Bay. Based on the analysis results shown in Table 7-1, WIA would expect noise levels to exceed the proposed impact criteria at receivers R3 and R7 based on the conservative conditions assumed. It should be noted that except for the wind condition the L_{max} levels would be expected to occur and possibly often, however the changes in L_{dn} levels are based on duration and level may not occur with regularity.

At R3, which is representative of the existing residential portion of the Hunters Point neighborhood closest to the stadium, crowd noise would be less than the 75 dBA L_{max} criterion during a game. There is the potential for an impact based on L_{dn} although the projected game day L_{dn} is less than 65. The potential increase is 2 to3 dBA which could be considered significant.

Higher noise levels are predicted at R7 which is representative of the new residential development closest to the stadium and closer to the stadium than R3 but not part of the Project. At R7, maximum crowd noise would approach but not exceed the 75 dBA L_{max} criterion. The L_{dn} may increase by 4 to 7 dBA assuming ambient noise data measured at R3 (N3) is representative of this location.

Table 7-1 Predicted Crowd Only Noise Levels (No Wind Condition)

Model Receiver	Distance[1] ft	L_{max}[2] dBA	Game Day Ldn[3]	L_{dn} Increase over existing[4]	Proposed Criteria Exceeded
R1	5,060	60	63 to 67	<1 dBA	None
R2	5,330	63	63 to 65	<1 dBA	None
R3	1,650	73	61 to 64	**2 to 3 dBA**	Increase in Ldn
R4	3,820	64	65 to 66	<1 dBA	None
R5	4,490	60	62 to 65	<1 dBA	None
R6	7,250	57	59 to 60	<1 dBA	None
R7	1,150	**79**	**65 to 66**	**4 to 7 dBA**	75 dBA L_{max}, 65 Ldn
R8	1,675	68	59 to 63	1 dBA	None
R9	6,880	55	63 to 65	<1 dBA	None
R10	8,600	56	65 to 66	<1 dBA	None

1. Approximate distance to center of stadium.
2. L_{max} is based on L_1 reference spectrum (Figure 5-1) and represents anticipated typical maximum noise levels.
3. Based on noise energy summation of measured or assumed ambient plus predicted game noise levels.
4. Relative to representative ambient data.

7.1.1.2 Stadium PA System Noise

The noise projections for the proposed PA system are shown in Table 7-2. The greatest potential for noise impacts due to PA sound would occur at locations R3, R7, and R8.

At R3, which is representative of the existing residential portion of the Hunters Point neighborhood closest to the stadium, PA noise levels would be roughly similar to crowd noise levels – less than the 75 dBA L_{max} criterion during a game. There is also the potential for an L_{dn} impact since although the projected game day L_{dn} is less than 65, the potential increase is 2 to3 dBA which could be considered significant.

At R7 which is representative of the new residential development closest to the stadium but not part of the Project, PA noise levels would be greater than the crowd noise levels alone. Typical maximum PA noise levels would be on the order of 82 dBA and exceed the 75 dBA L_{max} criterion. The L_{dn} may increase by 6 to 8 dBA assuming ambient noise data measured at R3 (N3) is representative of this location.

R8, the receiver representative of the new residential portion of the Project closest to the stadium, would experience a potential noise impact from PA noise even though crowd noise would be within the criteria. This is largely due to the loudspeaker coverage provided by the line arrays on the north end of the stadium which project out to the northeast. At R8, the projected L_{max} level is 78 dBA, which exceeds the 75 dBA L_{max} criterion. The L_{dn} would potentially increase by 4 to 6 dBA to 64 to 66 L_{dn} assuming ambient noise data similar to R3.

For most distant receivers the PA only noise levels are lower than the crowd only noise levels. This is apparent at locations R1 and R2 and other distant receivers west of the stadium. The directivity and orientation of the PA strongly influence the lower noise levels evident at receivers positioned away from the direction of the loudspeakers which face toward the east.

The PA noise projections are based on the nominal maximum design conditions and assume a continuous RMS signal. It is reasonable to expect that there may be isolated incidents where PA noise levels could be higher than the projections if PA sound levels are increased to overcome extreme bursts of crowd noise.

Table 7-2 Predicted PA Only Noise Levels (No Wind Condition)

Model Receiver	Distance[1] ft	L_{max} [2] dBA	Game Day Ldn[3]	L_{dn} Increase over existing[4]	Proposed Criteria Exceeded
R1	5,060	55	63 to 67	<1 dBA	None
R2	5,330	55	63 to 65	<1 dBA	None
R3	1,650	73	61 to 64	**2 to 3 dBA**	Increase in Ldn
R4	3,820	61	65 to 66	<1 dBA	None
R5	4,490	57	62 to 65	<1 dBA	None
R6	7,250	48	59 to 60	<1 dBA	None
R7	1,150	**82**	**67 to 68**	**6 to 8 dBA**	75 dBA L_{max}, 65 Ldn
R8	1,675	**78**	**64 to 66**	**4 to 6 dBA**	75 dBA L_{max}, 65 Ldn
R9	6,880	48	63 to 65	<1 dBA	None
R10	8,600	48	65 to 66	<1 dBA	None

1. Approximate distance to center of stadium.
2. L_{max} is based on L_1 reference spectrum (Figure 5-1) and represents anticipated typical maximum noise levels.
3. Based on noise energy summation of measured or assumed ambient plus predicted game noise levels.
4. Relative to representative ambient data.

7.1.2 Impacts Associated with Combined Noise Sources at Football Games

Table 6-3 present the results of combined crowd noise and PA system noise. As expected the noise levels slightly increase due to the energy summation of these simultaneous noise sources though this depends on the dominant noise source at each receiver. The greatest potential for noise impacts occurs at R3, R7, and R8.

At R3 which is representative of the existing residential portion of the Hunters Point neighborhood closest to the stadium, combined noise sources would generate typical maximum noise levels on the order of 76 dBA which is less than the 75 dBA L_{max} criterion. There is also the potential for an L_{dn} impact at this location since game days would potentially increase the existing L_{dn} by 3 to 4 dBA to 62 to 65 L_{dn}.

At R7 which is representative of the new residential development closest to the stadium but not part of the Project, combined noise sources would generate typical maximum noise levels on the order of 83 dBA exceeding the 75 dBA L_{max} criterion. The L_{dn} may increase by as much as 7 to 9 dBA to approximately 69 L_{dn} assuming ambient noise data measured at R3 (N3) is representative of this location.

R8, the receiver representative of new residential part of the Project closest to the stadium, would experience a potential noise impact from PA only noise. L_{max} level would be 78 dBA, which exceeds the 75 dBA L_{max} criterion. The L_{dn} would potentially increase by 4 to 6 dBA to 64 to 66 L_{dn} assuming ambient noise data similar to R3.

The general conclusion regarding potential noise impacts is that they would occur locally near the stadium but not farther out as would be expected. The influence distance appears to be on the order of approximately 2,000 to 2,500 ft. Beyond this distance it is not likely that game operational levels would exceed the proposed impact criteria.

Table 7-3 Predicted Crowd and PA Combined Noise Levels (No Wind Condition)

Model Receiver	Distance[1] ft	L_{max} [2] dBA	Game Day Ldn[3]	L_{dn} Increase over existing[4]	Proposed Criteria Exceeded
R1	5,060	61	63 to 67	<1 dBA	None
R2	5,330	64	63 to 65	<1 dBA	None
R3	1,650	**76**	62 to 65	**3 to 4 dBA**	75dBA L_{max}, Increase in Ldn
R4	3,820	66	65 to 66	<1 dBA	None
R5	4,490	62	62 to 65	<1 dBA	None
R6	7,250	58	59 to 60	<1 dBA	None
R7	1,150	**83**	**69**	**7 to 9 dBA**	75 dBA L_{max}, 65 Ldn
R8	1,675	**78**	**64 to 66**	**4 to 6 dBA**	75 dBA L_{max}, 65 Ldn
R9	6,880	55	63 to 65	<1 dBA	None
R10	8,600	57	65 to 66	<1 dBA	None

1. Approximate distance to center of stadium.
2. L_{max} is based on L_1 reference spectrum (Figure 5-1) and represents anticipated typical maximum noise levels.
3. Based on noise energy summation of measured or assumed ambient plus predicted game noise levels.
4. Relative to representative ambient data.

7.1.3 Meteorological Effects on Football Game Noise

Wind effects can increase noise levels downwind of a noise source, while reducing noise levels upwind. Generally speaking, the prevailing winds for the Project study area originate from the west, northwest, or west-northwest directions. These directions would actually be acoustically favorable for neighborhood receivers and have the potential to reduce noise levels from the Stadium[7]. However, as indicated in the Project wind assessment report, there are notable changes during winter months and winds become milder and less dominated by west-northwesterly winds. Therefore, WIA believes the above noise predictions for "no wind" present the typical worst-noise conditions for NFL games during fall and winter months.

A small percentage of the time wind conditions may occur such that the receivers are downwind of the stadium and its noise sources thus creating the potential for an increase in game noise levels over the baseline "no wind" condition. Based on preliminary analysis, WIA would expect the potential for an increase in typical maximum game noise levels of up to 3 to 5 dBA for model receivers. To calculate the potential increase, WIA assumed the downwind condition for each receiver and a wind velocity of 24 mph[8] as typical. A downwind condition however, would be a very seldom occurring and therefore unlikely condition on the order of only 6 to 7 % of the time during game season months[9]. In the event that such downwind conditions do occur, there is the possibility that

[7] Reference 8 discusses the Project Area wind climate. The dominant wind condition is associated with summer months.
[8] 24 mph is worst case based on review of wind rose plots contained in Reference 8 and would not necessarily occur in all receiver directions.
[9] Based on review of wind rose plots contained in Reference 8 for daytime winter data.

operational noise levels may exceed the proposed impact criteria at additional homes which would otherwise not experience any exceedance (i.e., locations which would otherwise be marginally in accordance with the proposed impact criteria but are near receivers already showing an exceedance). However, the overall picture does not change substantially since game noise levels would still be expected to be within the proposed impact criteria at the more distant receivers.

Most often the wind is blowing to the south or east. In this case, the noise from the Stadium during a football game would be significantly reduced in the surrounding community. This affect has been observed at the current home of the 49ers at Candlestick Park.

Temperature inversions occur when the normal temperature gradient (lower temperature with increasing height above the ground) becomes inverted due to certain atmospheric conditions. This can cause sound waves to temporarily travel faster at higher altitudes which may result in increased noise levels at distant receivers. Temperature inversions are fairly complex phenomena and modeling their potential effects is beyond the current scope of this study. Further, for the Project study area, while it is possible that temperature inversions do occur, wind conditions associated with the area are likely to disrupt an inversion condition and thus minimize its effect.

7.1.4 Potential for Audibility of Football Game Noise

Although audibility would <u>not</u> have the potential for causing a significant impact, we discuss the potential for audibility at distances greater than 3,300 ft when there is low background ambient noise. In this discussion the potential for audibility refers to the ability to easily detect game operational noise in the presence of ambient sources of community noise. For the purpose of this study the potential for game noise to be easily detectable exists where the A-weighted game noise level is equal or greater than the A-weighted community noise level. Technically, delectability is based on specific frequency bands (i.e., comparison of 1/3-octave band Stadium noise levels and corresponding 1/3-octave band ambient noise levels). However, low frequencies can mask higher frequencies and this analysis assumes that in general the ambient noise would be dominated by low frequencies while the (potentially audible) crowd and PA noise would be dominated by mid to high frequencies.

The potential for crowd and PA noise to be easily detectable both outdoors is shown in Table 6-4 and the likelihood of this condition can be determined by comparing anticipated game noise levels to the ambient statistical noise descriptors. For example, crowd noise that is less than the L_{90} would be masked (not easily detectable) at least 90% of the time. On the other hand, crowd noise that exceeds the ambient L_{10} would be easily detectable at least 90% of the time. However, the amount of time would be limited by the duration the crowd noise occurs. If the crowd noise L25 exceeds the ambient L_{10}, then, crowd noise would be easily detectable for approximately 23% of the time (or 13.5 minutes for a given hour). Review of Table 7-4 indicates that at times game noise would potential be audible at distances on the order of 1.6 miles.

The calculations for indoors also shown in Table 7-4 assume a 15 dBA nominal exterior-to-interior noise reduction provided by the building shell which is considered typical for single family homes without special acoustical mitigation. Compared with an assumed low-level ambient background noise level of 45 dBA, maximum game noise levels would potentially be audible at times at Receivers R1, R2, R4, and R5.

Table 7-4 Potential for Audibility of Game Noise at Distant Receivers Outdoors

Model Receiver	Distance ft	Exterior Ambient L_{10}, dBA	Exterior Ambient L_{50}, dBA	Exterior Ambient L_{90}, dBA	Exterior Game L_{max} (L_{25})	Detectable Outdoors?	Interior Game L_{max}, dBA	Detectable Indoors?
R1	5,060	52 to 55	44 to 48	42 to 45	61 (55)	At least 22.5% of the time	46	Yes
R2	5,330	60 to 64	48 to 53	45 to 47	64 (58)	At least 12.5% of the time	49	Yes
R4	3,820	60 to 63	48 to 52	44 to 46	66 (60)	At least 12.5% of the time	51	Yes
R5	4,490	61 to 63	47 to 50	43 to 44	62 (56)	At least 12.5% of the time	47	Yes
R6	7,250	58 to 62	49 to 50	45 to 46	58 (52)	At least 12.5% of the time	43	No
R9	6,880	60 to 64	48 to 53	45 to 47	55 (49)	At least 2.5% of the time	40	No
R10	8,600	60 to 63	48 to 52	44 to 46	57 (51)	At least 2.5% of the time	42	No

1. Range represents lowest ambient for afternoon or evening hours.
2. Compared with an assumed indoor ambient background noise level of 45 dBA.

7.2 Noise Impacts from Music Concerts

The projected noise levels for a concert (rock music) are presented in Table 7-5. Note that the L_{max} levels in terms of dBC are presented only for informational purposes. It can be seen that the as with a football game exceedance of the proposed criteria are projected for receptors R3 and R7. The noise levels associated with the music concert are due to the concert's sound system.

Because the concert's sound system would be located closer to the ground than the stadiums sound system it is projected the sound levels outside the stadium are somewhat less for the music concert compared with the football game. The general conclusion regarding potential noise impacts is that they would occur locally near the stadium but not farther out as would be expected. The influence distance appears to be on the order of approximately 2,000 ft. Beyond this distance it is not likely that music concert noise levels would exceed the proposed impact criteria.

Table 7-5 Predicted Concert Sound System Noise Levels (Rock Music)

Model Receiver	Distance ft	L_{max} dBA	L_{max} dBC	Concert Ldn	Ldn Increase over existing	Proposed Criteria Exceeded
R1	5,060	57	78	63 to 67	< 1 dBA	None
R2	5,330	63	83	64 to 65	<1 to 1 dBA	None
R3	1,650	72	92	63 to 65	**3 to 5 dBA**	Increase in Ldn
R4	3,820	64	84	65 to 67	< 1 to 1 dBA	None
R5	4,490	63	82	62 to 65	< 1 dBA	None
R6	7,250	56	76	59 to 60	< 1 dBA	None
R7	1,150	75	95	**65 to 67**	**5 to 7 dBA**	65 Ldn, Increase in Ldn
R8	1,675	63	83	59 to 63	1 dBA	None
R9	6,880	56	76	63 to 65	< 1 dBA	None
R10	8,600	58	78	65 to 66	< 1 dBA	None

8.0 Potential Noise Mitigation

8.1 Football Game Noise Mitigation

Potentially significant noise impacts have been identified for residential areas that are relatively close to the proposed Stadium. The following is a list of potential mitigation measures that could be used to reduce noise impacts associated with the Stadium:

- Improving the external noise insulation of individual residences that would be impacted
- Shielding the back of the PA speakers
- Constructing a partial canopy to reduce crowd noise
- Limiting the level of allowable sound within the Stadium associated with the PA system

8.2 Music Concert Noise Mitigation

Potentially significant noise impacts have also been identified for residential areas during a music concert in the Stadium. The following is a list of potential mitigation measures that could be used to reduce noise impacts during a concert:

- Improving the external noise insulation of individual residences that would be impacted
- Limiting the level of allowable sound within the Stadium during a concert

9.0 Summary and Conclusions

WIA has evaluated the potential for significant noise impacts for the proposed 49ers Stadium. Both football game and a music concert noise were model and noise levels projected for the community. Significant impacts are projected to occur up to a distance of approximately 2,000 ft and possibly somewhat further for both football games and music concerts. Potential noise mitigation for football games includes residential noise insulation improvements, shielding of PA loudspeakers, a partial canopy at the top of the east side of the Stadium or limiting the level of sound associated with the PA sound system. Potential noise mitigation for music concerts includes residential noise insulation improvements, and limiting the sound level produced by the concert's sound system.

10.0 References

1. "Audio-Video (incl scoreboards) narrative.doc" received 6 January 2009.
2. "Areas and Seat Counts etc 11-20-2006.xls" received 6 January 2009.
3. 0_Blueprints - Plans_101606.pdf received 6 January 2009.
4. City SF_Topo Drawings received from PBS&J
5. x-Korve-Topo received 12 January 2009.
6. Candlestick Point and Hunters Point Shipyard, Phase II, Proposed Land Use Drawings, Lennar Urban, 26 November 2008.
7. SoundPLAN® version 6.5 and related documentation
8. CPP Inc. Final Report, Preliminary Pedestrian Wind Assessment, Candlestick Point and Hunters Point Developments, San Francisco, California. Dated June 2007.
9. Kinsler, Frey, Coppens, and Sanders, Fundamentals of Acoustics, 4th Ed., John Wiley & Sons, Inc., 2000.

APPENDIX

Ambient Noise Data

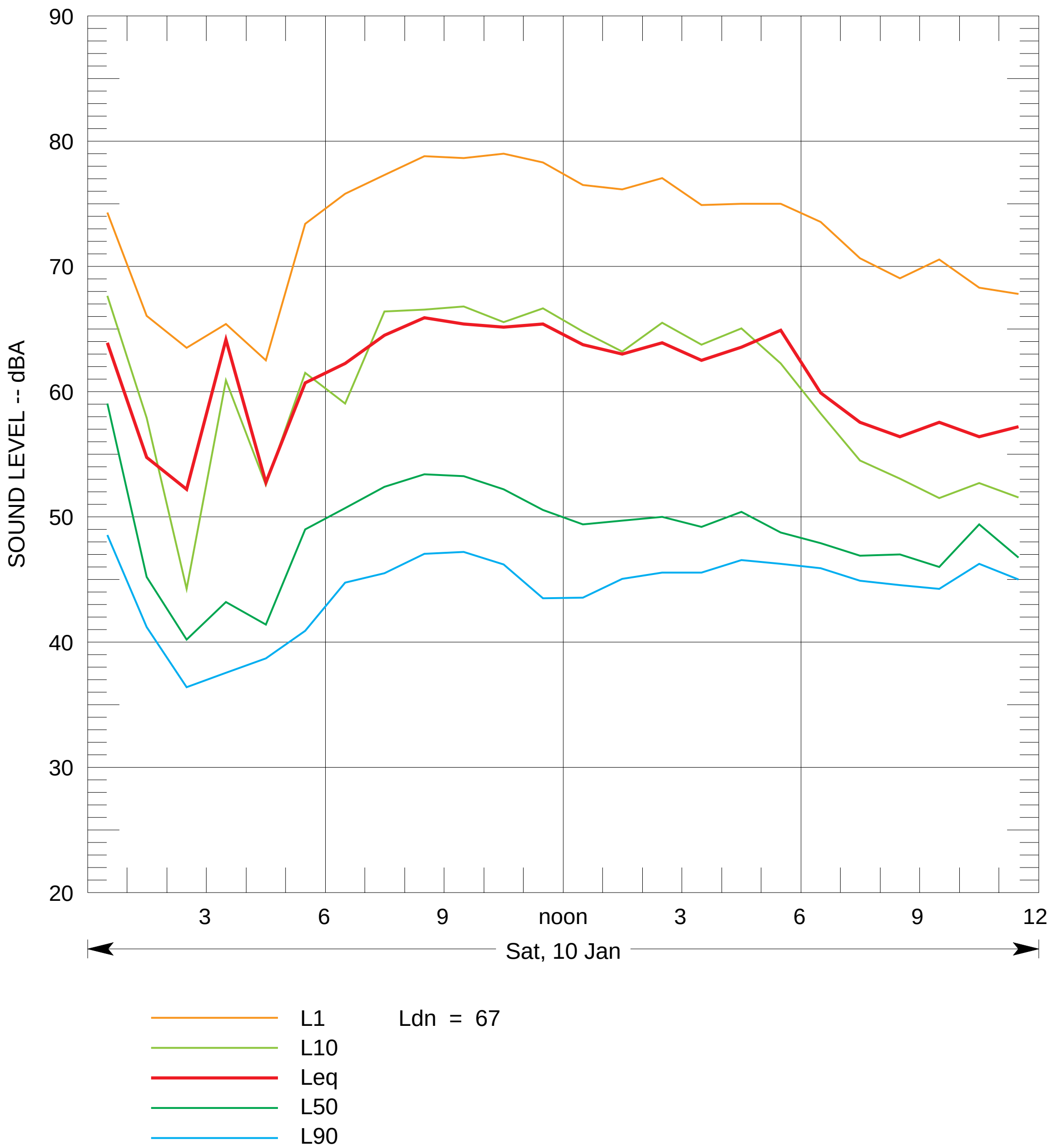

Figure A-1 Ambient Noise Levels Measured at Location N1
Carroll Avenue north of Walker Drive
Saturday, 10 January 2009

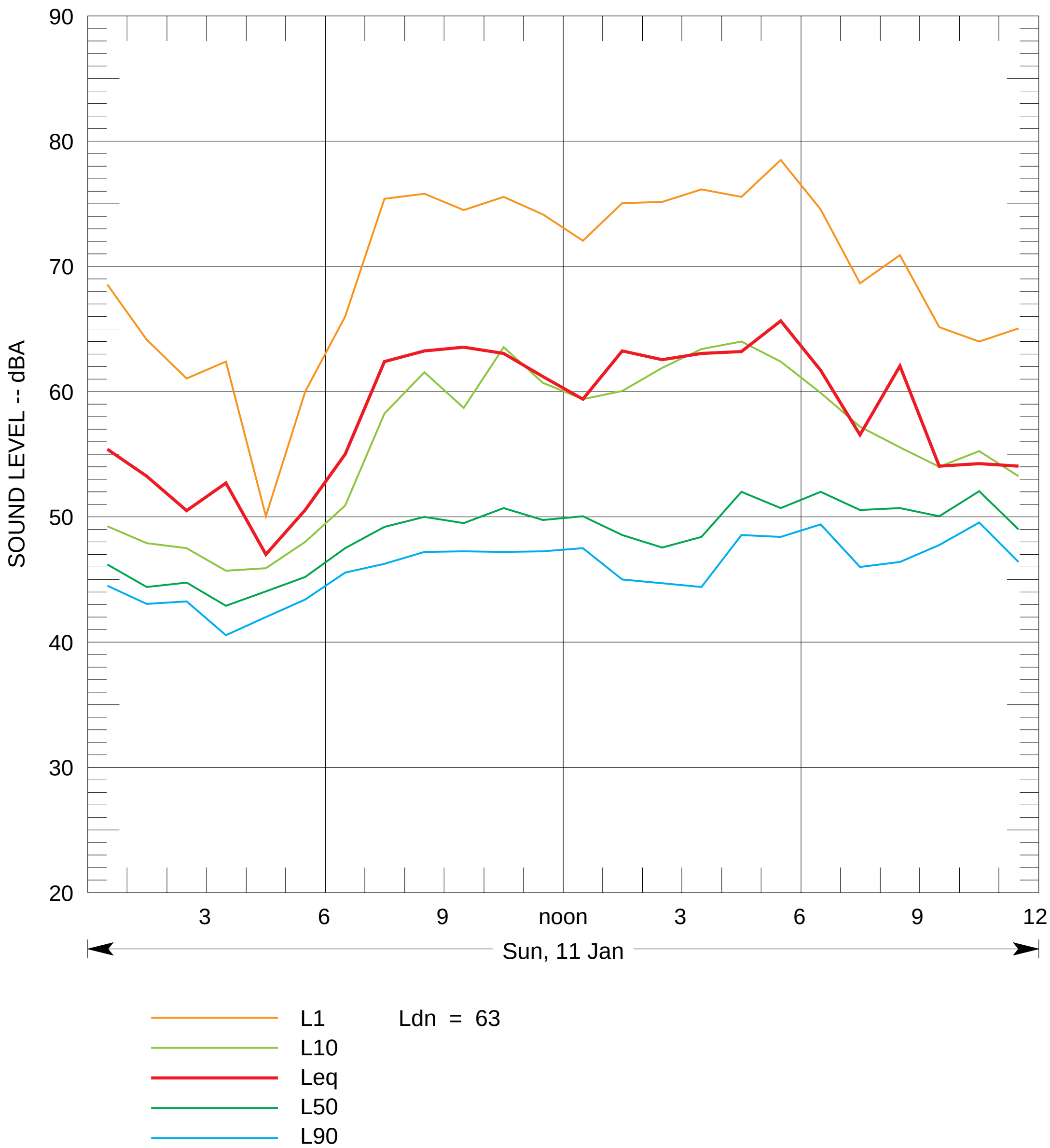

Figure A-2 Ambient Noise Levels Measured at Location N1
Carroll Avenue north of Walker Drive
Sunday, 11 January 2009

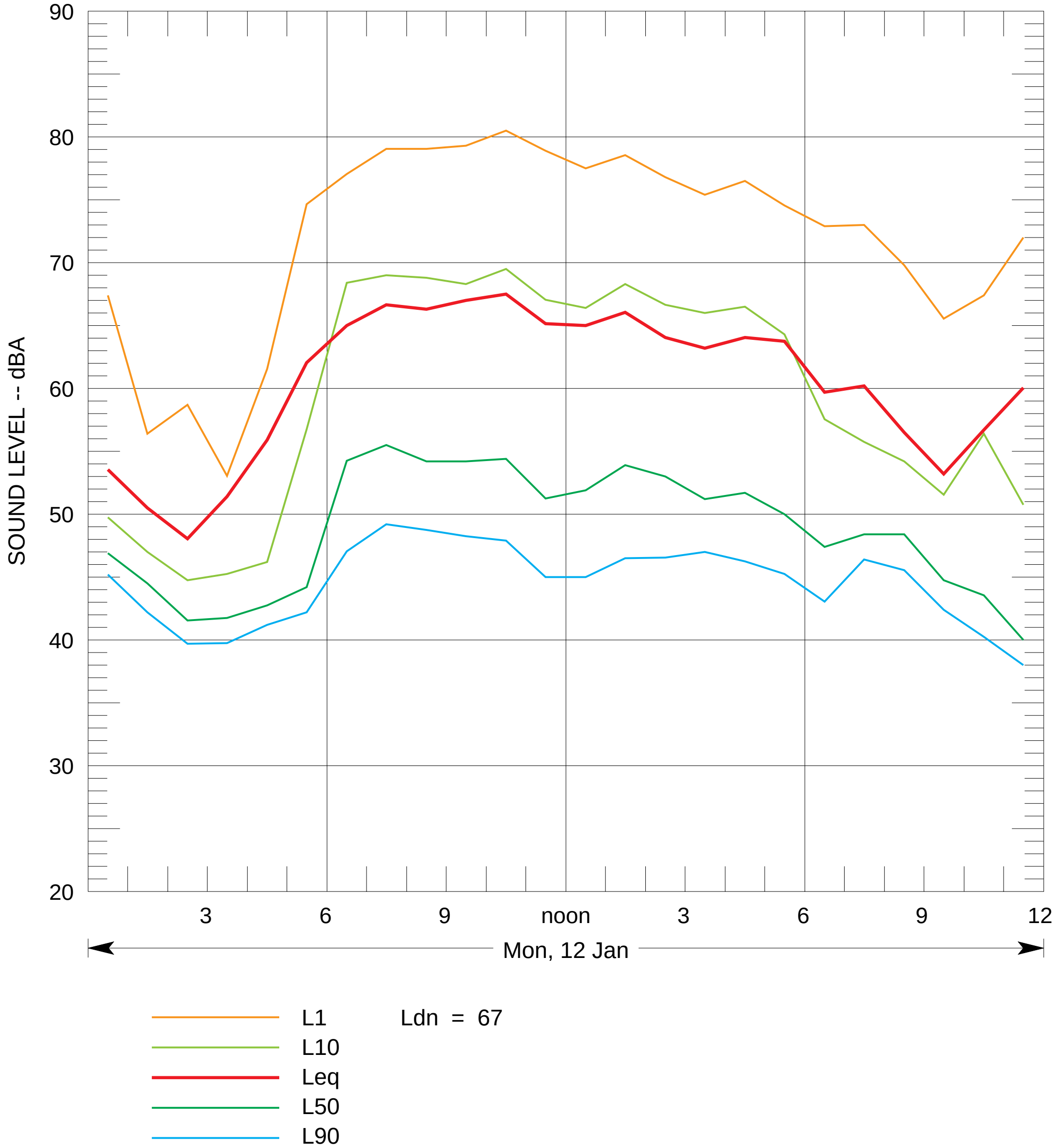

Figure A-3 Ambient Noise Levels Measured at Location N1
Carroll Avenue north of Walker Drive
Monday, 12 January 2009

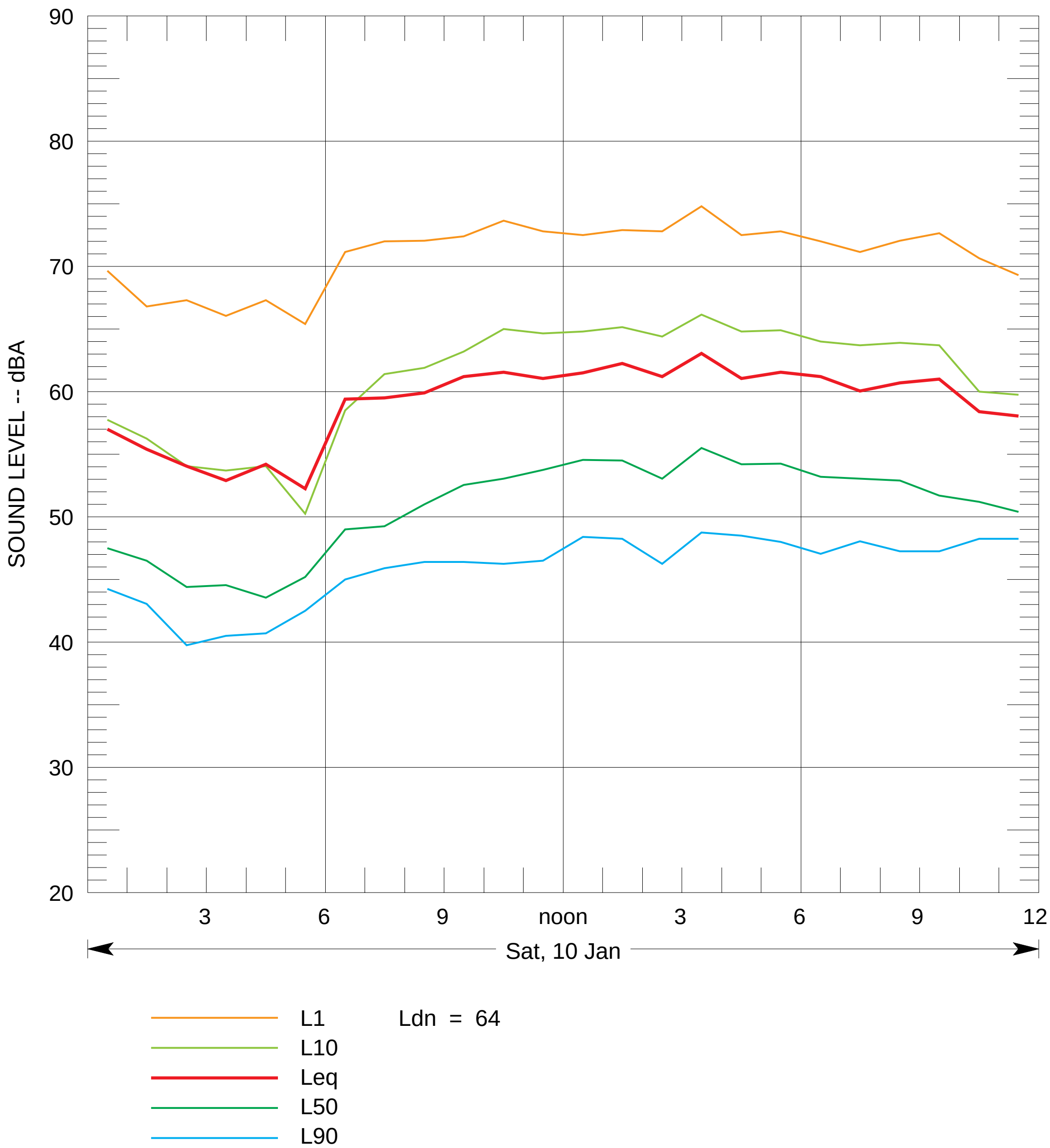

Figure A-4 Ambient Noise Levels Measured at Location N2
Revere Avenue between Ingalls Street & Jennings Street
Saturday, 10 January 2009

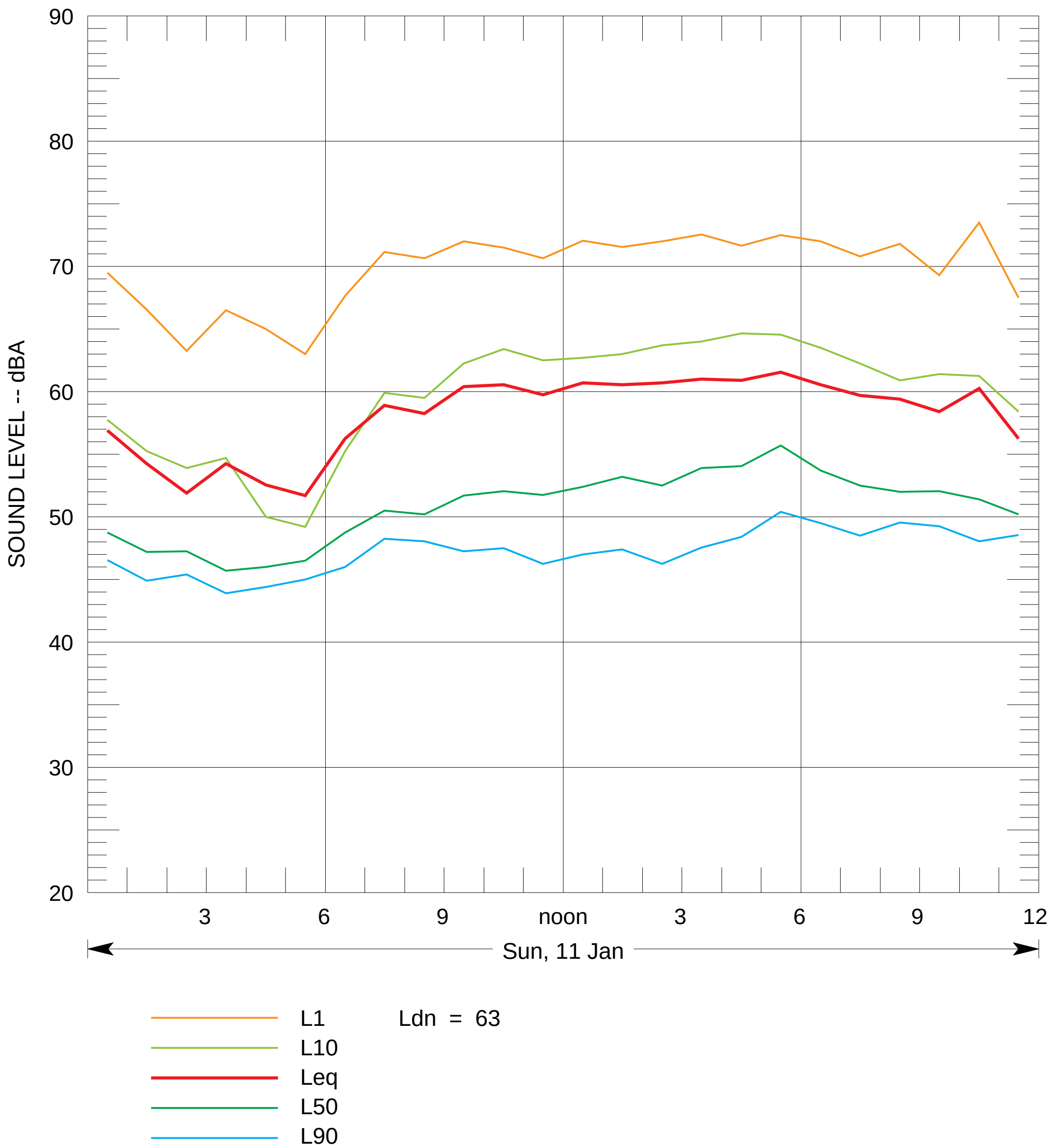

Figure A-5 Ambient Noise Levels Measured at Location N2
Revere Avenue between Ingalls Street & Jennings Street
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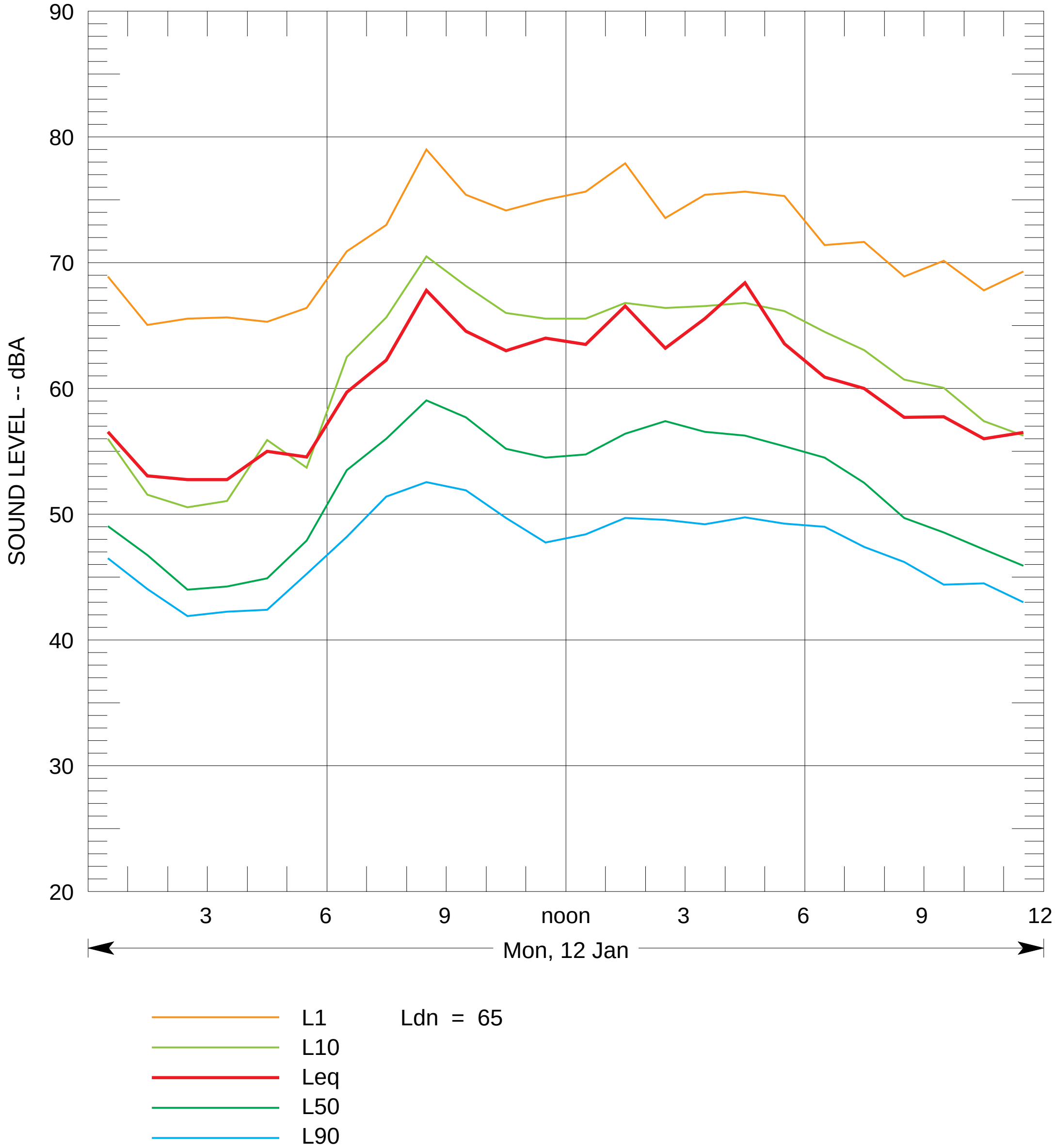


Figure A-6 Ambient Noise Levels Measured at Location N2
Revere Avenue between Ingalls Street & Jennings Street
Monday, 12 January 2009

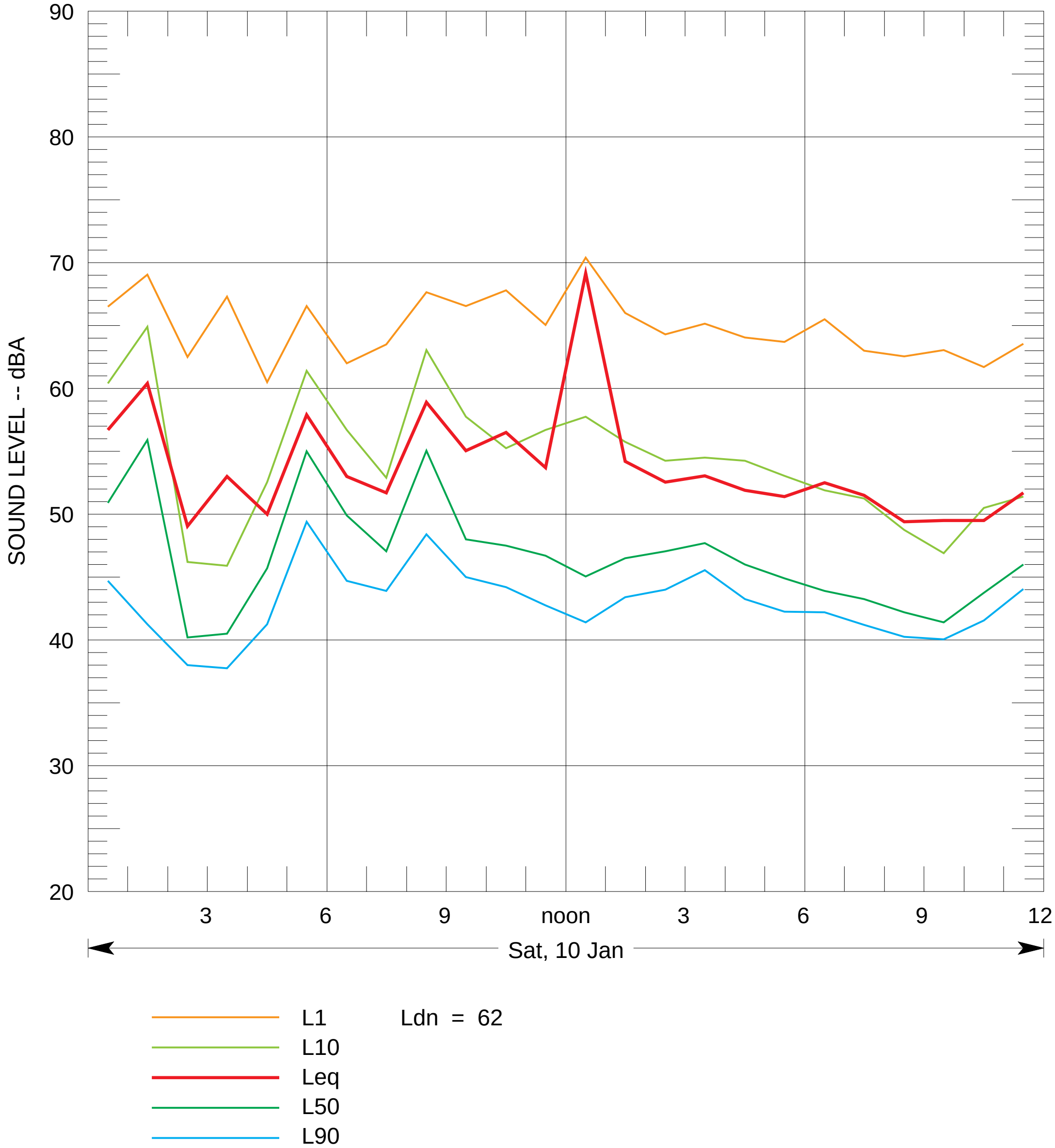


Figure A-7 Ambient Noise Levels Measured at Location N3
Donahue Street between Kirkwood Avenue & Jerrold Avenue
Saturday, 10 January 2009

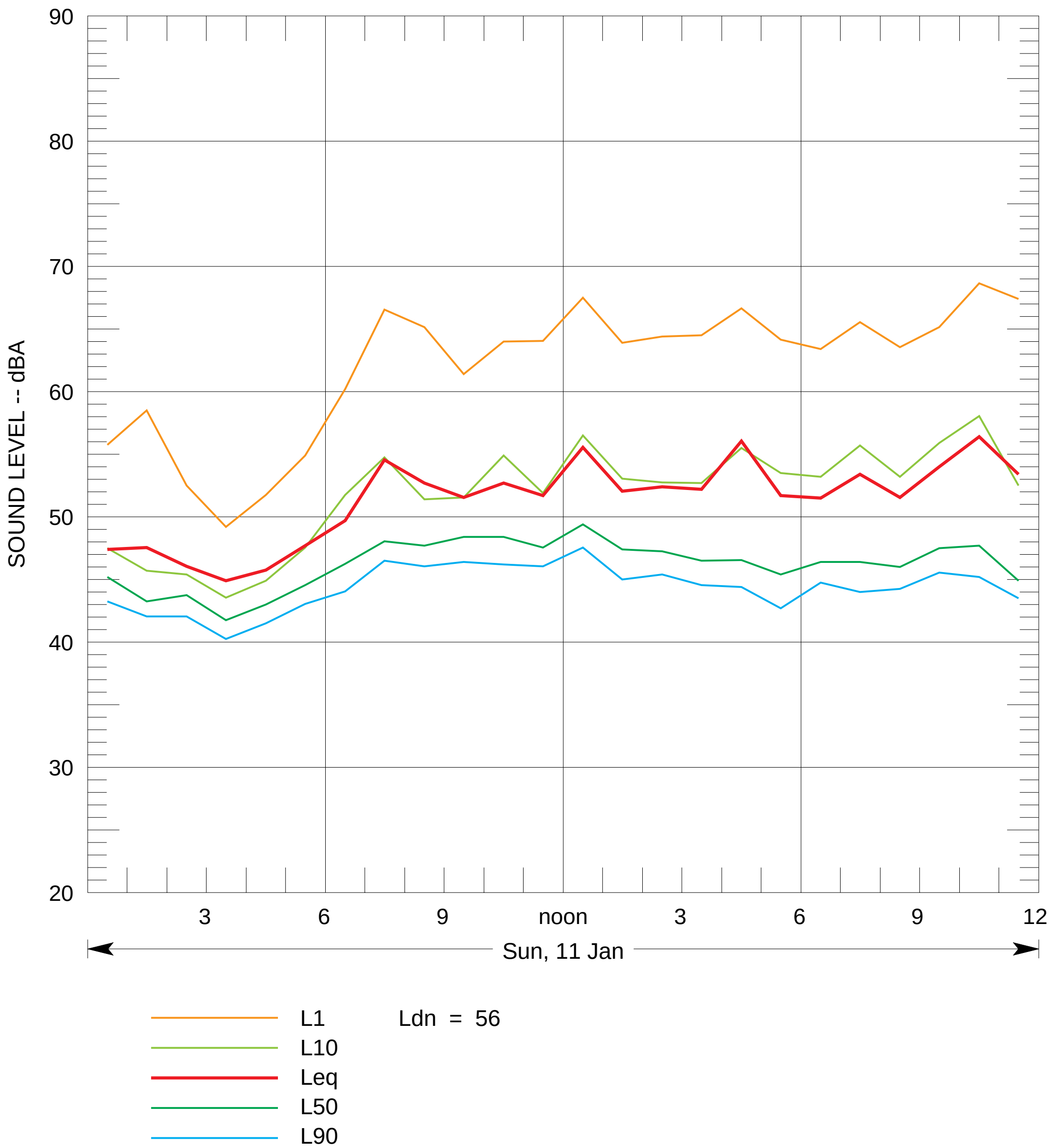


Figure A-8 Ambient Noise Levels Measured at Location N3
Donahue Street between Kirkwood Avenue & Jerrold Avenue
Sunday, 11 January 2009

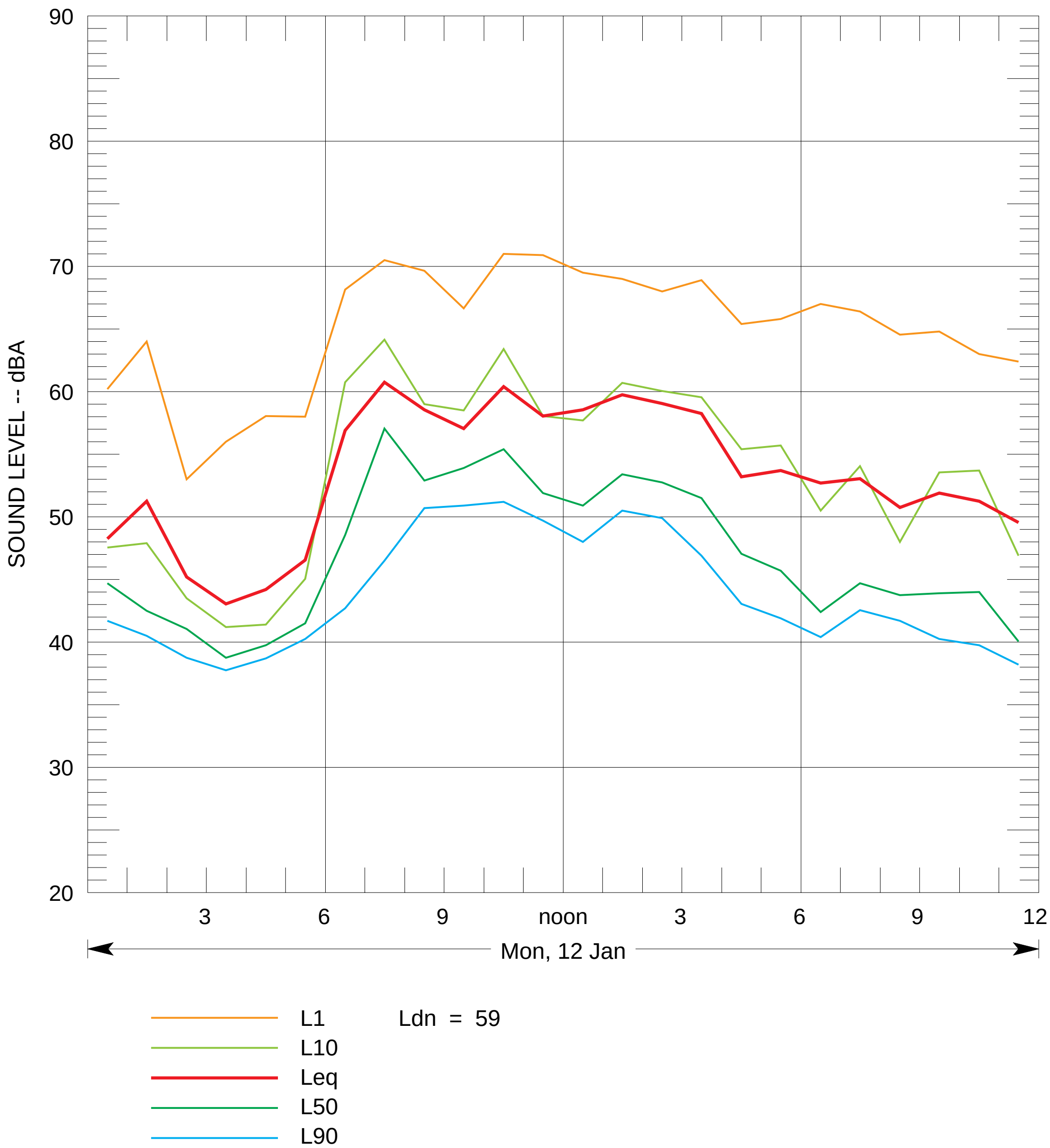


Figure A-9 Ambient Noise Levels Measured at Location N3
Donahue Street between Kirkwood Avenue & Jerrold Avenue
Monday, 12 January 2009

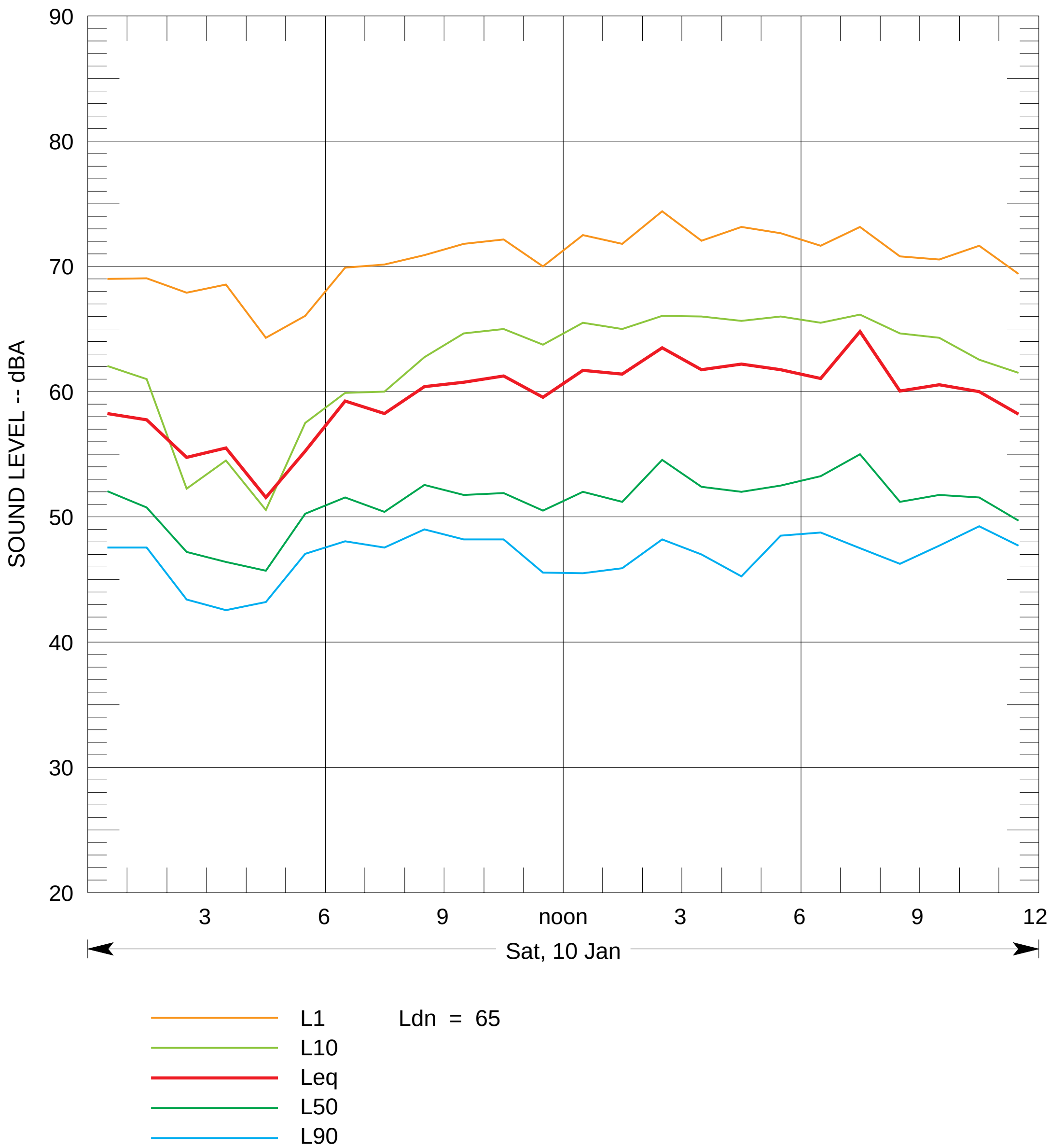


Figure A-10 Ambient Noise Levels Measured at Location N4
Kiska Road between Reardon Road & Ingalls Street
Saturday, 10 January 2009

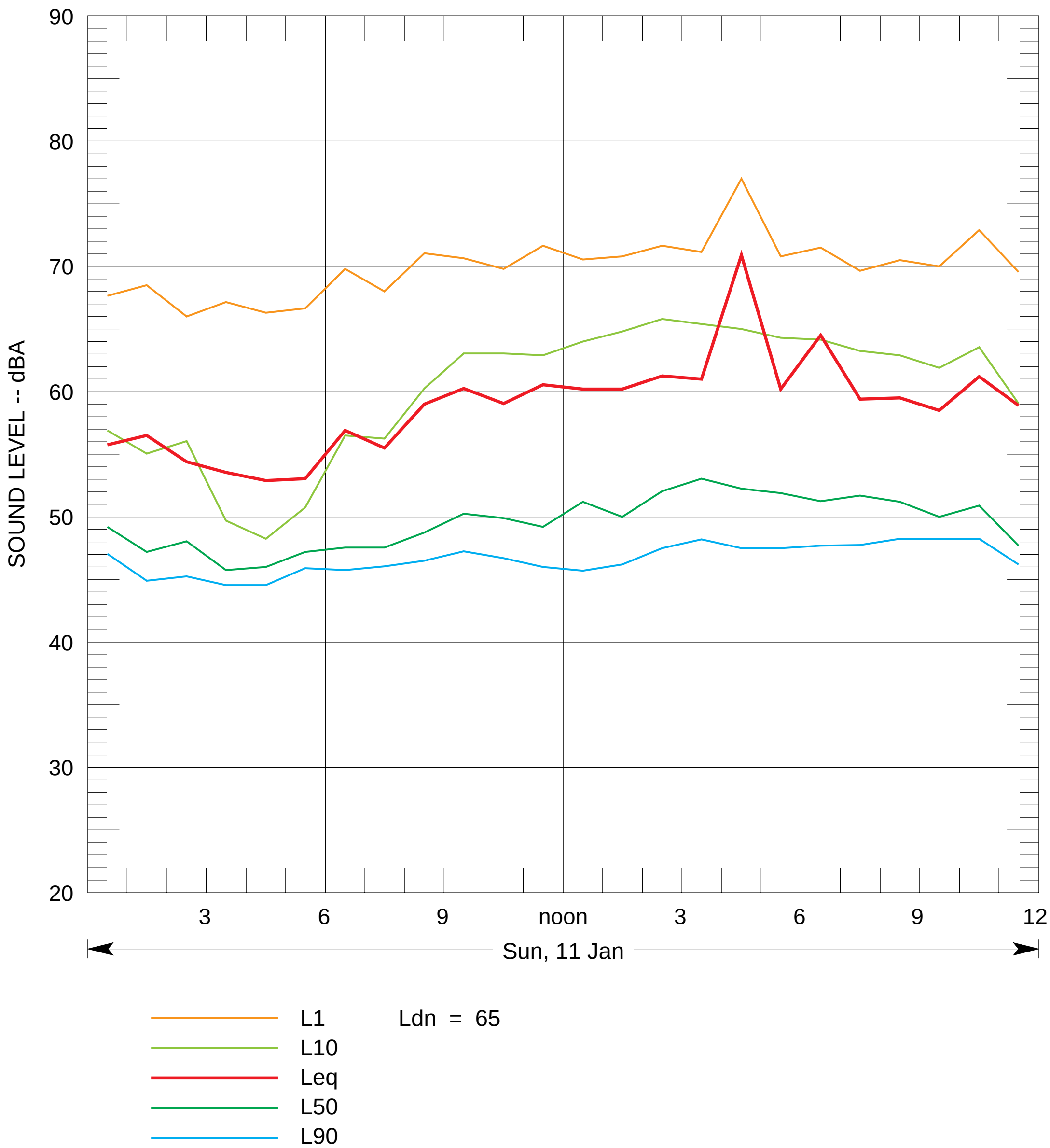


Figure A-11 Ambient Noise Levels Measured at Location N4
Kiska Road between Reardon Road & Ingalls Street
Sunday, 11 January 2009

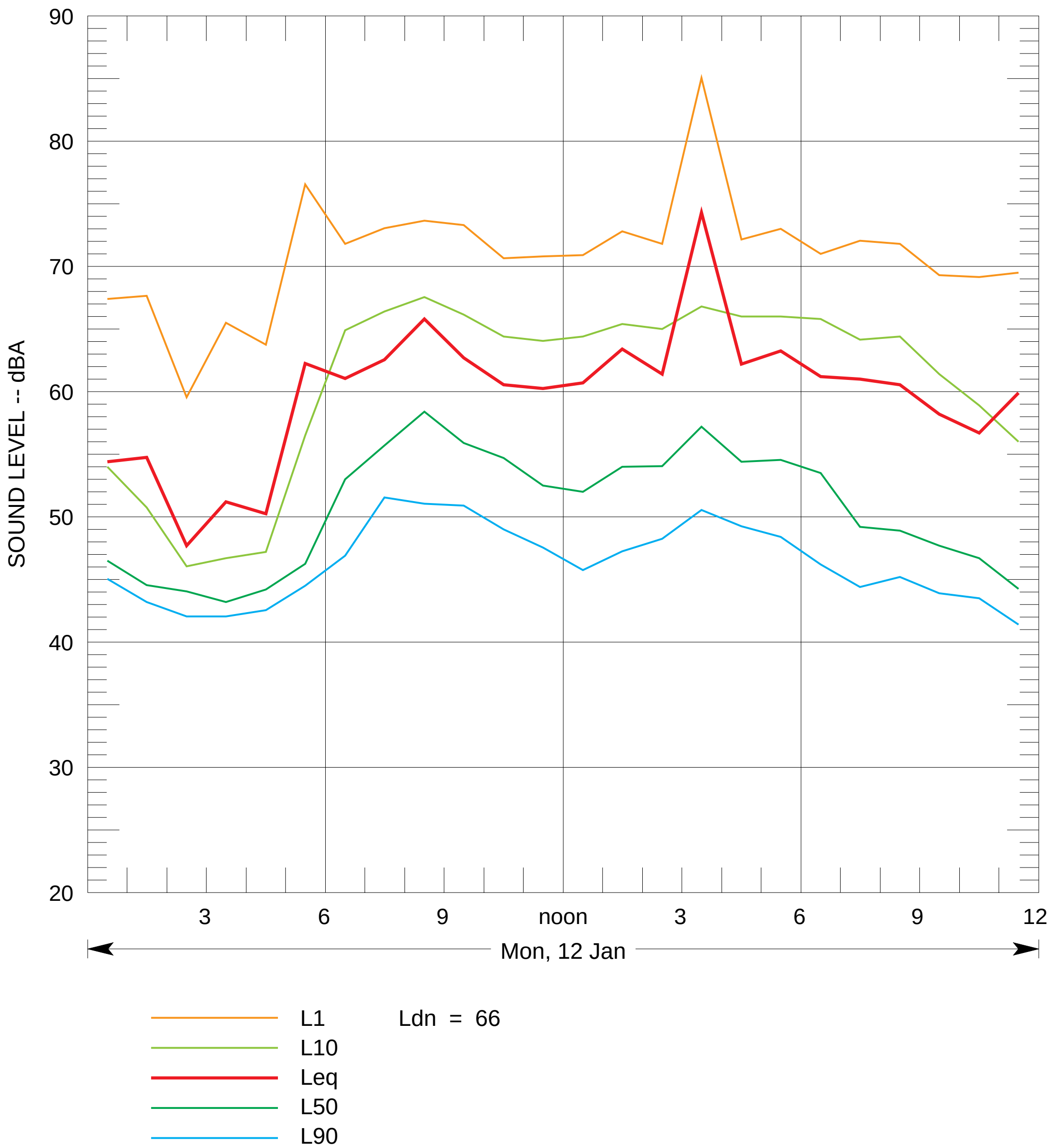


Figure A-12 Ambient Noise Levels Measured at Location N4
Kiska Road between Reardon Road & Ingalls Street
Monday, 12 January 2009

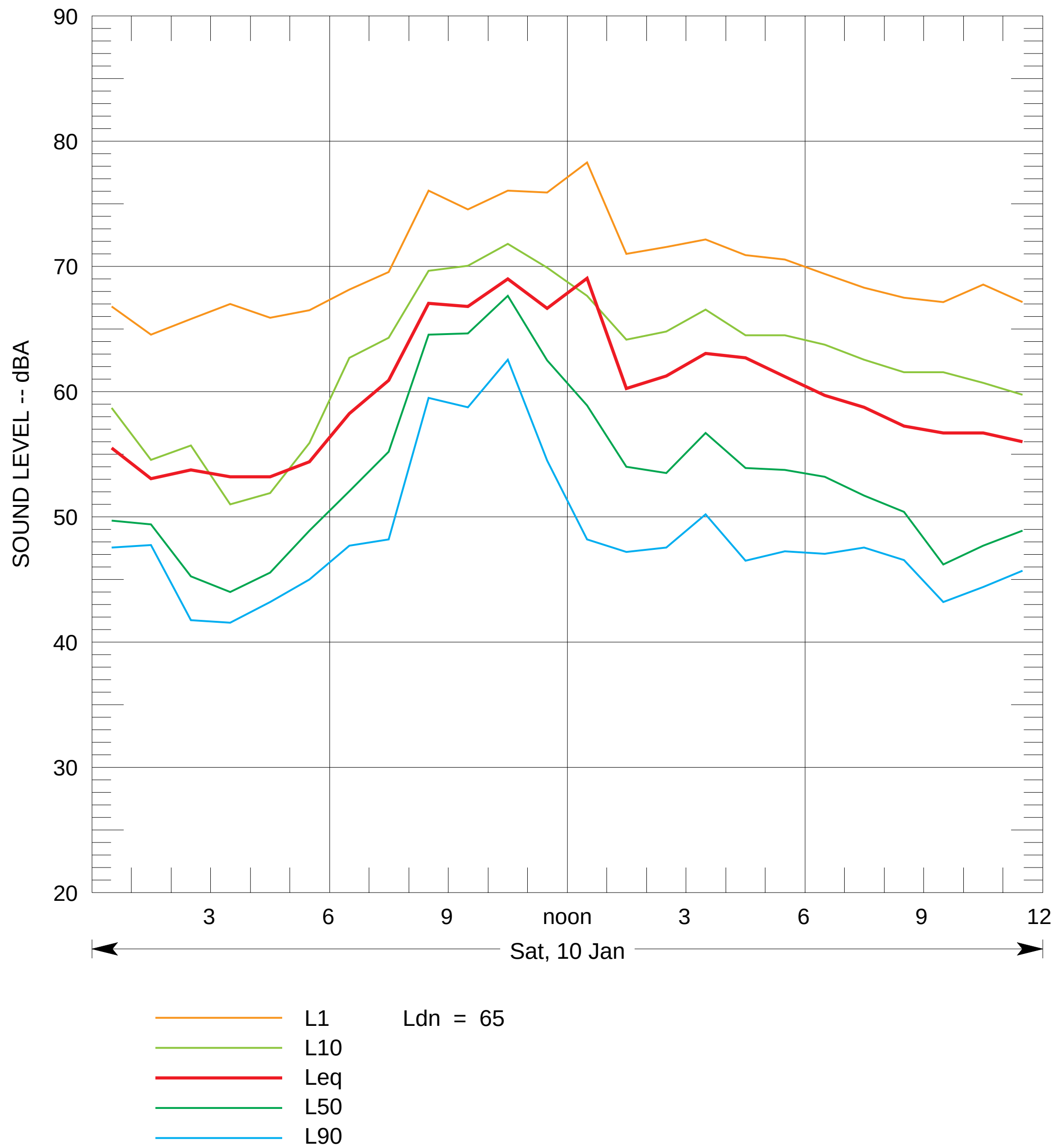


Figure A-13 Ambient Noise Levels Measured at Location N5
Hawes Street near Hunters Point Boulevard
Saturday, 10 January 2009

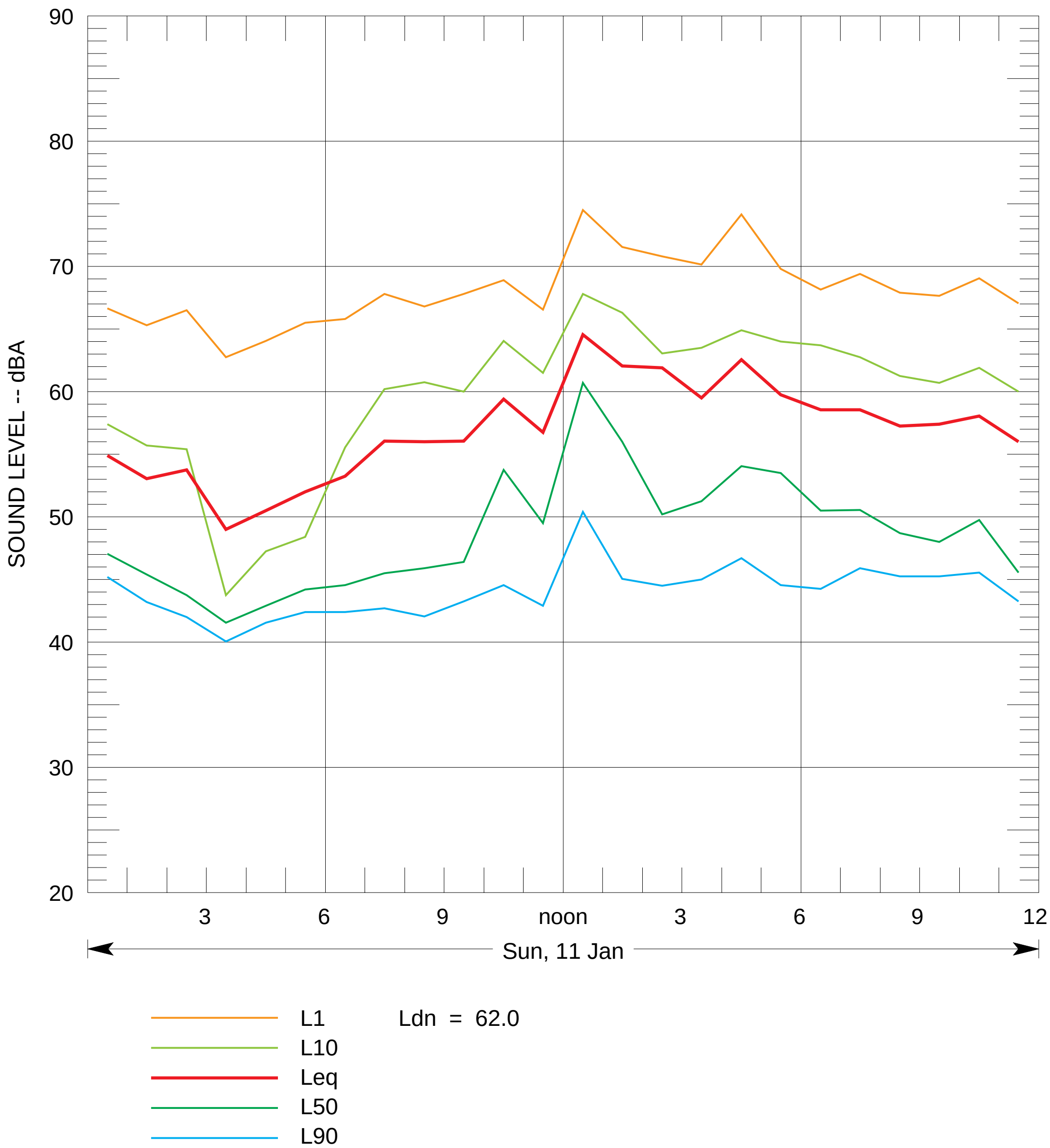


Figure A-14 Ambient Noise Levels Measured at Location N5
Hawes Street near Hunters Point Boulevard
Sunday, 11 January 2009

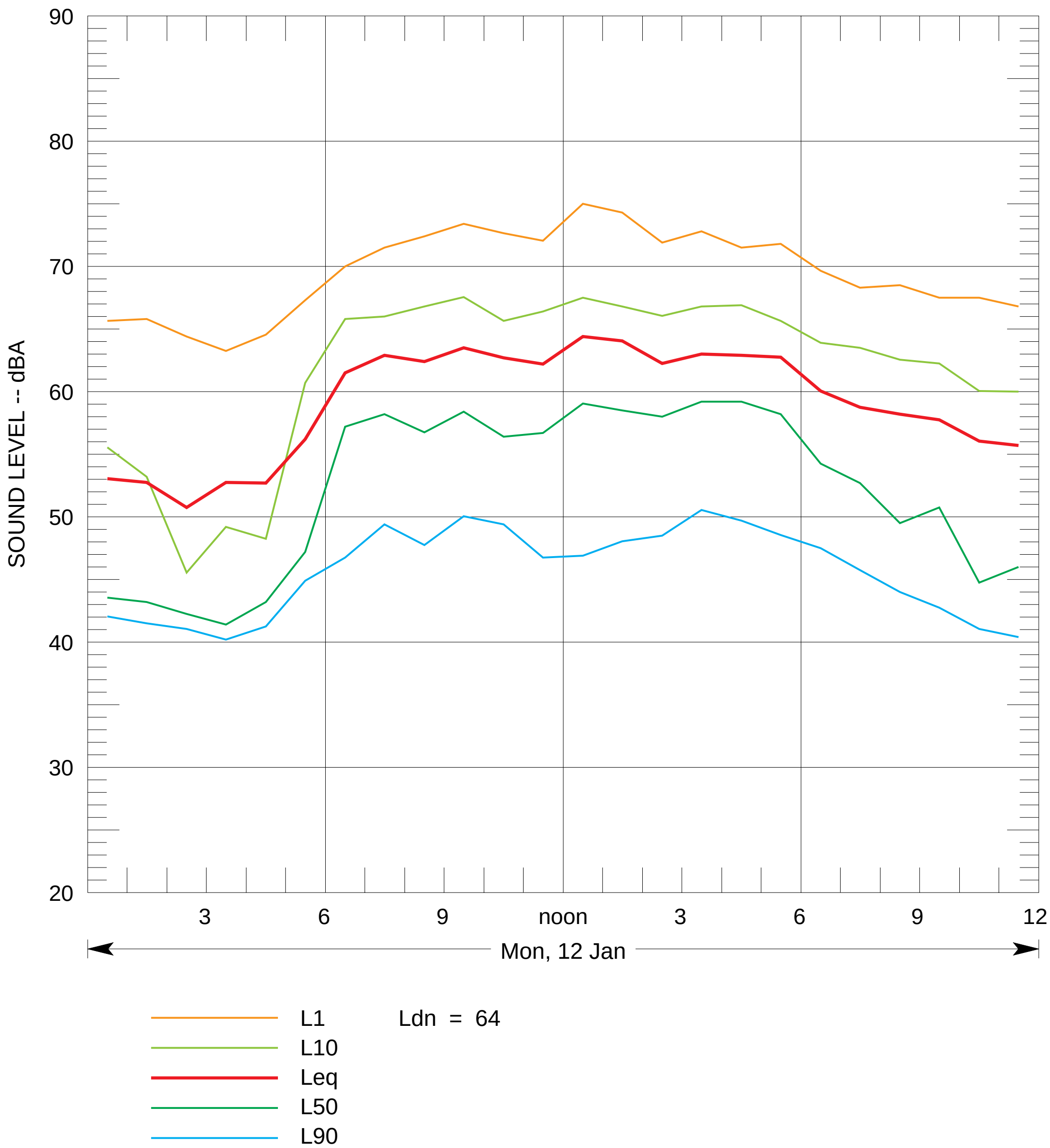


Figure A-15 Ambient Noise Levels Measured at Location N5
Hawes Street near Hunters Point Boulevard
Monday, 12 January 2009

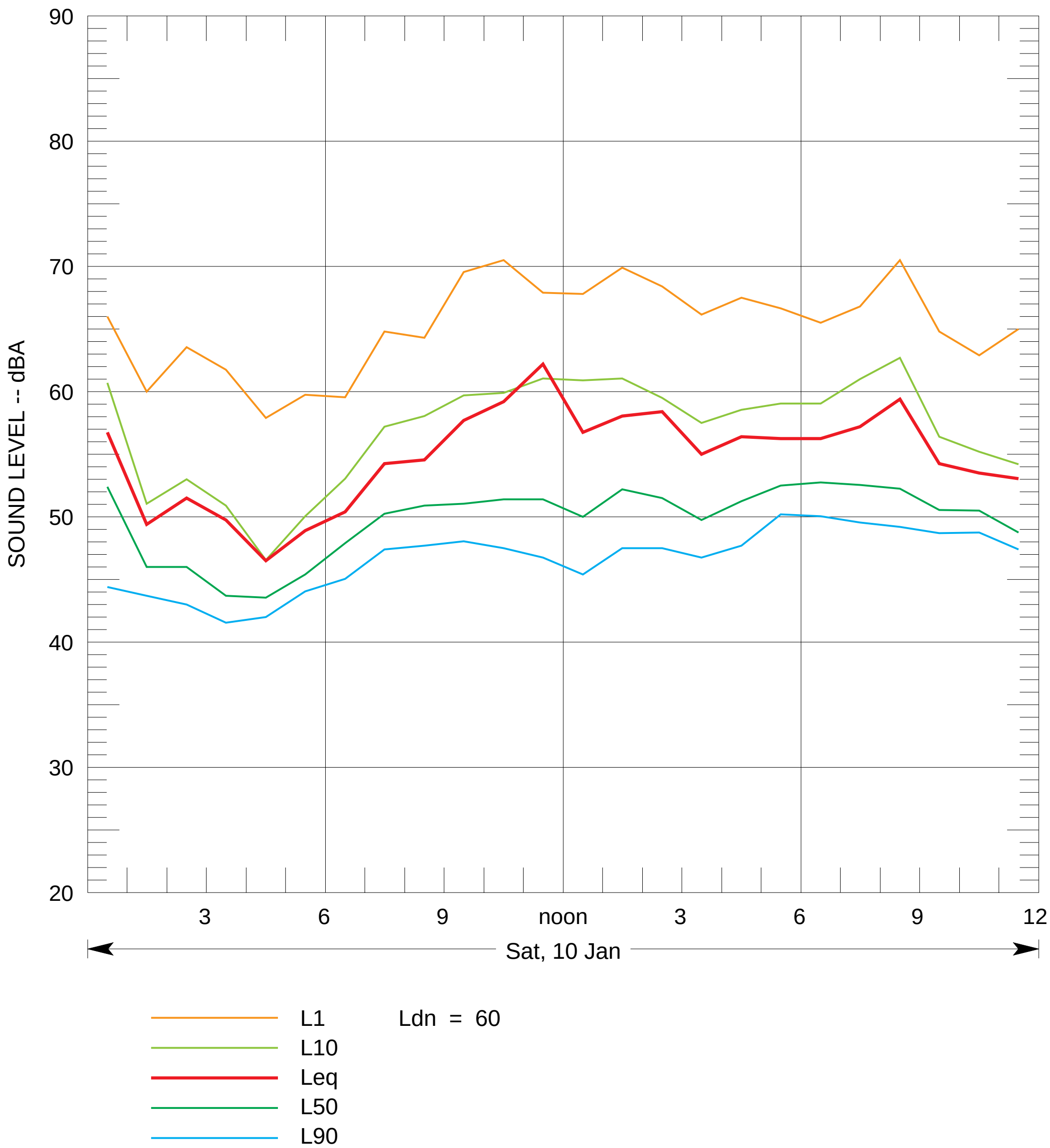


Figure A-16 Ambient Noise Levels Measured at Location N6
Jamestown Avenue at Hawes Street
Saturday, 10 January 2009

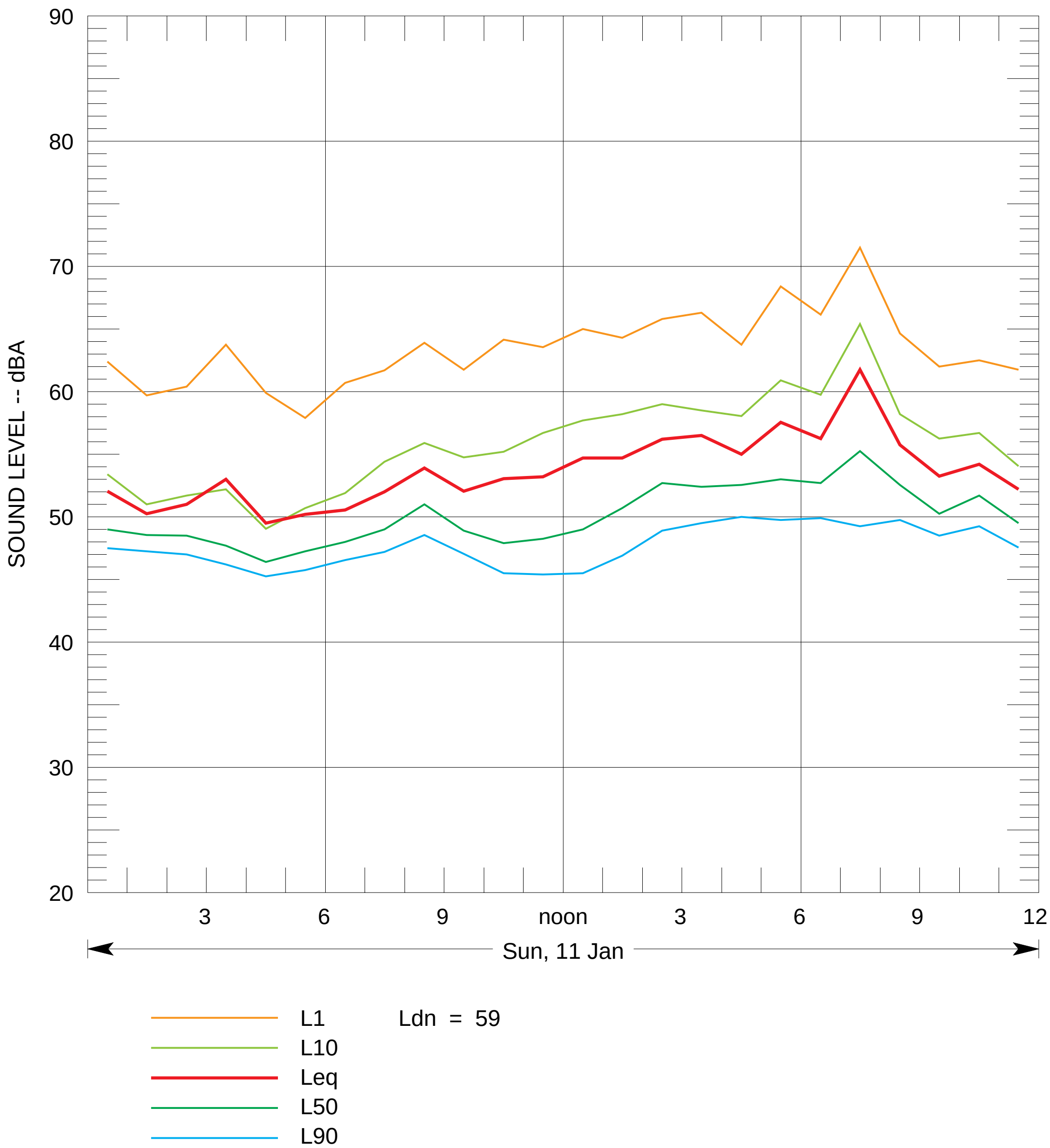


Figure A-17 Ambient Noise Levels Measured at Location N6
Jamestown Avenue at Hawes Street
Sunday, 11 January 2009

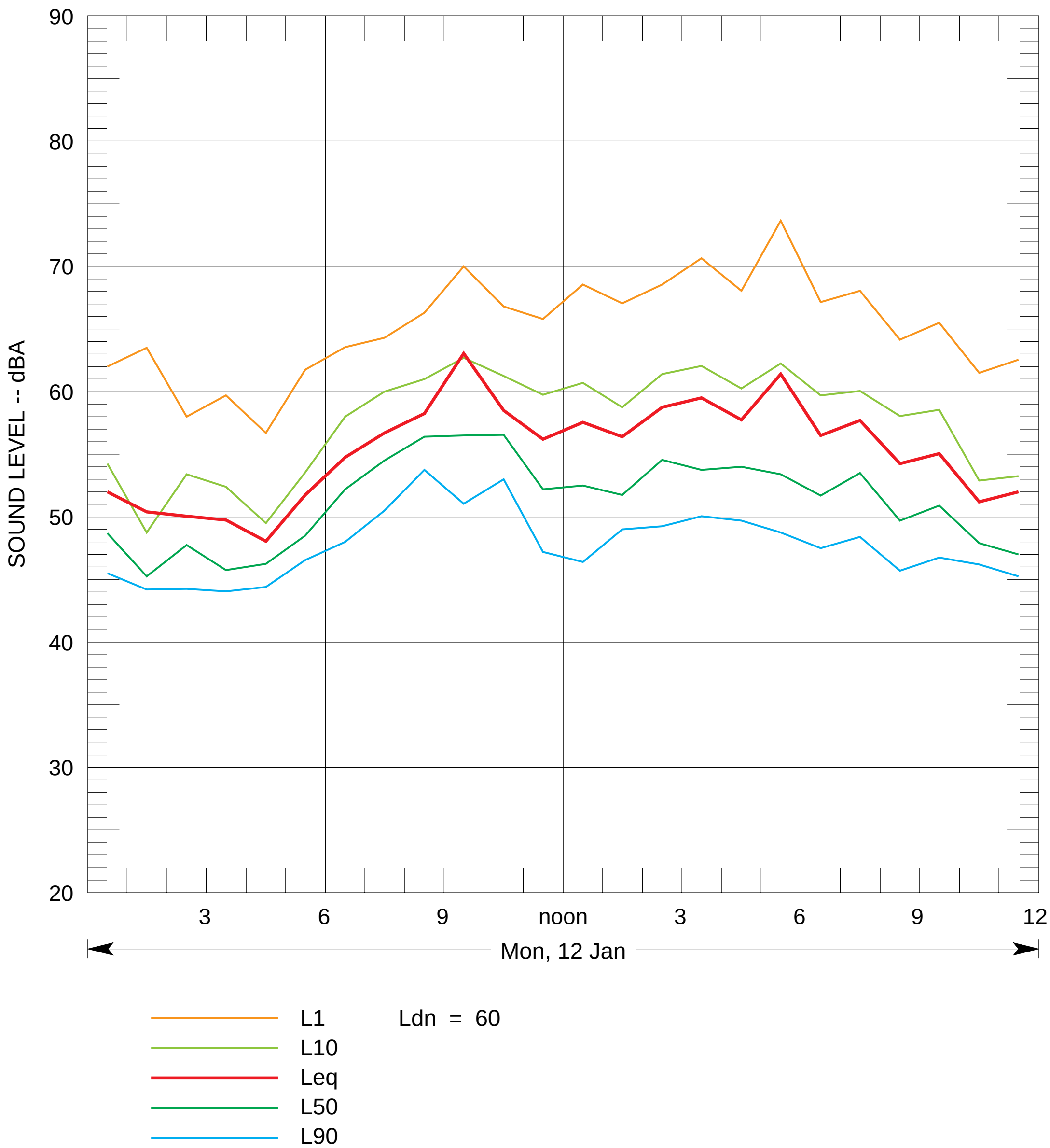


Figure A-18 Ambient Noise Levels Measured at Location N6
Jamestown Avenue at Hawes Street
Sunday, 12 January 2009

Appendix I2 PBS&J Short-Term Noise Measurements, May 20, 2009

MEASUREMENT DATASHEET: SHORT-TERM (AMBIENT): L1-10-50-90-95-99 — Location # 1

Project: Bayview Hunter's Point — **Date:** 5/20/09 — **Eqpt:** LD 820 — **Photos:** Y

Temp: Hot Warm Mild Cool Cold — **Wind (mph):** ≤2.5 2.5-5 5-10 ≥10 (dir): N E S W Δ — **Cloud Cover:** Clear Pt. Cld. Clouds Fog

Location Desc.: Candlestick Condos — **Noise Source(s):** traffic on Candlestick, 101 and air traffic

Rcp. Info: Residential — **Ground Effects:**

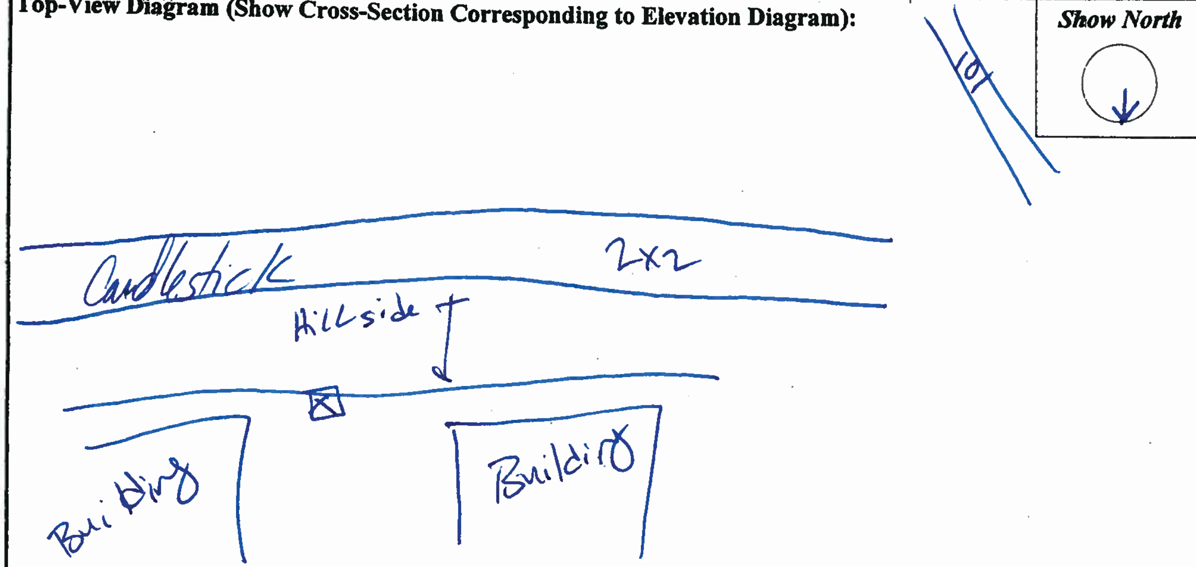
Barrier Effects:

Meas. Int.:			
Roadway: Candlestick			
Segment:			
Spd: *Post:* *Trav.:*			
Volumes			
Auto	MT	HT	Dir.
26	2	4	NB/EB
17	0	4	SB/WB

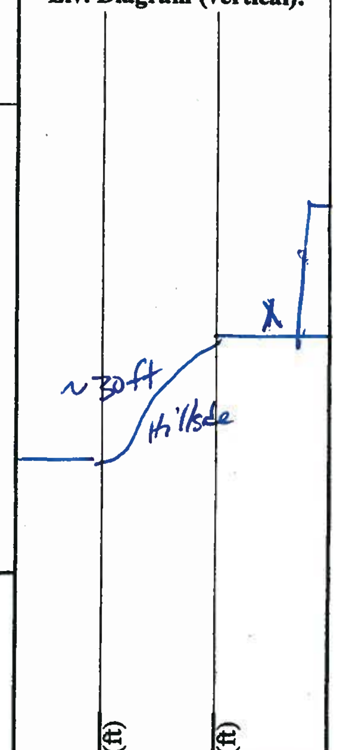
Meas. Int.:			
Roadway:			
Segment:			
Spd: *Post:* *Trav.:*			
Volumes			
Auto	MT	HT	Dir.
			NB/EB
			SB/WB

Cal. Δ @Int1		Cal. √	Offset
Yes	No	Int #:	

Top-View Diagram (Show Cross-Section Corresponding to Elevation Diagram):



Elv. Diagram (vertical):



General Comments:

Description	Int. #	Start (h:m(:s))	Duration ((h:)m:s)	SEL	Leq	Lmin	Lmax	L1	L10	L50	L90	L95	L99	Event/Anomaly Info: Description	Lmax	Begin	End
		3:10	15mins		66.8	60.5	87.3		69.6	64.7	62.9	62.5					

 Data File: ______ **Recorded By:**

...MEASUREMENT DATASHEET: SHORT-TERM (AMBIENT): L1-10-50-90-95-99 — Location # 2

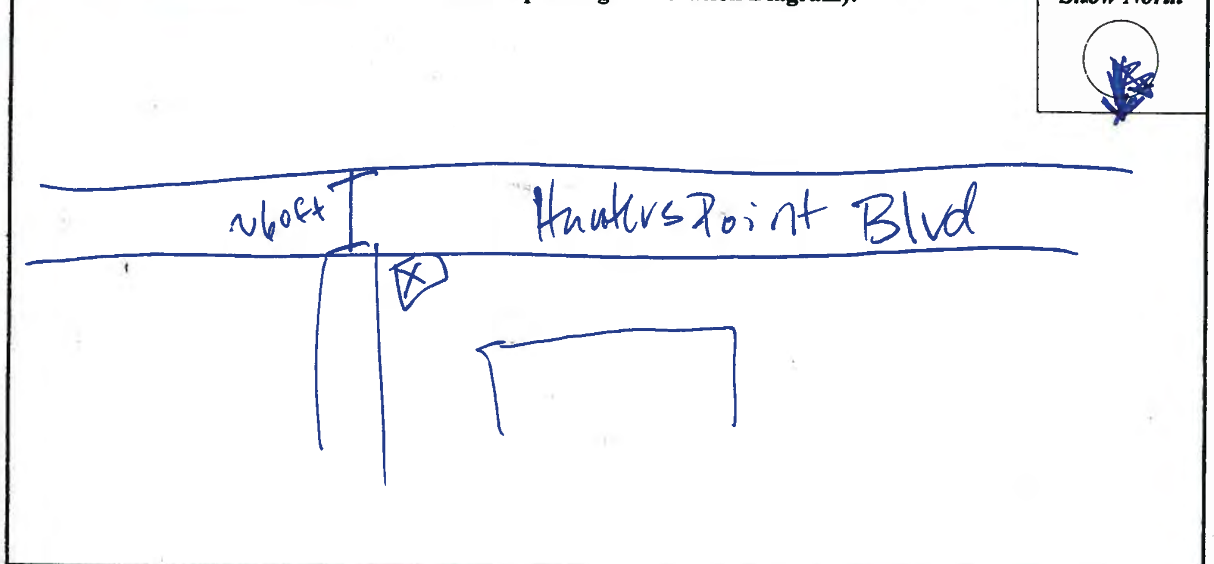
Project: Bayview Hunters Point	Date: 5/20/09	Eqpt: LD820	Photos: Y
Temp: Hot Warm Mild Cool Cold	Wind (mph): ≤2.5 2.5-5 5-10 ≥10 (dir): N E S W Δ	Cloud Cover: Clear Pt. Cld. Clouds Fog	
Location Desc.: Hunters Point Blvd ~~[illegible]~~	Noise Source(s): traffic		
Rcp. Info: Residential	Ground Effects: pavement		
Barrier Effects: None			

Meas. Int.:			
Roadway: Hunters Point			
Segment:			
Spd: *Post:*	*Trav.:*		
Volumes			
Auto	MT	HT	Dir.
[illegible]	2	0	NB/EB
24	3	2	SB/WB

Meas. Int.:			
Roadway:			
Segment:			
Spd: *Post:*	*Trav.:*		
Volumes			
Auto	MT	HT	Dir.
			NB/EB
			SB/WB

Top-View Diagram (Show Cross-Section Corresponding to Elevation Diagram):

Show North



Elv. Diagram (vertical):

(ft) (ft)

General Comments: sirens in distance

Cal. Δ @Int1		Cal. √		Offset
Yes	No	Int #:		

Description	Int. #	Start (h:m(:s))	Duration ((h:)m:s)	SEL	Leq	Lmin	Lmax	L1	L10	L50	L90	L95	L99	Event/Anomaly Info Description	Lmax	Begin	End
		4:00	15		67.8	47.1	86.3		70.9	55.7	50.6	49.9					

11/4/97(MSR-FORM.XLS; ST 1-10-50-90-95-99) Data File: ____________ Recorded By:

MEASUREMENT DATASHEET: SHORT-TERM (AMBIENT): L1-10-50-90-95-99 **Location #** 3

Project: Bayview/HP	**Date:** 5/20/09 **Eqpt:** **Photos:**
Temp: Hot Warm Mild Cool Cold	**Wind (mph):** ≤2.5 2.5-5 5-10 ≥10 **(dir):** N E S W Δ **Cloud Cover:** Clear Pt. Cld. Clouds Fog
Location Desc.:	**Noise Source(s):**
Rcp. Info:	**Ground Effects:**
Barrier Effects:	

Meas. Int.:

Roadway: palou

Segment: W/o Jennings

Spd: *Post:* *Trav.:*

Volumes			
Auto	**MT**	**HT**	**Dir.**
27	3	0	NB/EB
34	2	0	SB/WB

Meas. Int.:

Roadway:

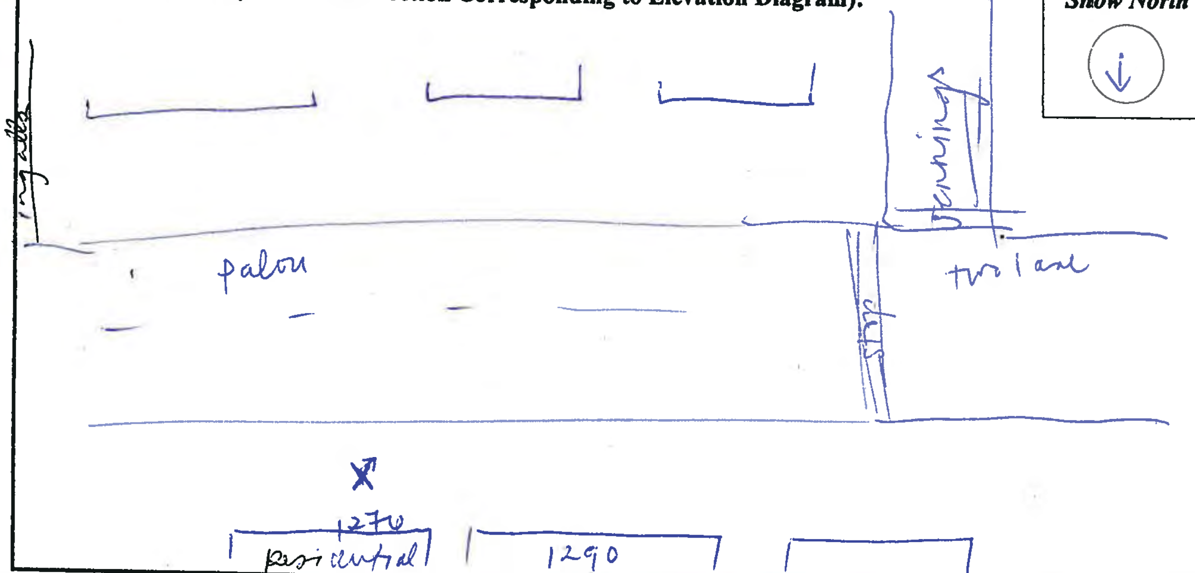
Segment:

Spd: *Post:* *Trav.:*

Volumes			
Auto	**MT**	**HT**	**Dir.**
			NB/EB
			SB/WB

Top-View Diagram (Show Cross-Section Corresponding to Elevation Diagram):

Show North



Elv. Diagram (vertical):

(ft) (ft)

General Comments: Majority cars, people walking/talking. car starting, door slamming, converse

Cal. Δ @Int1		**Cal. √**	**Offset**
Yes	No	Int #:	

Description	Int. #	Start (h:m(:s))	Duration ((h:)m:s)	SEL	Leq	Lmin	Lmax	L1	L10	L50	L90	L95	L99	Event/Anomaly Info Description	Lmax	Begin	End
		4:25	15min		65.8	51.6	84.4		68.7	60.1	54.4	53.9					

11/4/97(MSR-FORM.XLS; ST 1-10-50-90-95-99) **Data File:** ______ **Recorded By:**

... DATASHEET: SHORT-TERM (AMBIENT): L1-10-50-90-95-99 Location # 4

Project: Bayview Hunters Point | Date: 5/20/09 | Eqpt: LD820 | Photos: Y

Temp: Hot Warm Mild Cool Cold | Wind (mph): ≤2.5 2.5-5 5-10 ≥10 (dir): N E S W Δ | Cloud Cover: Clear Pt. Cld. Clouds Fog

Location Desc.: Carroll / Griffith | Noise Source(s): traffic

Rcp. Info: None/Residential across street | Ground Effects: pavement

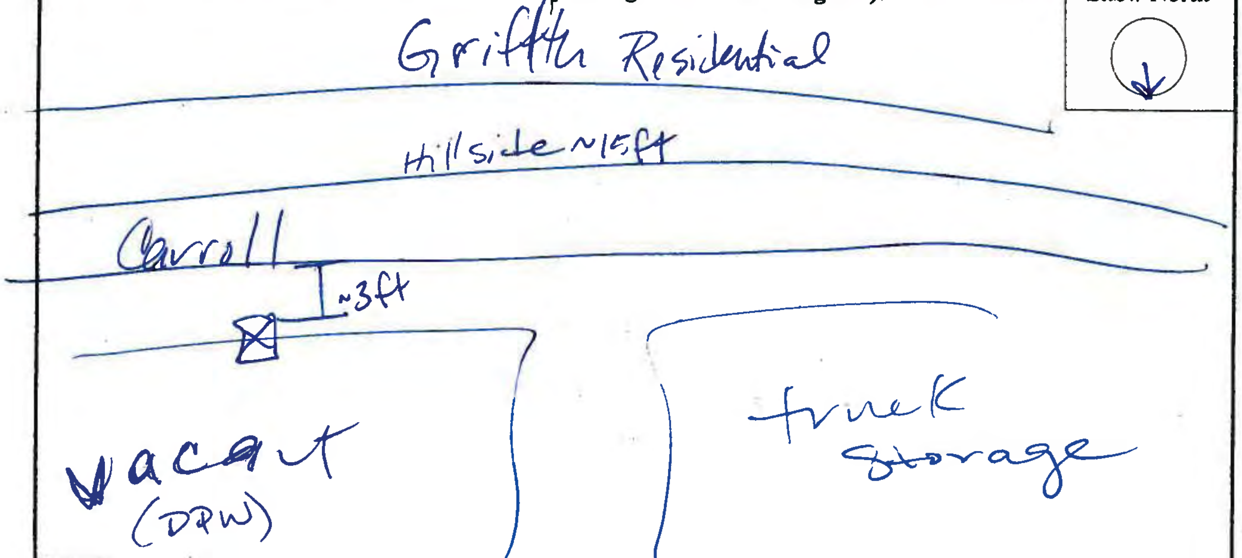
Barrier Effects: None

Meas. Int.:			
Roadway: Carroll			
Segment:			
Spd: *Post:*	*Trav.:*		
Volumes			
Auto	MT	HT	Dir.
12	1	Ø	NB/EB
6	1	Ø	SB/WB

Meas. Int.:			
Roadway:			
Segment:			
Spd: *Post:*	*Trav.:*		
Volumes			
Auto	MT	HT	Dir.
			NB/EB
			SB/WB

Cal. Δ @Int1		Cal. √	Offset
Yes	No	Int #:	

Top-View Diagram (Show Cross-Section Corresponding to Elevation Diagram):



Show North

Elv. Diagram (vertical):

(ft)

(ft)

General Comments:

Description	Int. #	Start (h:m(:s))	Duration ((h:)m:s)	SEL	Leq	Lmin	Lmax	L1	L10	L50	L90	L95	L99	Event/Anomaly Info: Description	Lmax	Begin	End
		4:50	15min		64.8	46.9	88.0		64.1	51.5	48.9	48.6					

11/4/97(MSR-FORM.XLS; ST 1-10-50-90-95-99)

Data File: ______________

Recorded By:

...SHORT-TERM (AMBIENT): L1-10-50-90-95-99 — Location # 5

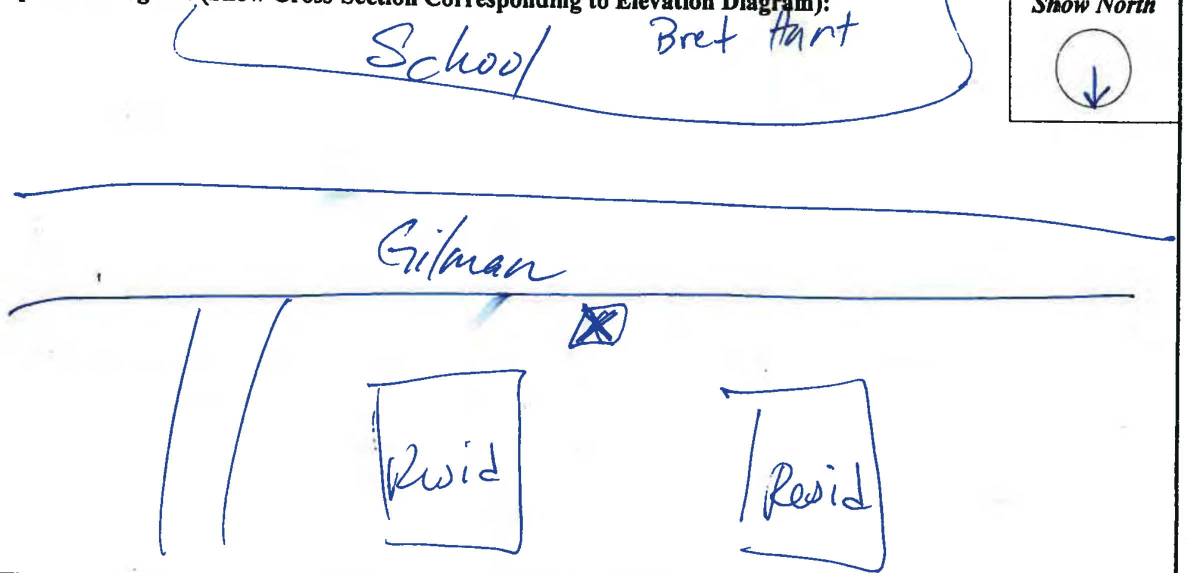
Project: Bayview Hunters Point	**Date:** 5/20/09
Eqpt: LD820	**Photos:**
Temp: Hot Warm Mild Cool Cold	**Wind (mph):** ≤2.5 2.5-5 5-10 ≥10 (dir): N E S W Δ
Cloud Cover: Clear Pt. Cld. Clouds Fog	
Location Desc.: Gilman	**Noise Source(s):** traffic
Rcp. Info: Residential / school	**Ground Effects:** Pavement
Barrier Effects: None	

Meas. Int.:			
Roadway: Gilman			
Segment:			
Spd: *Post:*	*Trav.:*		
Volumes			
Auto	**MT**	**HT**	**Dir.**
16	1	0	NB/EB
10	0	0	SB/WB

Meas. Int.:			
Roadway:			
Segment:			
Spd: *Post:*	*Trav.:*		
Volumes			
Auto	**MT**	**HT**	**Dir.**
			NB/EB
			SB/WB

Cal. Δ @Int1		**Cal. √**		**Offset**
Yes	No	Int #:		

Top-View Diagram (Show Cross-Section Corresponding to Elevation Diagram):



Show North

Elv. Diagram (vertical):

(ft) (ft)

General Comments:

Description	Int. #	Start (h:m(:s))	Duration ((h:)m:s)	SEL	Leq	Lmin	Lmax	L1	L10	L50	L90	L95	L99	Event/Anomaly Info Description	Lmax	Begin	End
		5:20	15min		61.4	52.4	78.9		64.1	57.0	54.2	53.9					

11/4/97(MSR-FORM.XLS; ST 1-10-50-90-95-99)

Data File: ____________

Recorded By:

Appendix I3 PBS&J Traffic Noise Model Output, October 6, 2009

PBSJ | **6 October 2009**
NI | **TNM 2.5**
Calculated with TNM 2.5

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: Candlestick Hunters Point
RUN: Existing
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	No Barrier LAeq1h Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Innes	1	1	0.0	55.3	66	55.3	10	----	55.3	0.0	8	-8.0
3rd Street north of Palou	2	1	0.0	64.0	66	64.0	10	----	64.0	0.0	8	-8.0
Cesar Chavez	3	1	0.0	61.4	66	61.4	10	----	61.4	0.0	8	-8.0
Palou	4	1	0.0	58.8	66	58.8	10	----	58.8	0.0	8	-8.0
Ingalls	5	1	0.0	58.7	66	58.7	10	----	58.7	0.0	8	-8.0
Carroll	8	1	0.0	54.6	66	54.6	10	----	54.6	0.0	8	-8.0
Gilman	10	1	0.0	59.7	66	59.7	10	----	59.7	0.0	8	-8.0
Jamestown	11	1	0.0	53.4	66	53.4	10	----	53.4	0.0	8	-8.0
Harvey Way residences	12	1	0.0	54.6	66	54.6	10	----	54.6	0.0	8	-8.0
Bayshore residences	14	1	0.0	67.1	66	67.1	10	Snd Lvl	67.1	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	10	0.0	0.0	0.0
All Impacted	1	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

PBSJ			6 October 2009
NI			TNM 2.5
			Calculated with TNM 2.5
RESULTS: SOUND LEVELS			
PROJECT/CONTRACT:	Candlestick Hunters Point		
RUN:	Future		
BARRIER DESIGN:	INPUT HEIGHTS		Average pavement type shall be used unless
			a State highway agency substantiates the use
ATMOSPHERICS:	68 deg F, 50% RH		of a different type with approval of FHWA.

Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated
							Sub'l Inc					minus
												Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Innes	1	1	0.0	62.9	66	62.9	10	----	62.9	0.0	8	-8.0
3rd Street north of Palou	2	1	0.0	69.3	66	69.3	10	Snd Lvl	69.3	0.0	8	-8.0
Cesar Chavez	3	1	0.0	65.5	66	65.5	10	----	65.5	0.0	8	-8.0
Palou	4	1	0.0	63.6	66	63.6	10	----	63.6	0.0	8	-8.0
Ingalls	5	1	0.0	63.7	66	63.7	10	----	63.7	0.0	8	-8.0
Griffith Park	8	1	0.0	55.8	66	55.8	10	----	55.8	0.0	8	-8.0
Gilman	10	1	0.0	62.6	66	62.6	10	----	62.6	0.0	8	-8.0
Jamestown	11	1	0.0	57.5	66	57.5	10	----	57.5	0.0	8	-8.0
Harvey Way residences	12	1	0.0	61.1	66	61.1	10	----	61.1	0.0	8	-8.0
Bayshore residences	14	1	0.0	70.5	66	70.5	10	Snd Lvl	70.5	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	10	0.0	0.0	0.0
All Impacted	2	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

PBSJ 6 October 2009
NI TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Candlestick Hunters Point
RUN: Future with Project
BARRIER DESIGN: INPUT HEIGHTS

ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
Innes	1	1	0.0	62.9	66	62.9	10	----	62.9	0.0	8	-8.0
3rd Street north of Palou	2	1	0.0	70.3	66	70.3	10	Snd Lvl	70.3	0.0	8	-8.0
Cesar Chavez	3	1	0.0	65.5	66	65.5	10	----	65.5	0.0	8	-8.0
Palou	4	1	0.0	64.1	66	64.1	10	----	64.1	0.0	8	-8.0
Ingalls	5	1	0.0	65.1	66	65.1	10	----	65.1	0.0	8	-8.0
Griffith Park	8	1	0.0	60.3	66	60.3	10	----	60.3	0.0	8	-8.0
Gilman	10	1	0.0	65.8	66	65.8	10	----	65.8	0.0	8	-8.0
Jamestown	11	1	0.0	64.3	66	64.3	10	----	64.3	0.0	8	-8.0
Harvey Way residences	12	1	0.0	61.6	66	61.6	10	----	61.6	0.0	8	-8.0
Bayshore residences	14	1	0.0	70.8	66	70.8	10	Snd Lvl	70.8	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	10	0.0	0.0	0.0
All Impacted	2	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Appendix J Page & Turnbull Secretary's Standards Evaluation of Proposed Treatments for Dry Docks 2, 3, and 4, October 5, 2009

DATE	October 5, 2009	PROJECT NO.	09061a
TO	Therese A. Brekke	PROJECT NAME	Hunters Point Shipyard
OF	Lennar Urban 49 Stevenson Street, Ste. 600 San Francisco, CA 94105 415.344.8853	FROM	Lada Kocherovsky and Richard Sucré
CC		VIA	Email

REGARDING : SECRETARY'S STANDARDS EVALUATION OF PROPOSED TREATMENTS FOR DRY DOCKS 2, 3 AND 4

This memorandum provides an evaluation of the proposed treatments planned for Dry Docks #2, #3, and #4, which are part of the Hunters Point Shipyard. These treatments are part of the proposed project being undertaken by Lennar Urban for the Candlestick Point/Hunters Point Redevelopment Project. The three dry docks under review will no longer be used as dry docks, and will function as elements of the shoreline flanked by public open space. As part of the proposed project, the area surrounding Dry Docks #2 and #3 will be known as Heritage Park, while the area surrounding Dry Dock #4 will be known as the Waterfront Promenade. Both areas will feature a park-like setting. The proposed treatments have been outlined by Moffatt & Nichol in a series of reports, which study the dry docks and shoreline, including:

- Moffatt & Nichol, *Candlestick Point/Hunters Point Redevelopment Project, Proposed Shoreline Improvements* (September 2009);
- Moffatt & Nichol, *Hunters Point Shoreline Structures Rapid Reconnaissance Investigation* (June 2009); and
- Moffatt & Nichol, *Hunters Point Shoreline Structures Assessment* (August 2009).

Dry Docks #2 and #3 are contributing elements of the Hunters Point Commercial Dry Dock and Naval Shipyard Historic District, which has been determined to be eligible for listing in the National Register of Historic Places (National Register). Dry Dock #4 has been individually recognized as a structure, which is eligible for listing in the National Register. Therefore, Dry Docks #2, #3, and #4 are considered to be historic resources.

This memorandum also addresses the requirements outlined in the Memorandum of Agreement (MOA) between the United States Navy, the Advisory Council on Historic Preservation, and the California State Historic Preservation Officer regarding the interim leasing and disposal of historic properties on the former Hunters Point Naval Shipyard in San Francisco, California. As noted in the MOA:

> *5. Leasing of Historic Properties*
>
> *a. Prior to the transfer, sale or conveyance by some other means from the control and jurisdiction of the Navy, the Navy may enter into interim leases which will permit tenants to adaptively reuse Shipyard's National Register eligible properties, provided that the lease agreements require tenants to follow the recommended practices of the Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings (Standards) in maintaining or adapting these historic properties for use.*

b. Until the Shipyard's National Register eligible properties are transferred, sold, or conveyed by some other means from the control and jurisdiction of the Navy, the Navy shall require the Agency to seek the comments of the San Francisco Landmarks Preservation Advisory Board prior to seeking Navy approval for adaptive reuses of Drydock 4 and the Hunters Point Commercial Drydock Historic District.

This memorandum analyzes the proposed treatments outlined for Dry Docks #2, #3, and #4, and would satisfy the requirements of the MOA. It should be noted that the San Francisco Landmarks Preservation Advisory Board has been replaced by the San Francisco Historic Preservation Commission.

Description: Dry Dock #2

Dry Dock #2 was completed in 1903 and was constructed as part of the San Francisco Dry Dock Company (formerly California Dry Dock Company and the predecessor to the Hunter Point Naval Shipyard). As noted in the DPR 523 forms completed by Circa: Historic Property Development in June 2008:

Dry dock 2 is a graving dry dock, measuring 750' by 122' at ground level and 712' by 74' at the base. It is approximately 30 feet deep. The dry dock was filled through 13, 30-inch culverts in the steel caisson. A discharge channel runs east from the dry dock to the Bay (NAVSEA). Typical of many dry docks, it was constructed in a terraced manner, with a regular series of shelf-like ridges excavated into the bedrock. The basin was lined primarily in concrete and at the gates, just above water level, the basin is lined with what appear to be granite blocks. The gates and gate structures were removed sometime after 1988 and the dry dock can no longer be dewatered (JRP). The crane ways, railroad spurs, perimeter fence, bollards and other site features are largely intact.

In the *Hunters Point Shoreline Structures Rapid Reconnaissance Investigation,* Moffatt & Nichol provide a description of all three dry docks, as follows:

Dry Docks 2, 3, and 4 consist primarily of concrete walls. Cross-sectional shape varies within these dry docks, ranging from trapezoidal to rectangular sections. The bottom surfaces are concrete. The sides are constructed of smooth-surfaced reinforced concrete walls and stepped reinforced concrete walls. Concrete steps are found at various locations along the sides. Concrete overhangs with hand railing are found intermittently above the waterline.[1]

Description: Dry Dock #3

Dry Dock #3 was completed in 1918, and was constructed to replace the original dry dock (Dry Dock #1), which was constructed in 1867. As noted in the DPR 523 forms completed by Circa: Historic Property Development in June 2008:

Dry dock 3 is a graving dry dock that is located north of and parallel to Dry dock 2. It measures 1,076' by 153' at ground level and 1,020' by 110' at the bottom. A channel for water from Dry dock 3 passes in a straight line north from the dry dock through Pumphouse 3 (Building 140) to the Bay (NAVSEA). Like Dry dock 2, it was constructed in a terraced manner, with a regular series of shelf-like ridges constructed to create the basin. The basin was then lined primarily in concrete and at the gates, just above water level, the

[1] Moffatt & Nichol, *Hunters Point Shoreline Structures Rapid Reconnaissance Investigation* (June 2009) 3.

> *basin is lined with stone blocks. The gates and gate structures were removed sometime after 1988 and the dry dock can no longer be dewatered (JRP). The crane ways, railroad spurs, perimeter fence, bollards and other site features are largely intact.*

<u>*Description: Dry Dock #4*</u>

Dry Dock #4 was completed in 1943 by naval architect and engineer Hugo Fear and the Pacific Bridge Company. It is noted as one of the largest graving dry docks on the Pacific Coast is one of the largest of its kind in the world. As noted in the DPR 523 forms completed by Circa: Historic Property Development in August 2008:

> *Dry Dock 4 is 1,092' by 143' northwest to southeast, 143' east to west and 53-foot-deep concrete graving dry dock, with a rounded northwest end. Access steps are recessed into the sloped sidewalls and the floor is flat. The dry dock is outlined by a crane track that permits access to ships in the dock from all angles. Two or more smaller ships could be docked for servicing at the same time. A caisson or closing gate is located at the south end of the dry dock and the drainage system runs from the southeast corner of the structure eastward to the Bay. Crane ways, rail spurs, bollards and cleats surround the dry dock at ground level and are still extant.*

> *Dry Dock #4 is a graving dock. A graving dock is cut (engraved) into the base rock, as opposed to a floating dry dock that is constructed of wood and other materials and has no foundation other than water. Graving docks; when located adjacent to deep water channels, supported by land transportation systems, and work forces, are the more efficient. They are also stable and require less maintenance than the floating dry dock. For these reasons graving dry docks are preferred, particularly for servicing large ships.*

In *Hunters Point Shoreline Structures Assessment*, Moffatt & Nichol describe Dry Dock #4 as:

> *Drydock no. 4 is a reinforced concrete structure with concrete sidewalls. The cross section of the drydock varies in trapezoidal shapes the entrance has steeper sloping walls compared to the main drydock with flatter sloping walls. It is larger compared to drydocks 2 and 3.*[2]

---

[2] Moffatt & Nichol, *Hunters Point Shoreline Structures Assessment* (August 2009) 5.
[3] Moffatt & Nichol, *Hunters Point Shoreline Structures Rapid Reconnaissance Investigation* (June 2009) 6.
[4] Moffatt & Nichol, *Hunters Point Shoreline Structures Assessment* (August 2009) 13.
[5] Moffatt & Nichol, *Hunters Point Shoreline Structures Rapid Reconnaissance Investigation* (June 2009) 10.
[6] Moffatt & Nichol, *Candlestick Point/Hunters Point Redevelopment Project, Proposed Shoreline Improvements* (September 2009) 9-10.
[7] Moffatt & Nichol, *Hunters Point Shoreline Structures Assessment* (August 2009) 21.
[8] Morton, W. Brown III, Gary L. Hume, Kay D. Weeks, and H. Ward Jandl, *Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines for Rehabilitating Historic Buildings* (Washington, D.C.: U.S. Department of the Interior, National Park Service, Cultural Resources, Preservation Assistance Division, 1992). The *Standards*, revised in 1992, were codified as 36 CFR Part 68.3 in the July 12, 1995 Federal Register (Vol. 60, No. 133). The revision replaces the 1978 and 1983 versions of 36 CFR 68 entitled *The Secretary of the Interior's Standards for Historic Preservation Projects*. The 36 CFR 68.3 *Standards* are applied to all grant-in-aid development projects assisted through the National Historic Preservation Fund. Another set of *Standards*, 36 CFR 67.7, focuses on "certified historic structures" as defined by the IRS Code of 1986. *The Standards* in 36 CFR 67.7 are used primarily when property owners are seeking certification for Federal tax benefits. The two sets of *Standards* vary slightly, but the differences are primarily technical and are not substantive in nature. The *Guidelines*, however, are not codified in the Federal Register.

Condition

As documented by Moffat & Nichol in *Hunters Point Shoreline Structures Rapid Reconnaissance Investigation* (June 2009), the condition of Dry Dock #2 and #3 was noted as follows:

> *These dry docks are rated in POOR condition. Although widespread, damage is primarily characterized by minor, infrequent spalls with occasional vertical cracks extending the full height of the concrete from above the waterline. Approximately half of these cracks show discoloration. The more widespread damage was observed on the concrete just above the waterline, which exhibits smaller cracking in vertical and horizontal directions. This type of cracking (see Photograph D3.4) typically shows corrosion, and is found along approximately half of the total length that bounds Dry Dock No. 3. As indicated on the stepped side in Photograph D2.1, the concrete matrix has deteriorated due to its age, and air pockets have expanded into large voids, displaying a rough outer surface. A rough outer surface is also visible on vertical and sloped portions of the wall (see Photograph D2.2).*[3]

Further observation of the condition of Dry Docks #2 and #3 noted that vertical cracks extend the full height of the walls and that air pockets have expended into large voids.[4]

For Dry Dock #4, Moffat & Nichol noted the condition as follows:

> *Dry dock No. 4 is rated in POOR condition. Advanced deterioration is widespread throughout the structure. Greater than 40% of the concrete structure exhibits patches of open and closed corrosion spalls and delamination. The majority of these types of damages are exhibited along the full height of the concrete, as shown in Photographs D4.1 through D4.6. Delaminations are observable on open faces of concrete, as well as around openings for utility lines (see Photograph D4.4). Spalls are also localized around cold joints and corners of various parts of concrete, such as the corners at the slots where the gate was positioned during periods of dry dock usage (see Photograph D4.8). Damage also consists of horizontal corrosion cracking, as shown in Photograph D4.7, where horizontal cracks with discoloration were observed in the splash zone.*[5]

Proposed Treatments

Based upon the proposed improvement concepts outlined by Moffatt & Nichol in *Candlestick Point/Hunters Point Redevelopment Project, Proposed Shoreline Improvements*, Dry Docks #2, #3, and #4 would be modified as follow:

- <u>Addition of Weep Holes</u>: The project will add weep holes on the sidewall to reduce pressure behind it. These weep holes shall be located above the lowest tide and shall extend to near the top of the dry dock walls;
- <u>Addition of Rock/Sand Buttresses</u>: The project will add rock or sand buttresses on the face of the dry dock walls at the bottom. This will result in additional passive resistance with the intent of increasing slope stability.
- <u>Concrete Repair</u>: The project will repair the exposed dry dock walls by patching any spalls, exposed and corroded reinforcing bars, and broken concrete. This will include applying high strength concrete grout to exposed surfaces and/or epoxy mix application to cracks. It should extend from below the lowest tide up to near the top of the dry dock walls.[6]

The quantity of these repairs is as follow:

- *Dry Dock #2* = Concrete Repair (9,000 square feet); Addition of Rock/Sand Buttresses (32,000 cubic yards); and Addition of Weep Holes (360 ea)
- *Dry Dock #3* = Concrete Repair (19,300 square feet); Addition of Rock/Sand Buttresses (44,500 cubic yards); and Addition of Weep Holes (440 ea)

- *Dry Dock #4* = Concrete Repair (38,000 square feet); Addition of Rock/Sand Buttresses (49,700 cubic yards); and Addition of Weep Holes (460 ea)

In detail, the concrete repairs are described as follows:

> *Concrete repairs include spall and crack repair above and under water. Concrete wall, caisson and underside of wharf deck repairs above the waterline will be completed from small floating platforms or temporary scaffolding. Spalled concrete areas above water will have the spalls removed (by grinding or abrasive blasting) and replaced with pneumatically placed concrete (shotcrete) or trowel applied mortar. Large-width concrete cracks will be cleared of debris (by air-blasting or hand tools) and pressure-injected with epoxy or cementitious grout.*
>
> *Underwater concrete repairs includes concrete removal (by high pressure water jets, pneumatic- or hydraulic-powered chipping hammers or saws), surface preparation (by high pressure water jets, abrasive blasting or mechanical scrubbers), installation of anchors and placement of concrete (for spalls) or epoxy (for cracks) by pipe and pump, injection or hand placement, spall repairs will be held in place by form work where spall sizes are large. Underwater repair work will be accomplished with support crew and equipment on a floating platform or barge.*[7]

In addition to the proposed treatments outline above, new guardrails would be added to the perimeter of each of the dry docks.

<u>*Evaluation*</u>
This section provides an evaluation of proposed treatments and examines their consistency with each of the Standards for Rehabilitation. *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines for Rehabilitating Historic Buildings* (Standards) provide guidance for reviewing proposed work on historic properties.[8] The Standards are used by Federal agencies in evaluating work on historic properties. The Standards have also been adopted by local government bodies across the country (including the Historic Preservation Commission) for reviewing proposed rehabilitation work on historic properties under local preservation ordinances. The Standards are a useful analytic tool for understanding and describing the potential impacts of substantial changes to historic resources. The following analysis applies each of the Standards to the proposed treatment.

1. *A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.*

The three dry docks under review will be used as an open space amenity and will no longer be used as a dry dock facility. This new use will require minimal change to the resource's distinctive materials, features, spaces and spatial relationships. The proposed treatments outlined for the dry docks provide for the repair and retention of the historic elements, including the concrete and trapezoidal or rectangular shape. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #1.

2. *The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.*

The overall historic character of the three dry docks will be retained and preserved by the proposed treatments. The proposed treatments call for the installation of weep holes into the concrete dry docks sidewalls, in order to reduce the pressure from behind. This treatment will involve the removal of some distinctive materials. These weep holes will be approximately 6" in diameter and spaced ten feet on center along the sidewalls of the dry docks. The weep holes will be located above the lowest tide point and will extend towards the top of the dry dock walls. Although the installation of the weep holes removes some distinctive materials, this treatment can be considered a minor alteration, especially when examined against the vast amount of surface area of the dry dock sidewalls. The amount of concrete sidewall being removed is minor compared to the overall size and scale of the dry docks. The installation of the weep holes provides for continued use of the dry dock walls, and the distinctive materials of the dry docks are largely retained and preserved as part of the project. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #2.

3. *Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.*

The proposed treatments for the three dry docks under review will not feature changes that create a false sense of historical development. The addition of the rock and sand buttresses will be clearly differentiated from the historic concrete form of the dry dock. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #3.

4. *Changes to a property that have acquired historic significance in their own right will be retained and preserved.*

In general, few alterations have occurred to Dry Docks #2, #3, and #4. These dry docks have not acquired changes, which have garnered historic significance in their own right. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #4.

5. *Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.*

The proposed treatments will preserve distinctive materials, features, finishes and construction techniques found in the three dry docks under review. In particular, the proposed treatments call for the repair of exposed dry dock walls, which may include patching any spalls, removal and replacement of exposed and corroded reinforcing bars, and broken concrete that can't be patch. Overall, the distinctive features of the three dry docks, including the concrete sidewalls, overall form, and location, are being maintained by the proposed treatments. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #5.

6. *Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.*

As mentioned previously, the proposed treatments call for the repair of the exposed dry dock walls, which includes patching any concrete spalls, repairing and/or replacing exposed or corroded reinforcing bars, and repairing broken concrete. These treatments are all consistent with Rehabilitation Standard #6, since they involve repairing, not replacing, deteriorated historic features. Where deteriorated beyond repair, the proposed treatments will replace materials in-kind, keeping the character of the dock walls consistent with the original design. Where parts of concrete walls need to be replaced due to severe deterioration, the replacement surface will be similar in texture and color to the original concrete wall finish. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #6.

7. *Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.*

The proposed treatments do not involve chemical or physical treatments, which may damage historic materials. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #7.

8. *Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.*

If archaeological resources are uncovered during the implementation of the proposed treatments, the project sponsor will seek consultation from a qualified archaeologist (meeting or exceeding the Secretary of the Interior's Professional Qualification Standards in Archaeology) and shall undertake appropriate mitigation measures. Since this resource involves underwater resources, specialized knowledge of underwater archaeology may be required. The environmental document for the proposed project should outline the appropriate mitigation measures for archaeological resources. If undertaken as outlined, the proposed treatments for the three dry docks would be consistent with Rehabilitation Standard #8.

9. *New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.*

The proposed treatments for the three dry docks under review involve the new addition of rock/sand buttresses and the installation of weep holes. These two treatments will affect the historic concrete sidewalls and the overall shape of the dry docks basins. However, these two treatments will not negatively impact these two features, or any other important historic materials, features, and spatial relationships that characterize the property. The proposed treatments provide for the longevity and continued use of the resource, and when viewed in reference to the overall size and scale of the dry docks, these treatments can be considered minor. The new work will be clearly differentiated from the historic dry docks, since the original form of the dry docks only included concrete, and new materials include rock and sand. Overall, the integrity of the property is maintained, since a minimal amount of historic materials are being removed and since the form, size, scale are being preserved. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #9.

10. *New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.*

The proposed treatments involve new construction consisting of new guardrails along the perimeter of the dry docks and new sand/rock buttresses, which will be located underwater in the basin of the dry dock. This new construction will not affect the overall form and integrity of the three dry docks, since its original concrete construction and trapezoidal/rectangular shape will be retained. Furthermore, the individual contributing features of the dry docks, including the concrete staircases, filling culverts, discharge culverts and adjacent decks will not be impacted by the proposed treatments, and will remain in place. Therefore, the proposed treatments for the three dry docks are consistent with Rehabilitation Standard #10.

Recommendations

The rehabilitation strategies and treatments, as outlined in Moffat & Nichol's reports, are preliminary. We recommend that, as the Dry Docks are evaluated further, details of the proposed treatments be reviewed for consistency with the Standards. For example, weep holes should be installed in a manner that would have the least visual impact on the face of the concrete wall, avoiding exposed piping and anchors. The specifications for the concrete patching should be developed to allow close matching of the texture and color of existing concrete surfaces. New elements, such as guardrails and handrails, should be designed to maintain the overall simple industrial character appropriate to the shipyard's original utilitarian uses. Contingencies should be included in the overall cost estimates for the future project in order to accommodate these recommendations.

Conclusion

The proposed treatments for Dry Docks #2, #3, and #4 are consistent with the Secretary of the Interior's Standards for Rehabilitation. The treatments outlined provide a methodology for resolving severe deterioration issues, and ultimately provide for the longevity of the historic resources.

This memorandum and evaluation has been undertaken by professionals whom meet the Secretary of the Interior's Professional Qualification Standards in Historic Architecture and Architectural History.

Appendix J1 CIRCA, Historic Context Statement, July 2009

BAYVIEW WATERFRONT PLAN HISTORIC RESOURCES EVALUATION, VOLUME I: HISTORIC CONTEXT STATEMENT

Prepared for

PBS&J on behalf of the San Francisco Redevelopment Agency

Prepared By

CIRCA: HISTORIC PROPERTY DEVELOPMENT

1 Sutter Street #910, San Francisco, California

JULY 2009

Updated: July 2009

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I. BACKGROUND AND OBJECTIVES

INTRODUCTION

This historic context statement is part of the review of the Bayview Waterfront Project (BWP) Environmental Impact Report (EIR). This project encompasses Candlestick Point, Hunters Point Shipyard and the India Basin Shoreline. The Candlestick Point-Hunters Point Shipyard Phase II Development Plan contains Candlestick Point State Park, Candlestick Stadium, the Alice Griffith public housing and most of Hunters Point Shipyard. The India Basin Shoreline plan includes parcels from the boundaries of Hunters Point Shipyard up to and including the Pacific Gas & Electric Hunters Point Plant, now under demolition. The purposes of this document are to provide background material for the evaluation of potential historic resources within the Project and to inform the relevant sections of the Environmental Impact Report for the BWP.

To this end, this document is primarily concerned with the historical development of specific project sub-areas noted above. However, these parcels have traditionally been part of a larger community. The history and development of this larger community must be discussed to a degree to more fully frame the significance within the specific project sub-areas. This report is not intended to be a comprehensive history of the Bayview or Hunters Point districts, though information on the early development of these districts is briefly discussed.

This context statement is focused on specific geographic zones. It is primarily concerned with the existing built environment. For further discussions on prehistorical and historical archaeological studies and contexts, please see the archaeological context statement for the Project prepared by Archeo-Tec: Consulting Archaeologists for a parallel discussion. Where relevant, sections of this complementary document have been used for continuity and clarification. Please see footnotes for more precise citations of their work.

USE OF GEOGRAPHIC TERMINOLOGY

The use of geographic descriptions throughout this report refer to the general districts of the City and County of San Francisco unless specifically stated otherwise. When the point being discussed is within a specific Project sub-area, this is noted as such. Because much of the historical context for the Project is tied closely with the development of nearby parcels and regions that are not part of the Project, discussion must include a broader geographic region than is defined in the EIR scope. Therefore, when discussing the general area, including the sub-area sites, the term "Bayview-Hunters Point" is used. Where the discussion is confined to the sub-areas only (Candlestick Point, Hunters Point Shipyard Phase II, or India Basin) then these specific terms are used. Alice Griffith public housing represents a portion of the Candlestick Point-Hunters Point Shipyard Phase II development area. It is discussed separately because its historical context is highly specific.

PURPOSE OF A HISTORIC CONTEXT

A Historic Context enables the assessment of a property's historic significance by creating a framework against which to qualify objectively its relationship to larger historical themes and events. Once this framework has been adopted, qualified historic professionals can then use the Historic Context as a basis for the completion of historical evaluations. Such evaluations encompass the following:

- Evaluate a property's historic significance including its associative value and context utilizing national, state and local criteria and status codes.
- Establish historic/cultural themes and periods of significance based on substantiated documentation.
- Evaluate a property's integrity and identify character-defining features.

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- Determine which Standard of the *Secretary of the Interior's Standard for the Treatment of Historic Properties* will be followed for proposed changes (Preservation, Rehabilitation, Restoration, or Reconstruction.)
- Review proposed changes for consistency with the selected Standard to meet the criteria and requirements of the California Environmental Quality Act (CEQA) to avoid a substantial adverse impact.

Historical evaluation of a subject property within the Project should use this context statement as a tool for understanding where the property's significance lies within the larger historical timeline. Such assessments should also include an analysis of the immediate environment that represents the physical context for the building or site. This is part of determining the level of the resource's historic integrity. Therefore, buildings in their original locations retain a much higher integrity level and consequently are of stronger historic importance than those that have been moved. When determining the historic and cultural value of the resource, its place in history should be evaluated as well as physical location within the City's jurisdiction. In many cases, the location and environmental surroundings played a large role in its historical use and importance in the larger Bayview-Hunters Point neighborhood historic context as outlined in the following pages.

LOCATION AND BOUNDARIES OF STUDY[1]

The Bayview Waterfront Project is within the southeast quadrant of the City and County of San Francisco. The site is generally bounded by Jennings and Newhall Streets to the north, U.S. 101 to the west, the Visitacion Valley and Executive Park neighborhoods and the City and County of San Francisco – San Mateo County line and the City of Brisbane to the south, and San Francisco Bay to the east. Figure 1, illustrates the regional location of the Project and the location of the Project within San Francisco. As shown in Table 1, Phase II would comprise approximately 728 acres. The India Basin Plan area would comprise 76 acres. The sites together comprise approximately 804

[1] Taken from EIR guidelines provided by PBS&J in April 2008.

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acres, occupying the waterfront from the northern boundary of the India Basin Shoreline area to the western edge of Candlestick Point, and extending inland from the waterfront. Figure 2, Bayview Waterfront Project Site Boundaries, illustrates the Project boundaries.

TABLE 1
BAYVIEW WATERFRONT PROJECT SITE AREAS

	Acres
Candlestick Point	299
Hunters Point Shipyard Phase II	429
Development Plan Total	**728**
India Basin Shoreline Plan	76
Project Total	804

Source: SFRA, Lennar, 2008.

CANDLESTICK POINT-HUNTERS POINT SHIPYARD DEVELOPMENT PLAN

The Candlestick Point area of the Development Plan is immediately east of Executive Park, with the Bayview neighborhood to the north, the Hunters Point Shipyard (HPS) to the north and east, and Candlestick Point State Recreation Area (SRA) along the Bay frontage, as shown in Figure 2. The Candlestick Point area of the Development Plan is generally bounded by Hawes Street to the north, Candlestick Cove and San Francisco Bay to the south, South Basin to the east and, Jamestown Avenue to the west. The northern boundary of Hawes Street is limited to the San Francisco Housing Authority's Alice Griffith public housing site between Gilman and Carroll Avenues, which extends north from Aurelious Walker Way. The Candlestick Point area also includes the Candlestick Point SRA land surrounding Yosemite Slough, generally bounded by Ingalls Avenue to the north, Yosemite Avenue to the west and Thomas Avenue to the east. The southern portion of the area surrounding Yosemite Slough is contiguous with the northwestern edge of the HPS Phase II.

The HPS Phase II area is to the south of the Bayview neighborhood. As shown in Figure 2, the HPS Phase II area is generally bounded by the San Francisco Bay to north, south and east. The west end of the northern boundary extends along Fitch Street to approximately Crisp Avenue, excluding the University of California San Francisco (UCSF) Animal Research and Care Facility and former Building 815 (now owned by DataSafe Records Storage and Information Management). The northern boundary generally extends along Crisp and Spear Avenues and is contiguous with the current north, south, and east boundaries of the HPS Redevelopment Project Area, Parcel A'. The northernmost end of the HPS Phase II area is contiguous with Earl Street and the southern boundary of the India Basin Shoreline Plan.

INDIA BASIN SHORELINE PLAN

The India Basin Shoreline Plan is comprised of approximately 76 acres, immediately north of the HPS Phase II. As shown in Figure 2, the India Basin Shoreline plan is bounded generally by Jennings and Newhall Streets and Heron's Head Park to the north, Hunters Point Boulevard and Innes Avenue to the west, and Earl Street to south. San Francisco Bay forms the eastern border.

CONTEXT STATEMENT OBJECTIVE

A historical context statement is an important planning tool that is the basis for making informed and consistent decisions. Historic contexts provide information to establish significance and answer the question "why is this property important?". Context statements are critical in later survey and evaluation phases. The information as to

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Figure 1. Map showing regional overview of Project site. Figure prepared by Archeo-Tec and excerpted with permission from their companion document, *Historic Context for the Archeology of the Bayview Waterfront Project, San Francisco, California.*

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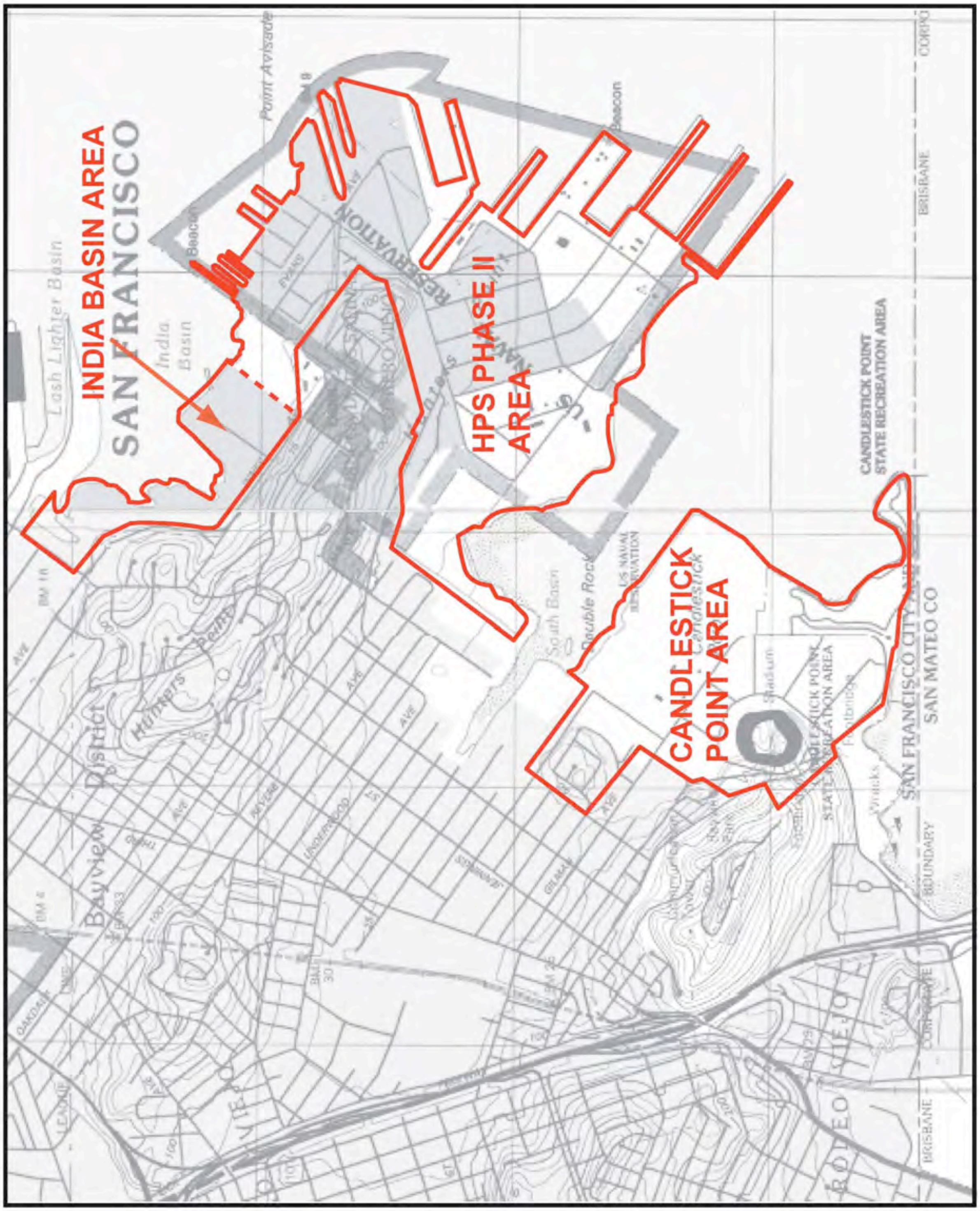

Figure 2. Map showing overview of Project site and sub-areas.. Figure prepared by Archeo-Tec and excerpted with permission from their companion document, *Historic Context for the Archeology of the Bayview Waterfront Project, San Francisco, California.*

"why?" is well researched using primary sources such as period photographs, maps, newspapers, brochures, etc., and secondary sources such as books and reports based on primary sources. Because properties can be significant for more than architecture (relationship to an event, person, yield information) a broad spectrum of sources are consulted. The context statement itself does not evaluate individual properties. Also, it is not intended to be a definitive history of the Bayview or Hunters Point neighborhoods. It is however, the basis for all preservation planning and provides much needed information that can be used by professionals and laypersons. Because the historic context statement is based on substantiated documentation it is therefore is a "living document" that can be added to as valid information arises.

Decisions about the identification, evaluation, registration and treatment of historic properties are most reliably made when the relationship of individual properties to other similar properties is understood. Information about historic properties representing aspects of history, architecture, archeology, engineering and cultural themes must be collected and organized to define these associations. The historic context statement provides identified areas of significance. The approach describes the important broad patterns of development in an area that may be represented by historic properties. The historic context statement is the foundation for decisions about identification, evaluation, registration and treatment of historic properties.

The objectives of this context statement are as follows:

- Create a well-defined historic context based on property types, architectural character-defining features, local development and land use patterns, and significance of place and cultural themes for the period of approximately 1849 to 1966.
- Outline the chronological development of the neighborhood with connections made between patterns of development, and structures and properties that may still exist today.
- Offer an understanding to how and why the neighborhood was developed in the way it exists today.

- Provide documented information to allow for the comprehensive evaluation of a property's importance within the historic context of the Bayview-Hunters Point area.

Historic context statements are important tools for the preservation planning process. This Historic Context Statement is meant to provide the San Francisco Redevelopment Agency, the San Francisco Planning Department and other bodies with a means to evaluate potential resources for their associative, architectural, or historic value. Such a tool will provide a baseline reference for determining environmental impacts related to future development of the area and inform mitigation measures to limit or avoid adverse environmental impacts.

All evaluations of significance for specific buildings within the Project area are presented in the second volume of this study, the *Bayview Waterfront Plan Historic Resources Survey Report,* also prepared by Circa: Historic Property Development. This companion volume presents the result of the historic resource survey, including State of California Department of Parks and Recreation forms (DPR forms) relevant to the Project and recommendations for further actions related to historic resources. This document, *Bayview Waterfront Plan Historic Resources Evaluation, Volume I: Historic Context Statement*, is intended to provide the initial background for these evaluations and to present general property types that may be associated with the historical development of the areas in question.

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II. METHODOLOGY

RESEARCH AND DEVELOPMENT

There have been many studies of the cultural and historical development of the areas within the Bayview Waterfront Project. The oldest were completed over 30 years ago, while others were undertaken concurrent with the writing of this document. Consequently, much of the background information presented here was first gathered from these existing documents, then cross-referenced to verify accuracy and merit. Where required, additional research with primary and secondary sources was undertaken. In some cases, the information presented in previous documents is paraphrased. These examples are typically noted at the beginning of the subject headings.

Unlike most historical context statements, this one encompasses several distinct plan areas. Much of this is comprised of lands reclaimed from San Francisco Bay during the World War II and later periods. Therefore, there is little to historically connect the project areas except their relationship to the larger development of the outer limits of San Francisco during the late 19th and early 20th Centuries. Therefore, original research was largely limited to the very early and very late chronological periods of development.

Gathering this information depended upon a diverse assortment of local archives and libraries. For those subjects within the more recent past, oral histories and personal remembrances of individuals who either worked, lived or had been associated with Hunters Point Shipyard, Alice Griffith public housing, Candlestick Park or India Basin have been used.

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SUMMARY OF RESOURCES

The following are general resource types. Individual resources of these types are listed in the bibliography.

- Historical societies – including the California Historical Society and other local historical societies.
- Public and private archives and libraries – including the San Francisco Public Library, Main Branch and Bayview Branch, the Bancroft Library, the Oakland Public Library, Main Branch, The Maritime Museum and Naval archives on Treasure Island.
- Census records
- Newspaper clippings – including historical and contemporary newspapers available in online repositories as well as in the collections of various archives and libraries.
- Books
- Maps – including Sanborn Fire Insurance Maps, United State Geological Survey Maps, coast survey maps and a wide variety of specialty maps included in previously completed reports.
- Promotional material
- Volunteers
- Scholarly articles
- Trade publications
- Period photographs
- Oral histories
- Government publications – including previously commissioned reports
- Environmental reports
- U.S. Navy documents
- Previously prepared contexts and historical evaluations – in particular evaluations of San Francisco Public Housing, the Shipyard, India Basin, Candlestick Park, among others.

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III. INTRODUCTION

HISTORIC CONTEXT THEMES

Main sections of historic contexts are generally organized into “themes’ or areas of significance as identified in National Register Bulletin 15, *How to Apply the National Register Criteria for Evaluation*. This bulletin explains that a determination must be made on how the theme of the context is significant in the history of the local area, the State, or the nation. “A theme is a means of organizing properties into coherent patterns based on elements such as environment, social/ethnic groups, transportation networks, technology, or political developments that have influenced the development of an area during one or more periods of prehistory or history. A theme is considered significant if it can be demonstrated, through scholarly research, to be important in American history. Many significant themes can be found in the list of Areas of Significance used by the National Register.” This list is quoted as follows:

AREAS OF SIGNIFICANCE:

- Agriculture
- Architecture
- Archeology
- Prehistoric
- Historic-Aboriginal
- Historic-Non-Aboriginal
- Art
- Commerce
- Communications
- Community Planning & Development
- Conservation
- Economics
- Education
- Engineering
- Entertainment/Recreation
- Ethnic Heritage
    - Asian
    - Black
    - European
    - Hispanic
    - Native American
    - Pacific Islander
    - Other
- Exploration/Settlement
- Health/Medicine
- Industry
- Invention
- Landscape Architecture
- Law
- Literature
- Maritime History
- Military
- Performing Arts
- Philosophy
- Politics/Government
- Religion
- Science
- Social History
- Transportation
- Other

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Themes are then tailored to accommodate areas of significance specific to a particular community when appropriate. In this way, contexts follow a common thread of understanding regarding building development and growth patterns, cultural and ethnic evolutions and economic changes etc., while allowing for customization or specification in areas that define community character. One obvious context for the Bayview Waterfront Project, and indeed the entire San Francisco Bay Area, is military development. However, we explore four other context areas that we feel more closely relate to the specific aspects of local history. These themes are: early development of the area, early development of India Basin with particular emphasis on maritime development, evolution of public and subsidized housing and recreation.

To better understand important historic events and their impact on the local community and/or historical resource, it is often helpful to have a sense of the larger natural, political and social setting in which these events took place. While this document is concerned with the chronological development of the Project, the more general community's connection to broad historical movements, development trends and natural setting are key elements in understanding the influential factors that may be implied, but not overtly stated, in the following discussions.

SUMMARY OF REGIONAL GEOGRAPHY AND GEOLOGY

The Bayview-Hunters Point and India Basin neighborhoods of southeast San Francisco generally occupy the waterfront south of Islais Creek (more generally, south of César Chávez Street (see Figure 1.) This area of Islais Creek has changed considerably during the 20th Century. What was originally a series of extensive marshes interspersed with rocky outcroppings was transformed into mostly flat land reclaimed by leveling nearby hills and clearing rocky shoreline. All of the project sub-areas contain a mixture of original and reclaimed land. What differs are the reasons the land was created and how it was developed.

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At the southern end of Bayview is Candlestick Point. This area is dominated by a large hill (now known as Bayview Hill), of serpentine and sandstone that originally arose from the shallow marshland at its base. Today, it has been extensively quarried and otherwise altered to accommodate Candlestick Park Stadium. The remainder of Candlestick Point is a former landfill that was further reclaimed with fill for parking lots and Candlestick Point State Recreational Area. Near Yosemite Slough and the Alice Griffith public housing, the land was a mix of marshlands and rocky shoals. During World War II, it was partially filled to create the site for the Double Rock War Dwellings. After the war, the area around Yosemite Slough, known as South Basin, was filled in to create its current configuration.

Hunters Point Hill is comprised of serpentine rock with steep slopes to the north and south. It rises much more gently to the east and west. What remains today is only a part of the original natural formation. Before U.S. Navy development in 1941, Hunters Point Hill extended almost a mile out into San Francisco Bay and was much steeper, longer and more prominent than its current form.

India Basin is a mixture of fill and original shoreline. Of all the sub-areas, this one has seen the least alteration of its natural geologic formations. It is here that the northern slopes of Hunters Point Hill fall steeply down to a gravelly shoreline that extends out into mud flats at low tide. See Figure 3 for a comparison of shore locations in 1852 to the present.

CHRONOLOGICAL SUMMARY OF AREA DEVELOPMENT

The story of the Bayview-Hunters Point project site is varied. For much of its early existence, it was part of San Francisco only on paper. Until the 1940s, its development and purpose showed little resemblance to the trends shaping the rest of the City. In many ways, it was akin to the farming communities of the San Francisco Peninsula,

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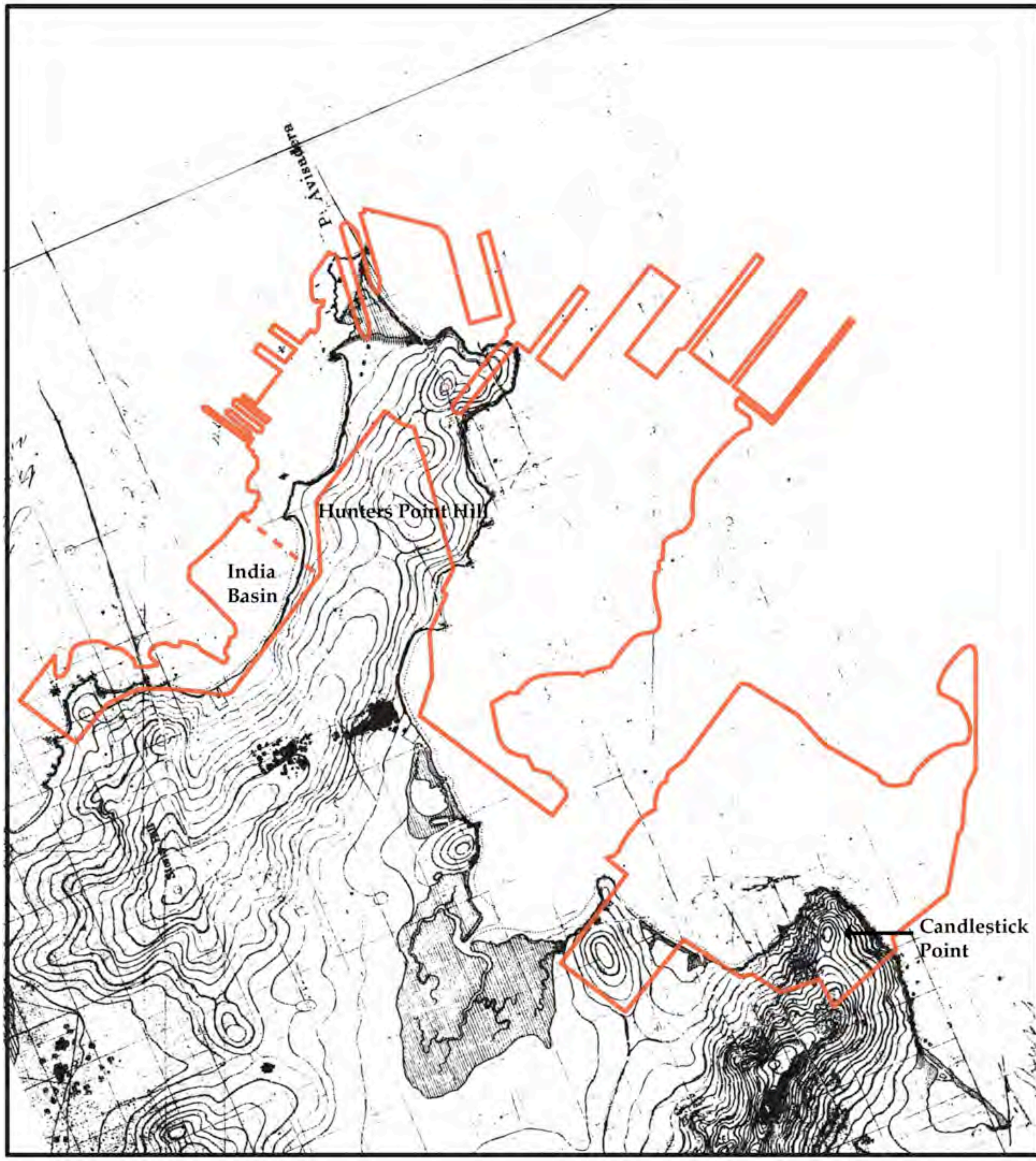

Figure 3. Map comparing the 1852 shoreline to present day shoreline. Figure prepared by Archeo-Tec and excerpted with permission from their companion document, *Historic Context for the Archeology of the Bayview Waterfront Project, San Francisco, California*.

mostly rural, used for weekend retreats and drives in the country. It was a relatively bucolic district composed of rocky shoreline, marshlands and fertile tidal plains. A place of continual speculation but little development, growth was focused and never sponsored from within the existing community.

This changed when the United States entered World War II in 1941. This seminal moment thrust the Bayview-Hunters Point area into the national spotlight. Farms were replaced with housing. Drydocks became shipyards. Fishing shacks gave way to cranes and berthing piers. When the dust settled, a whole new population called the area home and most of the reminders of the rural past were swept aside. A brief account of the history of this transition is provided in the following section. These areas are discussed in greater detail in the individual chapters of this document.

PRE-1849

Before modern settlements, the Bayview-Hunters Point project site was a favored fishing ground for native populations. It was relatively protected from the harsh winds and fogs of the ocean coastline and the extensive marshes harbored numerous species of waterfowl, fish and useful grasses. These first inhabitants lived in the area for several thousand years.

In 1775, the Spanish government sent Lieutenant Juan Bautista de Ayala into San Francisco Bay to map the coastline and to select sites for fortification. He dispatched his second mate, Juan Bautista Aguirre to explore the Bay further south. Aguirre and his crew came upon a rocky peninsula surrounded by deep water. They named it Point Avisadera (Beacon Point.) Aguirre's diary is the earliest known written account of Hunters Point Hill.

In 1776, as soldiers were busy building a military fortification at the entrance to San Francisco Bay, missionaries were establishing a church along Dolores Creek. Mission

San Francisco de Asis was granted all of the land now contained within the Project for use as pasture for its cattle. When Mexico secularized the Missions in 1834, their lands were disbursed to loyal Mexican citizens. In 1839, Jose Bernal was given most of Mission's southeastern pasture lands, including all of the land within the Project boundaries.

1849-1906

The discovery of gold at Sutter's Creek in 1848 brought floods of people from all over the world to California. Most came through San Francisco before heading east to the Sierra. Some decided to stay. More returned after mining claims proved worthless. As a result, San Francisco grew in both population and geographic extent very rapidly over a short period of time. When it became a state in 1850, even more people were drawn to settle in the area.

Settlement in the Project vicinity during this period was primarily limited to the India Basin sub-area where northern European boatwrights established small family boatyards. They found the area to be sparsely settled and easily navigable by boat. Slowly they were joined by Italian and Chinese farmers who grew vegetables for the expanding City center four miles north.

Access to the interior of the area was difficult. Few roads passed nearby and no roads ventured east except to access the boatyards along India Basin. Most travel was by ship or by a long, arduous journey through the swamps around Islais Creek. In spite of this, people came to Hunters Point Hill for outings, and to the flatlands near today's Yosemite Slough for recreation. The draw was the area's pleasant weather and wonderful Bay views.

These two factors also enticed several real estate speculations. One of the earliest was a partnership with Jose Bernal's family that involved a pair of brothers from the east coast. The Hunter brothers never found success in the venture but they stayed to settle on Hunters Point Hill where they lived and worked. The South San Francisco Homestead and Railroad Company was only slightly more successful. Their lasting legacy was the granting of land at the end of Hunters Point Hill for completion of a drydock in 1867. It was this drydock that eventually became the Hunters Point Shipyard.

1906-1941

The great earthquake and fire of 1906 had very little impact on development within the Project vicinity. A small increase in settlement occurred along Third Street near Butchertown and Islais Creek. The real improvement was the completion of a bridge across Islais Creek at Third Street in 1915. Finally there was a direct way to access Hunters Point Hill, India Basin and eventually Candlestick Point.

During this time the population was predominantly Italian with a fair number of Irish, Maltese, Portuguese, and Chinese settlers. They formed small enclaves within the larger community, sponsoring their own churches and social clubs. For the most part, this area of the City was largely self-sufficient and received little attention from the City government. The one exception to this was the commercial activity at the Union Iron Works Drydocks the end of Hunters Point Hill.

The drydocks were expanded twice during this period in response to U.S. Navy contracts. The Navy was increasingly dependent on the services at the drydocks as one of their primary shipyard resources on the Pacific Coast. This eventually prompted them to purchase the drydocks from Bethlehem Steel (then the parent company of Union Iron Works) in 1939.

1941-1945

When the United States entered World War II at the end of 1941, the Navy had just completed its takeover of the drydocks at Hunters Point. From there, construction ensued for the next five years, dramatically increasing the dry landmass around the end of the point and changing the topography of the entire area. Demands for housing for the defense workers at the shipyard resulted in over 12,000 units of housing constructed in the immediate area. Every portion of the Bayview was impacted by these housing projects. The population explosion transformed the rural Bayview and Hunters Point neighborhoods into an urban enclave almost overnight. Demographic shifts from Italian to African-American, economic shifts from agriculture to heavy industry and social shifts from multigenerational families to transient settlers all occurred during this highly tumultuous time.

1945-1966

After World War II, construction continued at Hunters Point Shipyard, but the jobs began to decrease in numbers. In response to peacetime activities, a sizable workforce was needed, but not in the around-the-clock mode that was common during the war. This decrease in work prompted some families to leave the area. Others moved into one of the hundreds of permanent single-family homes that were being constructed on the former truck garden lots. This left a great number of temporary war dwellings vacant.

The post-war period in San Francisco was marked with an extreme shortage of quality housing. However, the low-income segment of the market was even harder hit. These temporary buildings became apartment units managed by the San Francisco Housing Authority. The concentration of war dwellings around Hunters Point Shipyard was transformed into the highest concentration of low-income housing in San Francisco. The history of the post-war period within the Project boundaries is largely a story of the transition of this housing stock and its impact on the more well-established surrounding community.

SUMMARY

When considered as a whole, the Project areas had a relatively uneventful history up until 1941. The outbreak of World War II transformed the whole southeastern portion of

San Francisco. Each of the sub-areas was altered in its own way, but the result was a vastly different social (housing and demographics), economic (military and industry) and physical environment than what existed prior to 1941. The second most influential date was 1945 – the end of World War II. If the onset of the war changed the area from farmland to industrial powerhouse, the end of the war changed the industrial areas into a community. Even today, the various portions of the Project wrestle with their post-war identity and purpose. In most of the specific, these purposes and uses have remained relatively constant but in a state of routine unrest. The uncertainties of how to adapt from wartime to peacetime uses was the first step. Today they experience uncertainties of redevelopment on a scale not seen since World War II.

This context attempts to frame the past evolution of the Project site in order to help shape the path of this next major chapter in the Bayview-Hunters Point history. The following chapters each focus on one aspect of this history and present it in greater detail. Chapter IV discusses the general development of the geographic region prior to the start of World War II. It will elaborate on much of the information presented, briefly, in this section. Chapter V focuses on India Basin and its unique development history. Chapter VI concentrates on the Hunters Point Shipyard and its development from a single drydock to a vital military installation. Chapter VII looks at the history of public housing in San Francisco with a focus on the evolution of housing from temporary workers' housing to public housing in the South Basin Activity Node and at the Alice Griffith public housing. Finally, Chapter VIII briefly discusses the development of Candlestick Park and Candlestick Point.

Within the Project site there are a variety of previously identified historic resources. Several are discussed in this document. However, this context is meant to provide the background information necessary for facilitate *future* evaluations of historical significance for the Project. Please refer to the Bayview Waterfront Project Survey Report for a more complete account of existing and newly identified historic resources within the Project site.

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IV. BAYVIEW-HUNTERS POINT (PRE-HISTORY-1941)

Human habitation of Northern California has occurred since at least 11,000 years ago. What is generally recognized as the first native civilization on the San Francisco Peninsula appeared around 6,000 years ago and flourished as a population until the mid-1700s, when they encountered the first Spanish explorers.[2] For the next half-century, Spanish military and Catholic missionaries tried to bend the native cultures to the will of European social and religious norms, with little success. Their efforts largely ended when Mexico won its independence from Spain in 1821. When Mexico secularize the Missions in 1834, withdrawing strong governmental support of the mission system, most missions were abandoned or dramatically reduced. The lands were bought by or given to favored Mexican citizens. The grants within present-day San Francisco were initially used as grazing pastures for small herds of livestock. When gold was discovered in 1848, much of the land within several miles of the entrance to San Francisco Bay was surveyed and platted for more intensive development.

In the Bayview-Hunters Point area, this period between pasture land and urban settlement lasted much longer than elsewhere. Even though several individuals and corporations tried to entice people to build their homes on the slopes and valleys of the area, it was not until World War II that the current neighborhoods started to take on substantial form. This late development is unique within the history of San Francisco and as a result, Bayview-Hunters Point has an unusual development history.

The following brief history covers the period from pre-history through the military buildup to World War II, marked by three periods settlement: Pre-history, settlement prior to statehood and settlement after 1850. Little of the architectural record remains for any of

[2] Archeo-Tec, Historic Context for the Archeology of the Bayview Waterfront Project, San Francisco, California-Draft. 2008, p. III.J-18.

these periods, but it is important to understand this period to comprehend the extreme changes brought by World War II.[3]

PRE-HISTORY

As the ice sheet retreated from Northern California at the end of the last Ice Age approximately 10,000 years ago, San Francisco Bay was formed from the flood plains around a deep pre-historic river. For thousands of years the shores of the Bay were covered with extensive wetlands, grasslands and sand dunes. The area that now comprises the Bayview and Hunters Point districts was a mixture of shallow, tule covered swamps and deep channel drop-offs. Hunters Point extended over a mile out into San Francisco Bay and was edged with deep water almost immediately off its steep slopes. Those areas around the Islais Creek delta (now India Basin) and between Hunters Point and Candlestick Point (centered on Yosemite Slough), were fairly shallow and bordered by tidal mud flats.

Hunters Point Hill is a bedrock formation that originally extended over 6000 feet into San Francisco Bay. Its serpentine rock and steep slopes made it quite inhospitable but afforded settlers on its slopes protection from prevailing wind patterns and weather. At Candlestick Point the eastern edge of Bayview Hill dropped almost straight into the Bay waters, with sandy beaches extending north and south along the shoreline.

Accounts from 1776 by Spanish settlers note encounters with the native population around Islais Creek and the presence of good land and a small spring. A large marsh spanned the distance from Potrero Point to Hunters Point. Further south, a smaller outlet existed near the present-day Yosemite Slough. See Figure 3 for a view of the 1852 shoreline.

[3] The specifics of the various types of archaeological deposits, their context, importance and locations are discussed more fully in the archaeological survey of the Bayview-Hunters Point District created by Archeo-Tec Consulting Archaeologists in parallel with the development of this document (2008).

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The marshy shore and sheltered coves of the Bayview-Hunters Point area made it a natural settlement location. Native peoples had inhabited the San Francisco Peninsula for an estimated 6,000 years before European and Mexican explorers came to the region. Islais Creek had a large tidal plain rich with various reeds, grasses, waterfowl, and other wildlife. This rich saltwater marshland covered most of the area between today's Potrero Hill and Bayview districts. Yosemite Slough supported a second, smaller marshland. The lowlands around and between these two areas were flooded daily by the continual ebb and flood of the Bay waters, creating marshlands over half a mile wide along this section of the shore.

A detailed account of the social customs and lifestyles of the native populations is presented in Historic Context for the Archeology of the Bayview Waterfront Project, San Francisco, California, prepared by Archeo-Tec in parallel with this document. The information presented on these peoples is summarized from this report. For additional detail, please see the referenced document.

OHLONE

The Project is situated along a relatively protected area of Bay shoreline. Before modern reclamation it was covered in extensive marshes rich with plants and animals. As a result, it was a favored location by native inhabitants, as evidenced in the numerous indigenous sites that have been identified within the Project boundaries.

"The Northern tip of the San Francisco peninsula was once the Yelamu tribal territory. The Yelamu were one of a number of smaller tribal groups within the larger Costanoan (Ohlone) language family, composed of no more than 160 people who spent much of their year split into three semi-sedentary villages. The present Project is located within several miles of the predicted location of the Yelamu village of Chutchui… The group of people who lived at Chutchui moved seasonally along Mission Creek to the Bay shore, where they had another village called Sitlintac."[4]

By the time Europeans arrived in the 18th Century, a stable and thriving native population existed in the San Francisco and Monterey Bay regions. At the time of the Missions' founding, central California had the densest native population north of Mexico with an estimated 7,000 to 10,000 inhabitants between Point Sur and San Francisco Bay. This population was made up of many different groups, or tribelets. Each tribelet constituted an autonomous governing body but they did not always live in a single village. Around San Francisco Bay these tribelets were more nomadic and often traveled between two or more settlements depending on the time of year.

The abundance of natural springs and freshwater wetlands in the region provided many suitable locations for temporary settlement. This cultural habit of wandering made them unusual from other Native American groups in the western United States. This was due in part to the abundance of fish, game, and wild grains around them. With little effort they had plenty to eat and never had a need for supplementing their diet with cultivated crops. Instead they were able to sustain themselves relatively comfortably with staples such as acorns and acorn flour, seeds, grasses and whatever elk, deer, rabbit, wild birds and fish they could readily hunt or catch. Their primary hunting weapons were the bow and arrow but most were also proficient with knives for close hunting and meat preparation.

Linguistically, the Ohlone language was the most widespread of the five distinct native languages in the Bay Area. These languages also included Bay Miwok, Coast Miwok, Patwin and Wappo. Ohlone, Bay Miwok and Coast Miwok were derived from a common linguistic base known as Utian. Patwin was more distantly related and Wappo was from

[4] Archeo-Tec, *Historic Context for the Archeology of the Bayview Waterfront Project, San Francisco, California-Draft*. 2008, p. III.J-12.

unrelated origins. Within the Ohlone language were many dialects. While recognized as distinct languages, some were similar enough to be understood across tribelet groups.[5]

When the missionaries came to the region in the 18th Century, the Ohlone first greeted them cautiously. The Spanish tried to trade glass beads and cloth, items both foreign and fascinating to the Ohlone. Increased contact brought about an evolution of their behavior and most soon greeted the Spanish with excitement and anticipation of the goods they traded.

The missionaries sought to convert the natives to Catholicism and to show them how to live as they did, farming the land and conducting themselves as proper Spanish citizens. The newly converted were referred to as neophytes. Generally, after conversion the neophytes moved to the mission and lived in single-sex dormitories. Living in close quarters allowed Western diseases, to which the Ohlone had no resistance, to spread quickly through the population. “Between 1817 and 1835, several hundred Indians were transferred from Misison Dolores to Mission San Rafael in Marin County where agriculture and grazing were better. By 1827, there were reported only 241 Indian men, women and children at Mission Dolores.”[6] In this way, traditional ways of life were lost. Under Mexican rule, the missions were secularized in 1834. There were no villages to return to and the wildlife and plants they depended upon were largely gone or severely impacted by the use of the land for cattle grazing.[7] Most neophytes left and tried to find work on the ranches.

[5] Ibid,, pp. 25-26.
[6] Ibid., pp. 29-30.
[7] Ibid., pp. 31-32.

EARLY SETTLEMENT (EXPLORATION – 1849)

Spanish Era

The first Europeans to come to the San Francisco Bay area in the 18th Century were Spanish explorers from Spanish-controlled Mexico. Captain Gaspar de Portola and his exploration party are generally credited with "discovering" San Francisco Bay in 1769. The purpose of their mission was to locate Monterey Bay, which they failed to do, by taking a coastal route. Instead they passed Monterey and viewed San Francisco Bay from a hilltop in present-day Pacifica. This expedition was the first to the general region and established a Spanish claim over the land between the two bays.

By 1776, permanent settlements were desired to secure Spain's claim over the newly discovered land. The great harbor was of particular value so it was one of the sites chosen for both a mission and for a Spanish fort. The mission was founded by Father Francisco Palou on June 29, 1776. He named the site for his order's patron saint, Saint Francis of Asis. The mission was inland several miles along the shores of a small creek which they called Arroyo de los Dolores.[8] Eventually the mission became known as Mission Dolores, the name in use today.

At that time, five of the original 13 missions had been established. They eventually ranged geographically from San Diego to San Francisco, founded over a 22-year period. The chain of missions up through Alta California were to be connected by El Camino Real, spaced about a day's ride apart. Mission Santa Clara (1777) was the closest mission to Mission Dolores. The original 13 missions were further apart than called for in the plan, making travel between them dangerous. In 1797, the Spanish government authorized the founding of five more missions. Mission San Jose (1797)

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[8] Historic American Buildings Survey, San Francisco de Asis, Mission Dolores Church, San Francisco, California: HABS No. CAL-38-SANFRA, 1937.

dates from this period. El Camino Real continued to be a primary north-south route well into the 19th Century.

Mexican Era

The founding of the missions continued in Alta California even as problems began for the territorial governors in Mexico. By 1810, tensions between Spain and its Mexican territory had become too great and Mexican rebels declared themselves an independent country. Nearly a decade of fighting on Mexican soil ensued. In 1817, a Mexican constitution was ratified and five years later, the newly established government took over control of the missions.

For a period, the Franciscan brothers remained at the missions and ran them with the support of the Mexican Army. However, in 1834, the Mexican government secularized the missions, stripping them of their lands and government support. The lands were given to well-connected Mexican citizens, who either paid a nominal fee or were being rewarded for military services. With the loss of military and governmental protection and support, the missions soon fell into poverty and disrepair. Food shortages and old age forced many Franciscans to return to Mexico or to abandon the more remote missions.

In 1839, a large section of the lands originally attached to Mission Dolores were granted to Jose Cornelio Bernal. According to the c1854 land case map, Bernal's Rancho Rincon de Las Salinas encompassed all the lands between Precita Creek on the north and a series of hills just north of Visitacion Valley on the south, and from El Camino Real to San Francisco Bay.[9] In total he was eventually granted approximately 4,400 acres (see Figure 4.)

Bernal was a well-established Spanish soldier. (His father, Juan Francisco Bernal traveled with Juan Bautista de Anza when they discovered San Francisco Bay.) In his

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[9] Land Case Map D-8, Unites States District Court. California, Northern District. Land Case 5 ND, p. 365, http://oac.cdlib.org/.

lifetime, Bernal was granted several other plots of former mission lands. In 1834, he was given a small plot of land near Mission Dolores as a reward for his civic services in the fledging political realms of San Jose and San Francisco. In 1840, he was granted the adjacent Potrero Viejo lands, giving him ownership of approximately 20 percent of present-day San Francisco. Unfortunately, he did not live long enough to capitalize on his gains. Jose Cornelio Bernal died in 1842 at the age of 46.[10]

Because most of the Mexican land grants were large and far from existing settlements, they were difficult to patrol. Consequently, it was easy for squatters to occupy land. According to Mexican law, non-Mexican citizens could not own Mexican land. Because of this, many Americans came west and tried to force claims on pieces of the large ranchos. Over the next ten years, problems continued to brew.

In 1846, the Mexican Governor, Jose Castro, issued an edict to all American settlers in the Mexican territories in California. They were told to relinquish all their claims on Mexican-held land or face involuntary removal. Many settlers had lived and worked the land for close to a decade and were angered by the governor's proposal to remove them. Twenty men banded together near Santa Clara and ambushed a shipment of Castro's horses being sent to troops charged with carrying out his orders to evict the Americans. They met little resistance. Embolden with this success, they continued to Sonoma to General Vallejo's home to force his surrender.[11] Here too, they met little resistance and easily captured Vallejo, who did not put up any struggle. U.S. Army Captain John Charles Fremont joined their fight and the small group, called the "Bear Flaggers" after the flag they fashioned for their independent Republic of California, soon controlled most of northern California. These events, and similar struggles in Texas, prompted the U.S. to declare war on Mexico later that year.

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[10] Greg Pabst, "To Have But Not To Hold: The Bernals of Early San Francisco and their Lost Corner of the City", gregnoevly.home.mindspring.com/Bernal.html.

[11] Vallejo was the Mexican government's acting commandant of the Northern Frontier. As such, he controlled all military forces and supplies in Northern Alta California.

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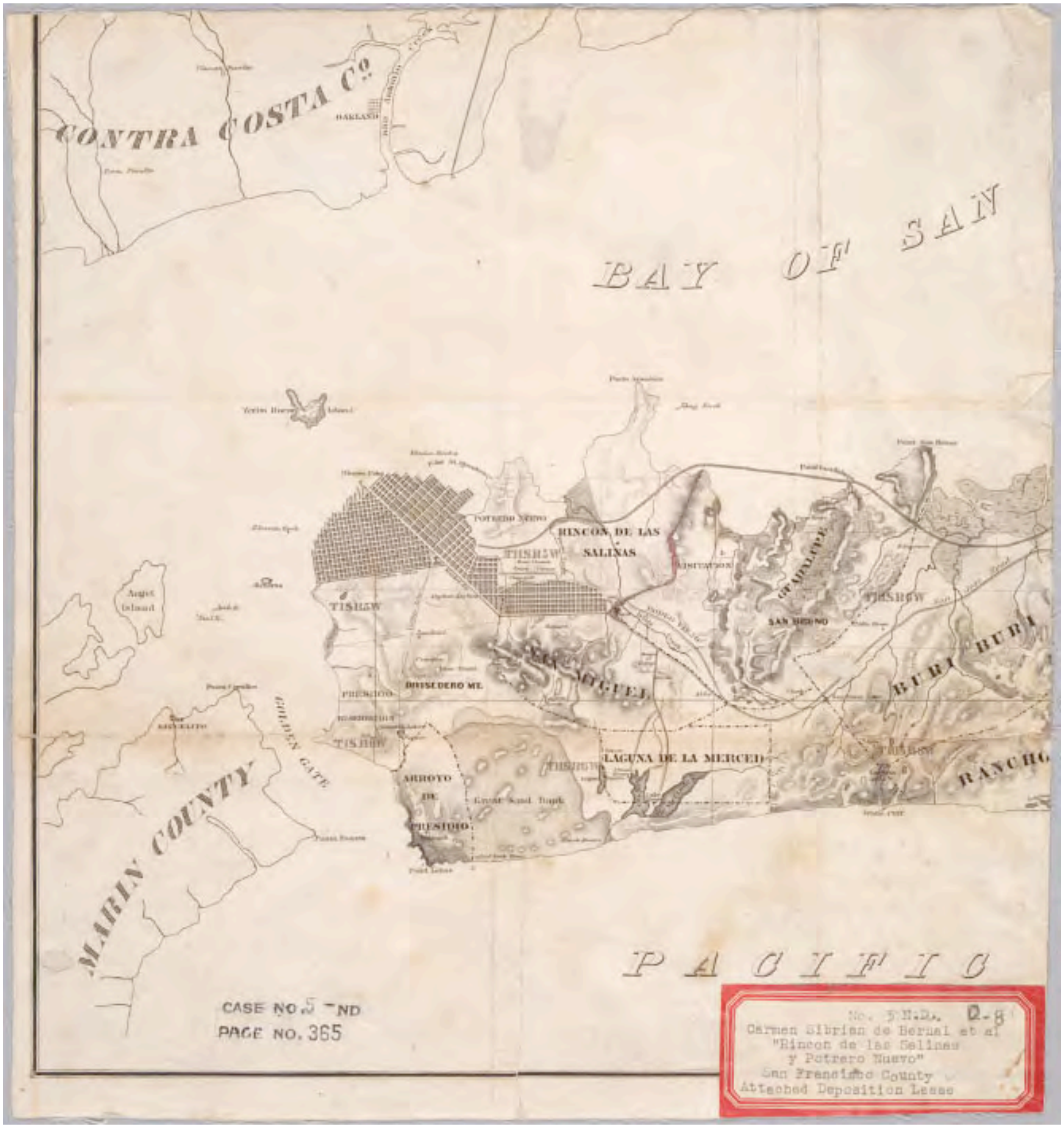

Figure 4. A map of the end of the San Francisco peninsula showing the City and the surrounding Ranchos, including Bernal's Rancho Rincon de las Salinas y Potrero Viejo. Image courtesy of the Bancroft Library, University of California, Berkeley.

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The Mexican-American War ended in 1848 with the signing of the Treaty of Guadalupe-Hidalgo just days before the discovery of gold at Sutters Creek was announced. The terms of the treaty transferred all of present-day California, Nevada and Utah and parts of Arizona, New Mexico, Colorado and Wyoming to U.S. control in exchange for $15 million. California became a state in 1850.

STATEHOOD (1850 – 1941)

Early statehood in the Bayview-Hunters Point area was relatively quiet. The former Mission Delores lands were still largely held by the Bernal family or farmed by tenant farmers to supply produce to San Francisco. While the Gold Rush transformed San Francisco from a backwater port to a bustling city, the effect within the Project was minimal. The number of farms increased but it was mostly left in its natural state or used for recreational purposes. As the 19th Century progressed, more people did settle in the area, but the overall population gain was slow. Commercial development was centered around Railroad Avenue (now Third Street), near the Butchertown enclave. Transportation was the main impediment to more widespread development. However, this obstacle did not stop several entrepreneurs from attempting to bring greater residential development to the area. In the end, only the onset of World War II brought about any major alterations to the relatively quiet Bayview-Hunters Point section of San Francisco.

EARLY TRANSPORTATION

One of the biggest impediments to development of the Bayview-Hunters Point area was access. The first roads through the general area were not much more than wide footpaths connecting the scattered small settlements and farmsteads. El Camino Real, also known as San Jose Road at the time, traveled well inland, along the base of inland hills. Further east was the Bay View Turnpike, but it too avoided the marshes and rocky outcroppings in the area. Just before the gold rush, in 1848, the San Bruno Road was graded to more efficiently connect downtown San Francisco with the Mission district, Potrero Point and the farmlands immediately south. This road started further east near downtown San Francisco, following the shoreline a little more closely than the San Jose Road. Even though it was the first road to cross Islais Creek, it too took a route well west of today's Bayview neighborhood, roughly following the present-day Bayshore Boulevard. It met up with the San Jose Road near the present City of San Bruno. The San Bruno Road served workers on dairy farms in Bayview, Visitacion Valley, and present-day Brisbane. The road was so narrow that a driver had to pull the wagon into the deep grass to let another wagon pass.[12]

The first direct overland access to Hunters Point was completed in 1868. Known as Long Bridge, this horse-drawn railway trestle spanned Mission Bay and the Islais Creek estuary. South of the estuary, the route continued down Railway Avenue (now Third Street) to its original terminus at the Bay View Race Track.[13] (See page 46 for more information on this early recreational facility.) Construction of Long Bridge took three years of working through the mud flats and blasting into the serpentine rock of the coastline.[14] Shortly after its completion, tracks were laid for the Potrero and Bayview Railroad, thus opening (in theory) the southern areas of the City to settlement (see Figure 5.) Unfortunately, the railroad completion was not accompanied by improved road access. To reach the area, travelers could arrive by horse-drawn train, sail by boat, or endure the long, circuitous route around the marches if they went by wagon. Because of this most of the Bayview-Hunters Point area remained fairly sparsely settled except for those areas directly accessible by train or boat: Butchertown, Third Street and India Basin.

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[12] Visitacion Valley Grapevine, *A Concise History of Visitacion Valley*. http://www.visvalleygrapevine.com/vvvalleyhist.html.
[13] Bay View Race Track was constructed at the approximate location of today's Yosemite Slough. It covered roughly ten city blocks near the area now developed as the Alice Griffith Housing.
[14] Christopher VerPlanck, The Story of Dogpatch: Dogpatch Historical Context, http://pier70sf.org/dogpatch/DogHistSig.htm. p. 5.

Figure 5: Long Bridge shortly after construction, c.1866. Note the cut through the hillside in the distance. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

The Southern Pacific Railroad finished the Bayshore Cutoff in 1908, opening a direct rail line to the entire area. It eventually included a 4110-foot bridge over Islais Creek north of Custer Streets between Islais and Tulare Streets. The Bayshore Cutoff ran parallel to Long Bridge and the Potrero & Bay View Railroad horsecar tracks and trestle, then through a series of tunnels through Hunters Point, over the marshes of Bayview and around San Bruno mountain before meeting up with the existing main line in present day South San Francisco.[15][15]

In the aftermath of the earthquake and fire of 1906, Hunters Point became an area of respite from the smoke, chaos and debris. Accounts from the period tell of the railroad construction crews working on the Southern Pacific's Bayshore Cutoff opening their work camps to refugees. Because the area received little major damage, businesses and homes were open and occupied immediately after the earthquake stopped. Most damage occurred to buildings on the long piers over the mudflats or to buildings sliding from their foundations. Once righted, these latter buildings were once again serviceable. People took in the homeless with overflow shelters being set up in local cultural and community institutions, such as the Bayview Opera House and camps established on the open grazing lands of Hunters Point and Bayview.[16] At the drydocks, only the tall pumphouse chimney received any damage and the pumps remained functional in the immediate aftermath.

Even with the Bayshore Cutoff, the Bayview-Hunters Point area remained largely undeveloped. Foot and vehicular traffic were still required to go around most of Islais Creek to cross near the intersection of Bay Shore Boulevard and Army (present day Cesar Chavez) Street. A bridge connecting Third Street with Railroad Avenue at Butchertown was not completed until 1915.[17] This drawbridge was the final element to provide direct access to the area.

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[15] Roger and Nancy Olmsted, Historical Consultants, San Francisco Bayside Historical Cultural Resource *Survey*, 1982, p. 145
[16] "Great Drydocks at Hunters Point Are Not Damaged," *San Francisco Call*, May 3, 1906.
[17] Roger and Nancy Olmsted, Historical Consultants, San Francisco Bayside Historical Cultural Resource *Survey*, 1982, p. 145

SETTLEMENT AND DEVELOPMENT

Settlement in Bayview-Hunters Point happened rather gradually compared to those districts closer to the City's core. The building boom in downtown San Francisco at the height of the Gold Rush did not extend the four miles down San Jose Road. However, speculators did try to entice people to the area. In 1849, Dr. John Townsend and John Cornelius de Boom entered into a business venture with the Bernal family to subdivide large portions of their Rancho de las Salinas and Rancho Potrero Viejo. Townsend and de Boom handled promotions and business matters in exchange for 50 percent of the sales revenues.[18] They extolled the virtue of the superior climate, protected harbors, fertile land and relative proximity to the City's core. Robert and Philip Hunter had recently arrived from New York, when they joined Townsend and de Boom's team as real estate agents.[19]

Townsend and de Boom abandoned the project by the beginning of 1850, leaving the Hunter brothers as sole agents. They built a hotel at the tip of Hunters Point Hill for prospective clients who toured the area. Ultimately, the venture was commonly referred to as "Hunters Folly" and the area became known as an escape from the noise and grime of the city. The later addition of the Bay View Race Track in 1863 only emphasized its early fame as a place for fresh air and relaxation (see page 47.)

Eventually, Robert and Philip Hunter obtained ownership of the peninsula from the Bernal Estate and were joined by their older brother John and his family in 1856.

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[18] Millie Robbons, "A Hunters Point Dream Scheme" Millie' Column. *San Francisco Chronicle.* August 24, 1973.

[19] Ironically, Robert and Philip Hunter settled themselves on the slopes of the point that would eventually bear their names but never actually purchased the land from either the Bernals or from de Boom and Townsend. While they eventually did receive claim to a small portion of Hunters Point Hill, it was years later after a court suit.

Besides the hotel and selling the occasional lot, the brothers ran a successful water supply business with abundant spring water well on their property.[20]

The Hunter brothers stayed at Hunters Point until the early 1870s, when they sold their land to a savings and loan company.

SOUTH SAN FRANCISCO HOMESTEAD & RAILROAD COMPANY

In 1861, the State Legislature passed an act authorizing the legal formation of homestead associations.[21] At that time, most of the land in San Francisco was owned by a handful of wealthy families, who had the connections and means to acquire portions of, or entire, rancho grants. The sums of money and political clout required for these transactions were well beyond the means of the average person. As demand for housing continued to increase, speculators formed homestead associations to purchase large tracts of land, made minor access improvements, and then sold smaller lots at a price within the reach of a workingman's wages. Many offered installment payments to ease the financial burden. Many neighborhoods in San Francisco were developed in this way, each with a slightly different character depending on the improvements made by the speculative owners. In the next several decades, homestead associations were responsible for forming much of present-day San Francisco.

The South San Francisco Homestead and Railroad Company was formed in 1862 in anticipation of rail service extending to the Bayview-Hunters Point area. They owned and subdivided over 2,000 75 by 100 foot lots covering Hunters Point and most of the Bayview neighborhood. In addition, they gained development rights to hundreds of underwater lots extending out into the shallow Bay waters around Hunters Point Hill and running south to Candlestick Point.

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[20] Millie Robbons, "The Mysterious Hunters" Millie' Column. *San Francisco Chronicle.* August 27, 1973.
[21] Roger and Nancy Olmsted, Historical Consultants, San Francisco Bayside Historical Cultural Resource *Survey*, 1982, p.101.

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As with many homestead associations, the South San Francisco Homestead and Railroad Company tried to lure investors to their sites by building or partnering with existing recreational facilities. In this case, the company attempted to capitalize on the popularity of the recently opened Bay View Park (c.1863) race track by partially subsidizing the construction of an extension of the Potrero and Bayview Railroad's horse-drawn rail line to the park (see page 48 for more on Bay View Park.) Not only would this bring in customers for the races, but it eventually would serve the residents of "South San Francisco," as the area was then called. To further the appeal of their holdings, the Association donated land for the construction of drydocks at the end of Innes Street to attract businesses, and employees, to their land.[22] (See Chapter VI: Hunters Point Shipyard for a more complete account of the development of the drydocks at the end of Hunters Point.)

Although the Bayview Turnpike and Potrero and Bayview Railroad improved access to the area, the anticipated building boom did not materialize. Other homestead associations appear on historical maps, mostly corresponding to the larger shares of land given to stockholders in the South San Francisco Homestead and Railroad Company. These include Hunters Tract, Central Park, and Hudson Gardens and Orchards.[23] Most of the tracts and associations appeared only on paper and did not represent developed land.

By 1907, most of the area still appeared fairly open with development concentrated along Third Street (Railroad Avenue), close to Islais Creek and Butchertown (discussed below), or further south near the intersection of Yosemite and Third Street (see Figure 6.) However, the 1899 and 1913 Sanborn maps show extensive water lots platted in a

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[22] Roger and Nancy Olmsted, Historical Consultants, San Francisco Bayside Historical Cultural Resource *Survey*, 1982, pp. 101-102; "The Bay View Valley Sale," *Daily Alta California*, May 2, 1867; "Dock Company Acquires Homestead Land Tracts," *San Francisco Call*, March 12, 1910.

[23] San Francisco Block Book Vol. II, Homesteads, 1907. Other, larger homestead associations were found west of Third Street but these appear to have been formed concurrent with, and separate from, the South San Francisco Homestead and Railroad Company

strict grid from the shoreline out to the tip of Hunters Point (see Figure 7.) These water lots remained part of the South San Francisco Homestead and Railroad Association until 1910. At that point, all the remaining unsold lots east of H Street (Hudson) were transferred to the South San Francisco Dock Company (not to be confused with the San Francisco Drydock Company, discussed below.) The transfer amounted to approximately 40 city blocks, largely comprised of these underwater and tidal flat lands.[24]

Street Grid and Names

The impact of the South San Francisco Homestead and Railroad Company remains in the street grid in Bayview-Hunters Point. Unlike development in much of the rest of San Francisco, the association decided to lay out streets to minimize the impacts of topography, with 60-foot wide streets parallel to the prominent ridge of Hunters Point Hill. Thus, the streets east of Third Street are offset from the typical San Francisco north-south/east-west orthogonal grid. While this made the east-west streets much more amenable to horse and foot traffic, it meant that the north-south streets over Hunters Point Hill were largely impassable. Today, many of the streets are interrupted as they pass over Hunters Point Hill. The South San Francisco Homestead and Railroad Company surveyors used units based on the English system of measurement (feet, inches, gallons, etc.), as opposed to the rest of the City, which was surveyed according to the Spanish vara.[25] The north-south streets were originally given alphabetical letter names such as “N” and “P” Streets while the east-west streets were numbered. A similar system was employed elsewhere in the City, causing confusion for the postal service. About 1880, the post office requested that the streets be renamed.

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[24] Dock Company Acquires Homestead Land Tracts,” *San Francisco Call*, March 12, 1910.
[25] Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008. p. 14.

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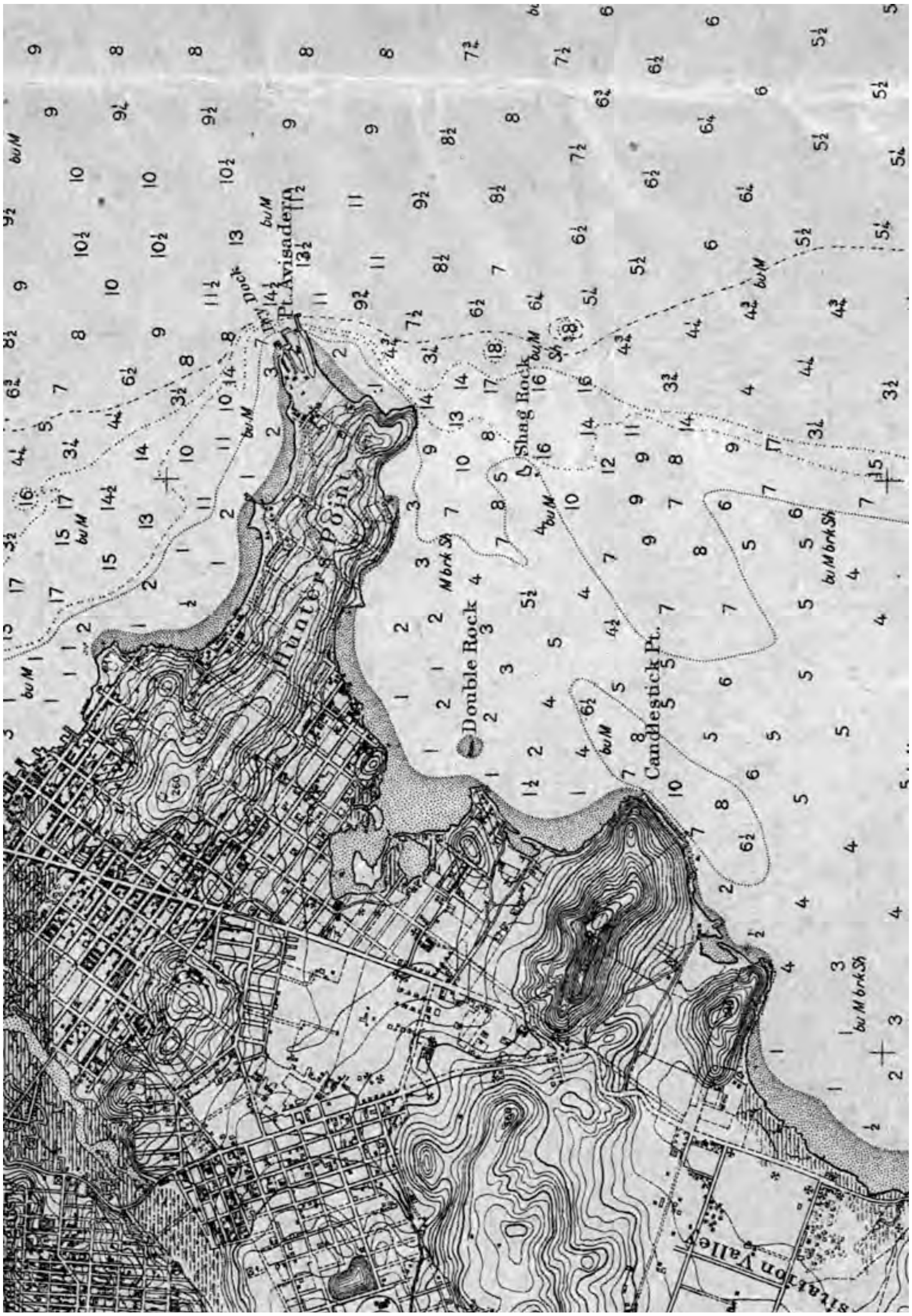

Figure 6. 1905 Coast Survey Map showing locations of development just prior to the 1906 earthquake.

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Figure 7. 1913 Sanborn Map showing the extensive water lots that had been platted for development.

The streets were given exotic geographical names of major islands and foreign nations. The north-south streets were renamed after major American rivers. The local residents resisted the new, difficult to remember names and petitioned the Board of Supervisors in 1890 to restore the old names. A compromise restored the letter and number street names, but with the designation of "south" for Bayview-Hunters Point and "north" for those streets in the Sunset district.[26]

This nomenclature continued to be confusing. Some estimates from the period claimed over 500 units of post per day were mishandled because of the street names. As San Francisco rebuilt after the earthquake and fire of 1906, and expanded into new neighborhoods in the western and southern districts, the time seemed right to address the problem of duplicate or very similar names in various districts. Mayor Taylor authorized the *Commission on the Changing of Street Names* in 1909. The three primary affected areas were the Richmond, the Sunset and the Bayview-Hunters Point districts. Most of the proposed changes were in favor of honoring the Spanish and Mexican heritage of the area. This proved to be more contentious than the committee envisioned. Because the Richmond and Sunset districts had well-organized neighborhood improvement associations, they received the bulk of the commission's time and press coverage. Because of this, the Bayview name changes were postponed until 1910, when the commission addressed the community's comments.

Until 1908, this section of the city had been generally known as South San Francisco. When the City of South San Francisco incorporated, this district was forced to change its popular identity to Bayview. When the Naming Commission started to work with the lettered and numbered streets in the district, the residents were generally in agreement that it was needed but lacked a consensus as to what names would best honor their community. The relatively remote, small and self-sufficient community lacked both a unifying organization and a collective identity. Into this stepped two prominent religious

[26] Ibid, p. 22.

leaders, Father O'Sullivan from All Hallows Parish and Father Ford from St. Ignatius College. They set about pushing their pro-Catholic, pro-Irish agenda in the naming of the streets in the district. The results were the selection of Palou Avenue for Padre Palou, founder of Mission Dolores. (The proposed name was Paine after Thomas Paine who the Fathers felt was an atheist and therefore unfit for a street in their neighborhood.) Another street was named for Charles Carroll, the only Catholic signer of the Declaration of Independence. (The proposed name was Cromwell, which the Irish priests objected to out of patriotic fervor.) A third street was named for H.H. Bancroft the historian, one of the only streets named for a living person. (This naming replaced the proposed Belfast, which was objected to because it was a Protestant city.) The Fathers protested unsuccessfully against Wallace (a Scotsman), Fitzgerald (after author Edward Fitzgerald who they felt was an pagan), and Nelson, until they were told it was named after American General William Nelson of Kentucky and not British Admiral Horatio Nelson.[27]

The street names negotiated in 1910 remain today throughout the Bayview-Hunters Point area. Some changes have been made, especially around Hunters Point Hill and on Hunters Point Shipyard where many of the streets were created by the Navy and do not follow the street grid.

Reclamation

Other problems also complicated the situation. The failure of the homestead associations in the Bayview and Hunters Point meant that many of the unsold lots were distributed to the respective stockholders. The end result of this was a patchwork of largely absentee landowners. For the City, trying to purchase outright or exercise eminent domain to obtain rights to these lands and water lots was a formidable task, both financially and politically. Hunters Point itself acted like a natural barrier, limiting

[27] John Freeman, "Street Naming Controversy–1909," Encyclopedia of San Francisco, http://www.sfhistoryencyclopedia.com/articles/s/streetNaming.html

settlement and transportation both to and around it.[28] Limited access to the choicest waterside locations would be a hard sell to industrial leaders looking for good locations to establish marine businesses.

In 1925, the State legislature passed the Tidelands Reclamation Act. In response, San Francisco established a reclamation district. This included a 280-acre section near Islais Creek. As with many prior ventures, this held a promise to open the district for development. This was reflected by the business community in San Francisco who saw it as an opportunity to reap economic benefit from the neglected area.

"This area has been an eyesore for years. It has prevented the development not only of the territory within the district itself but that surrounding it… The reclamation of Islais Creek is but the beginning of the utilization of the land and facilities that are available to industry and commerce lying between the Potrero and Bay View District…"[29]

Reclamation began with seawall construction between Third Street and the Southern Pacific right-of-way. This roughly half-mile wall was then backfilled with muck dredged from the resulting channel on the opposite side of the seawall. The seawall itself was constructed of rock blasted from nearby hillsides. The U.S. Army Corps of Engineers completed a dredged a channel out to the Bay as well as a turning basin at the inland terminus. The dredged fill was used to raise the ground in the flood plain. The process continued through 1930 when the remaining marshlands of Islais Creek were filled to City grade and streets were adjusted to maintain the grid over the newly reclaimed land. The entire reclamation project was completed in 1936.[30]

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[28] Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008. p. 26.

[29] San Francisco Business 1925, as quoted in Roger and Nancy Olmsted, Historical Consultants, *San* Francisco Bayside Historical Cultural Resource Survey, 1982, p. 146

[30] David Chavez & Associates, Archaeological Resources Investigation for the Bayview-Hunters Point Redevelopment Plan, San Francisco, California, Oakinba and South Basin Activity Nodes, May 2004, p. 8. and Roger and Nancy Olmsted, Historical Consultants, San Francisco Bayside Historical Cultural Resource Survey, 1982, p. 146

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CONTINUED DEVELOPMENT

Further south along Railroad Avenue, improvements to the Southern Pacific rail lines in 1905 resulted in demolition of at least a dozen early buildings. The Bayshore Cutoff included a tunnel through the block bounded by Phelps Street, Palou Avenue, Quint Street and Oakdale Avenue, just west of Railroad Avenue. That loss was more than made up for in the next ten years as the area grew. Buildings constructed after 1905 tended to be larger and of varied uses with street front retail and residential above. The increase in lodging houses along Railroad Avenue was the result of the increasing importance of the drydocks as well as the growing popularity of the area as a home for Southern Pacific's Pullman porters.[31]

Closer to the shoreline, maps after 1906 tend to show many water lots platted into the mudflats. However, little development occurred. One of the only areas of continual development was that around Butchertown and along Third Street. Some lots were used for housing, but most were for new industrial buildings. Butchertown was slowly starting to be squeezed out.[32]

Elsewhere in the district, construction was piecemeal and not part of a concerted effort for development. This is tempered with a relatively significant shift in the development of single-family homes in the areas immediately around Third Street from 1899 to 1913. Even though many lots were still rather sparsely built up, there was more general settlement along Third Street down to Palou Street, and again south of Yosemite Avenue. The in-between area was still swampy in comparison and remained devoid of buildings.[33] It was largely used for vegetable farming.

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[31] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR, Appendix E*, certified February 8, 2000, File No.1994.061E, pp. E4-E5.

[32] Butchertown was an industrial area located along the banks of Islais Creek in the late 19th century. In addition to slaughterhouses, the district was home to a multitude of related businesses including tallow works, glue factories, sausage factories, mattress manufacturers, tanneries and large stockyards. See below for further discussion.

[33] Sanborn Fire Insurance Maps: San Francisco, Volume 5, 1889 and Volume 8, 1913.

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Post-1906 Housing

The 1906 earthquake and fire left a vast number of San Francisco residents homeless and afraid of the crowded city. Many sought to rebuild their lives in more spacious, though more remote, areas of the city. Some small subdivisions of the early homesteading attempts in the Bayview area had enjoyed modest success, but most of these early plans remained fairly wide open. While the number of people who moved to the Bayview-Hunters Point area was significantly greater than during the preceding years, it was by no means the rush of families that areas closer to the city core enjoyed (see Figure 8.) At this time, the character of the Bayview started to shift from industrial and pastoral to a more organized urban environment. However, Butchertown, the boatyards near India Basin (see Chapter V), the drydocks on Hunters Point (see Chapter VI) and the greenhouses and farms in the Bayview area continued to dominate the landscape and shape where people settled. Up until the beginning of World War II, most of the blocks east of Third Street remained developed only in pockets.

HUNTERS POINT IMPROVEMENT ASSOCIATION

By the 1930s, City government officially recognized Hunters Point as a separate district. However, this recognition did little to bring about civic-sponsored improvements to the area. Public transportation, adequate water and sewer service, and public recreational facilities were all still woefully lacking. The different settlement and industrial nodes – Butchertown, the boatyards of India Basin, the Drydocks, the Third Street corridor and the settlements around Yosemite Avenue were not united politically or socially.

After fighting for years to get streets graded and paved, to get parks, sewer line extensions and public transportation, the residents near the India Basin boatyards in 1939 formed the Hunters Point Improvement Association to try to bring more awareness to the needs of the community. At first they received little attention from City Hall, both because the district was not politically well connected, and because there were few

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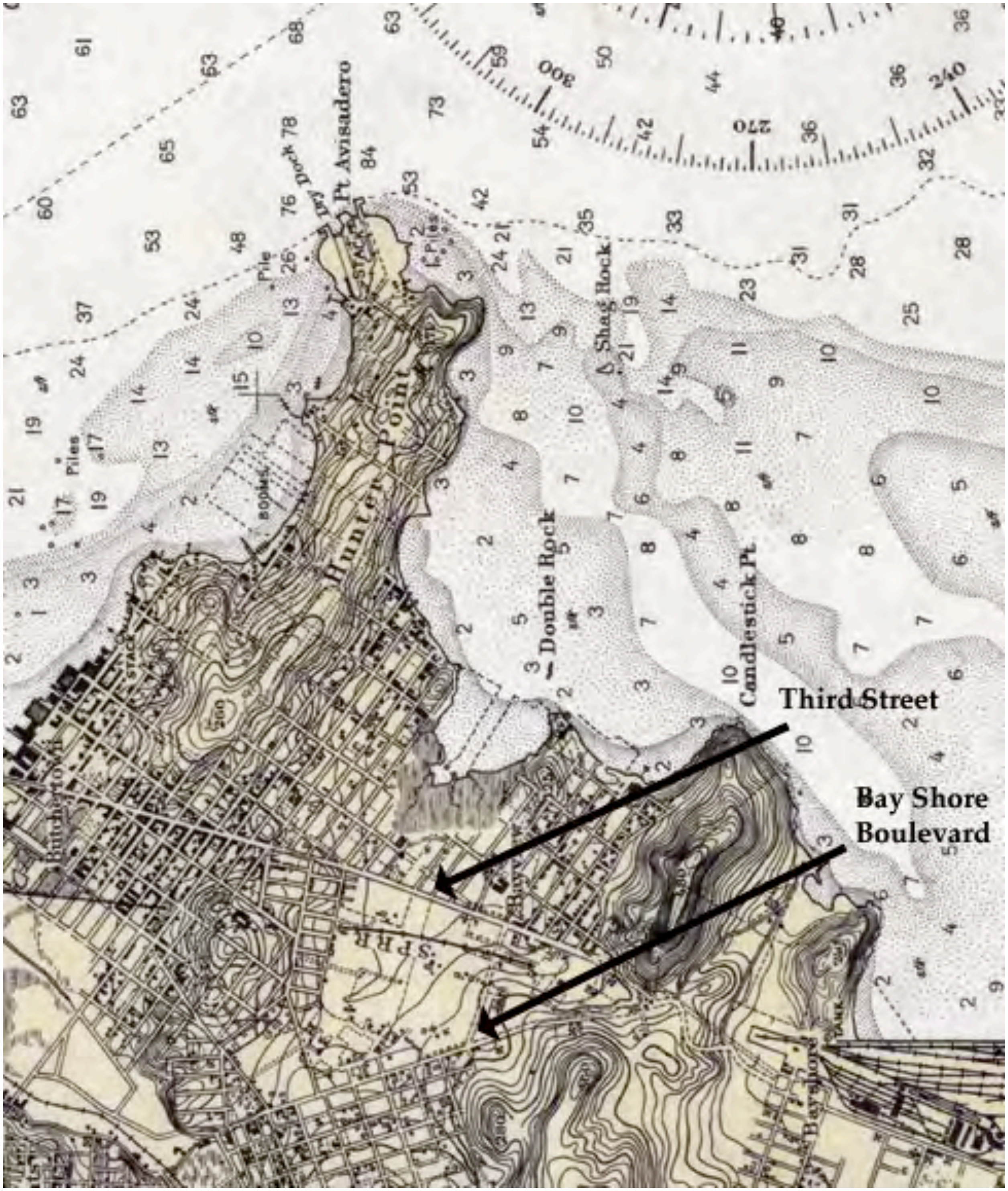

Figure 8. 1926 USGS map showing areas of increased development after the earthquake. Compare to Figure 6 and note the higher density development along Third Street.

because the district was not politically well connected, and because there were few public improvement projects happening anywhere in San Francisco because of the shaky financial environment of the Great Depression.[34]

Instead, the neighbors took matters into their own hands, just like they had on numerous past occasions.[35] This time, they undertook a cooperative grocery to address the poor access to food staples in the area. Their efforts met with limited success. The grocery came to symbolize the spirit and attitude of the district, something that was well praised in the popular media, but it did little to bring about long-lasting improvements. For that, they had to wait for the U.S. entrance into World War II.

COMMERCIAL DEVELOPMENT

Adequate transportation remained an obstacle to development well into the 20th century. However, development did occur to a limited extent. It was precisely because of the remoteness and relative isolation of the Bayview-Hunters Point area that it became a favored place to relocate necessary yet undesirable commercial uses. First this included the dairy farms, and then it was Butchertown (see Figure 9). In later years it became a favored industrial center and public works facility location.

BAY VIEW PARK

The area just north and west of the Alice Griffith Public Housing (between Third Street and the former water line) was first developed in 1863 as a high-class horse racing track known as Bay View Park. The racing oval was on soft ground, only partially dry, that gave it a reputed spring, enabling the horses to run record times. In a City filled with

[34] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR, Appendix E*, certified February 8, 2000, File No.1994.061E, p. E3.

[35] In 1920, after years of lobbying the City for a playground, the people of the Bayview district got tired of waiting. On February 21, 1920, they held the first Community Labor Day to clear a vacant lot at Railroad and Jerrold. It became the first community playground in San Francisco. "Bay View Citizens Build a Community Playground," *Community Service Recreation League Bulletin,* February/March 1920.

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Figure 9. A view of a portion of Butchertown, c.1925. Photo used with permission from the Bancroft Library, University of California, Berkeley.

over a dozen horse racing venues, Bay View Park was thought to be one of the best. It boasted a hotel and grandstands in the latest architectural styles, and offered it own horse-drawn railroad to transport people from downtown San Francisco the hinterlands known as the Bayview (see Figure 10.)

Bay View Park had very influential investors, including George Hearst, father of William Randolph Hearst.[36] It was successful for many years and became a popular location for the City's elite. However, by 1880s, the track had been reclaimed by the sea.[37] Hearst, Crocker and other had grand plans for redevelopment of the area as a new "country" retreat for monied San Franciscans. Unfortunately, the land was not as desirable for residential development. Apparently, no one wanted to live in the swampy bottomlands so far from the City's core, in spite of the pleasant weather and wonderful views. Instead, Crocker turned his sights south to Hillsborough and the Bay View Park land remained undeveloped marshland until the eve of World War II.

Truck Farming

Before the advent of modern refrigerated transport, the costs and timeframes associated with shipping fresh fruits and vegetables limited where, when and how food could be transported. For San Francisco, food was supplied from farms around the Bay then sold at local markets, or door-to-door by individual vendors. The location of the farms on the periphery of the City was limited to those area blessed with a fresh water supply. Early on, most of these farms were in the Cow Hollow and Lake Merced sharing water with dairies. As San Francisco grew, it became apparent that relocating all agricultural pursuits to the unpopulated lands south of Market would remove the more unpleasant aspects of these businesses from residential areas. In the 1880s, San Francisco passed an ordinance to move the farms out of Cow Hollow.

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[36] The Book Club of California, California Sheet Music Covers: Bay View Park Galop, 1959.
[37] Roger and Nancy Olmsted, Historical Consultants, *San Francisco Bayside Historical Cultural Resource Survey*, 1982, p. 98.

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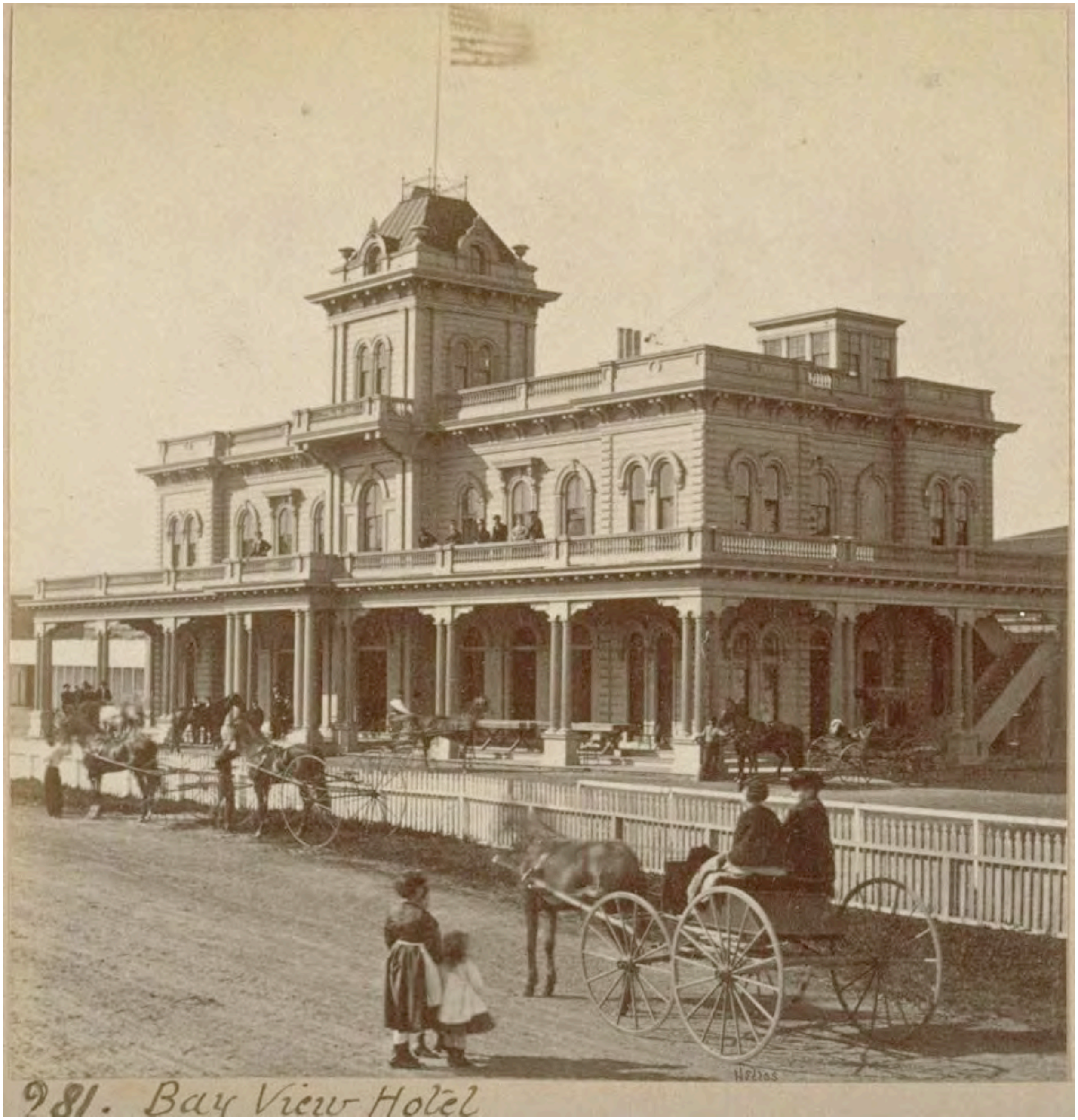

Figure 10. Bay View Hotel, San Francisco, c.1868-1880. Photo used with permission from the Bancroft Library, University of California, Berkeley.

One area that had both fertile land and ample fresh water was the Bayview area in the old pasturelands of Mission Dolores. It was here that the vegetable farms had their greatest concentration, providing San Francisco with a nearly constant supply of fresh fruits and vegetables to feed the rapidly expanding population.

Before 1870, the majority of vegetables were grown by Chinese immigrants on lands leased to them by real estate speculators. Sanborn maps up through the 1950s show many large plots labeled “vegetable gardens” or “nursery”. While many of the plots were tended by Chinese immigrants, they were not the only ethnic and cultural group to be drawn to the work. A smaller number of Italian and Portuguese citizens also grew vegetables for sale in the local markets.[38] The difference was that many of these families owned their land outright, a fact that allowed them to ascend into relative prosperity much more quickly than the Chinese farmers who immigrated with nothing and relied on a collective arrangement to amass land shared between several families.

After 1870, the proportions had changed and most of the farms were owned or operated by Italians. They tended to favor workers of similar backgrounds, hiring recent arrivals or family members to tend the fields. An account from the 1880s describes the typical market farm in the Bayview area.

“The Italian market gardens are chiefly located along the San Bruno Road, in the San Miguel Rancho, along the borders of the Presidio reservation, and in South San Francisco [Bayview]. There are a few small gardens operated by the Chinese in the neighborhood of Black Point [Candlestick Point] and between South San Francisco and Hunters Point. Where once the Chinese were the commonest sight with their vegetable cars heading for the market places, now they have been crowded out by the Italians and the Portuguese who have bought larger and larger plots of land. Like the Chinese, the

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[38] Roger and Nancy Olmsted, Historical Consultants, *San Francisco Bayside Historical Cultural Resource Survey,* 1982, p. 114.

Italian laborers in the local gardens are content with a little – so far as wages are concerned. Most of these men live on the scene of their daily toil in light shanties, part of which is devoted to the storage of root crops and seeds, and the remainder to the domestic uses of the family."[39]

In 1868, the proliferation of the "market gardens" in the Bayview area was aided with the completion of the Potrero and Bayview Railroad through the center of the district. Until then the farmers were forced to move their goods either by horse and cart or via barge. As rail service and roads improved, the smaller farms were consolidated into larger operations. The 1913 Sanborn map (the first to show much of Bayview) labels a major portion of the land east of Railroad Avenue (Third Street) for vegetable production. As late as 1950, there were still commercial farms in the area, concentrated mostly near the Bay shore, and several of the larger growers had established greenhouses west of Railroad Avenue, closer to the railroad tracks and San Bruno Boulevard.

Butchertown[40]

The original Butchertown was located at Ninth and Brannan Streets in the south of Market area. After the Gold Rush swelled San Francisco beyond its humble beginnings at Yerba Buena Cove, this once remote district of the city proved to be more valuable for other forms of industry. Therefore, in 1871, the city passed an ordinance and amended the Municipal Health Code to move Butchertown to the banks of Islais Creek, away from the then residential and industrial centers of San Francisco, and could not contaminate the water supply of the city core.[41] The move resulted in a shift in

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[39] "Market Gardens: Practically an Italian Monopoly," *San Francisco Chronicle*, November 17, 1889.
[40] Like many cities, San Francisco has traditionally concentrated certain industries in various enclaves. These enclaves then acquire nicknames derived from those industries. Butchertown is one of these examples where many different businesses associated with the butchering industry tend to be established in close proximity to each other.
[41] David Chavez & Associates, Archaeological Resources Investigation for the Bayview-Hunters Point Redevelopment Plan, San Francisco, California: Evans Avenue Addition, 2004, p. 5.

boatbuilding businesses along Islais Creek, where boatwrights moved east, further down Hunters Point to escape the worst of the "effects."[42]

Islais Creek was, in many ways, the ideal location for Butchertown. Although most parts of the slaughtered animals were used for one purpose or another, the industry still generated a large amount of biological waste. The slaughterhouses were constructed on long piers set over the mudflats of the tidal basin of Islais Creek. When the useful portions had been sent to processing plants nearby, the wastes were pushed onto the mudflats. Once here, the ebb and flow of the tides would carry the waste out into the Bay. This tidal scrubbing was so effective, that very little archaeological materials have been unearthed during construction in this area. Everything was swept out to the Bay.[43]

With the slaughterhouses, Butchertown also consisted of a host of related businesses including tallow works, glue factories, sausage factories, mattress manufacturers, tanneries and large stockyards. Most of the butchering was done on the piers over the Islais Creek running east from Railroad Avenue along the shoreline (roughly along present day Davidson and Evans Avenues.) The stockyards were west of Railroad Avenue (Third Street) near the present-day Caltrans railroad tracks. Easy railroad access was key to the transportation of cattle and livestock from the Central Valley and the south. Most were brought overland either on foot or via rail to the stockyards where they were held before slaughter. The stockyards in Butchertown were typically used for short-term holding. Tanneries, tallow and glue works were a bit further inland, on dry ground.[44] Most of the other early businesses and services, such as lodging houses, saloons and barbershops along Railroad Avenue (now Third Street) catered to the Butchertown workers.

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[42] Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008. p. 20.
[43] Roger and Nancy Olmsted, Historical Consultants, *San Francisco Bayside Historical Cultural Resource Survey,* 1982, p. 144.
[44] Sanborn Fire Insurance Maps: San Francisco, 1886, 1899, 1913, 1950.

One other commercial area that developed was in India Basin. Here a community developed around the shoreline and various marine industries such as boat building and fishing. The history and development of India Basin is covered in the next chapter.

PROPERTY TYPES

Building, structure and object types related to the discussion above would include, but are not limited to:

- Greenhouses
- Early residential buildings including farmhouses and rowhouses
- Early commercial buildings, mostly wooden frame, such as the Bayview Opera House
- Community buildings, including churches, halls and recreational facilities
- Hotels, Lodging Houses and Saloons, mostly wood frame, typically around Third Street, false fronts and Italianate detailing would have been common
- Street patterns
- Retaining walls
- Storage sheds
- Transportation facilities – loading platforms, docks, railbeds, tracks and tunnels

Most of the buildings from this pre-1941 period within the Project were removed in the building booms that occurred during World War II and in the immediate post-War period. The one major remnant that survives in much of its original form is the street grid and its naming convention.

Buildings from these periods within the boundaries of the Project are investigated, presented and evaluated more fully in Volume II of this report. This document, *Bayview Waterfront Plan Historic Resources Evaluation, Volume II: Resource Survey and Report*, also prepared by Circa: Historic Property Development, should be referenced for further information regarding specific buildings or architectural styles found within the Project.

CONCLUSIONS

The overall development of the individual districts within the Project before World War II was rather slow and measured. In spite of its superior weather, abundant water and wonderful Bay views, general access to the area greatly hampered its development as a residential neighborhood. Commercial enterprises were lacking because the overall population was too small to sustain them. Instead, specific industries developed in specific areas where the natural conditions were most suitable. Butchertown utilized the tidal basin of Islais Creek. Farming occurred on the flat lands. Recreational facilities developed at the ends of excursion rail lines. Other develops included India Basin for boat building and the tip of Hunters Point Hill for ship repairs. These industries each had a small community of workers associated with them, but no large-scale residential development occurred until the onset of World War II.

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V. INDIA BASIN[45]

India Basin is composed of approximately ten full and partial blocks ranging from Earl Street to the former Pacific Gas & Electric plant site along Jennings Street. Many of these blocks are occupied by small, light industrial enterprises and residential buildings. The area has historically been a small boatbuilding community since the middle of the 19th Century. This community was fairly self-sufficient, establishing their own churches, schools and social support network. Economically, they were dependent on the Bay for their livelihoods, whether they were involved with boat building or fishing. Today, several of the early religious institutions remain, as does at least one working boatyard and several residences from the 19th Century and early 20th Century. It remains a unique working landscape within the City of San Francisco.

EARLY HISTORY – BEFORE 1941

In 1868, proximity to the newly constructed drydocks at the end of Hunters Point, brought about real estate speculation for the entire neighborhood. That same year, in preparation for this devolvement, the State Board of Tide Land Commissioners named the inlet between Potrero Point and Hunters Point at the mouth of Islais Creek, “India Basin.” The land and submerged lots were set aside for “docks, piers slips, and basins, and other purposes of commerce.”[46] At that time there were already several small dwellings along the northern coastline of Hunters Point Hill. When the drydocks opened at the eastern end of Hunters Point Hill, several small roads and footpaths connected India Basin to both the drydocks and to the rail line along Third Street. The most widely used route followed approximately along the line of today’s Innes Avenue.[47]

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[45] Most of the information in this section is paraphrased from the comprehensive historical context for India Basin prepared by Kelly and VerPlanck for The Bayview Historical Society. Specific references are provided as follows.
[46] Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008. p. 16.
[47] U.S. Coast Survey Map, 1869.

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Development in the India Basin sub-area was driven largely by proximity to and availability of water. To this end, the industries that defined the history of India Basin were boatyards, breweries, and fishing.

BOATYARDS AT INDIA BASIN

The boatyards were active in India Basin for over three quarters of a century from the mid-19th Century to the early 20th Century.[48] For much of that time, they constituted one of the only stable communities beyond the boundaries of Butchertown in the area. Most boatwrights were of northern European descent from England, Holland, Germany and Scandinavia. Boatbuilding tended to be a trade that was passed down from father to son, creating a close-knit, multi-generational atmosphere. This community took pride in their work and was largely self-sufficient.

When the first boatyards opened in the 1850s, India Basin was largely unimproved shoreline property. Arriving over land involved a circuitous journey around Mission Bay and the marshes at the delta of Islais Creek. Even the opening of Long Bridge across Mission Bay in 1868 did little to improve the route for foot travelers. Once a person disembarked from the train along Third Street, there was still a walk of a mile or so to the boatyards. Extending beyond the boatyards a single road ran along the northern shore to the drydocks being completed at the tip of the point. As more and more yards opened, this last road was greatly improved but that was mostly because of the increased business at the drydocks rather than the need to better service the boatyards. By 1906, the area had remained largely stable in size for twenty years. This period from their establishment through the great earthquake represents the height of growth of the boat yards at India Basin (from the 1850s through 1906).

[48] A more detailed account of the names and dates of the various boatyards in India Basin is given in "India Basin Historic Survey," Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008.

Individually, the boatyards at India Basin were rather small commercial operations. However, taken as a whole, they constituted one of the largest concentrations of shipwrights and shipbuilding services in San Francisco. Most specialized in the construction and repair of San Francisco Bay scow schooners. These unique craft were the workhorses of local maritime trade (see Figure 11**.)** The number and quality of roads through the region, combined with the difficult topography made shipment of goods over land an expensive and cumbersome process. Moving goods by water, however, was relatively cheap and efficient. The main difficulty was the wide marshlands that made much of the shoreline unusable. The scow schooners were developed with an adjustable and very shallow centerboard that had drew mere inches when fully retracted. Their flat decks, simple construction and efficient use of materials meant they could be built and maintained cheaply and that they could haul a variety of goods into shallow waters. To do so they sacrificed speed and agility, two qualities that were much less important on the protected waters along the shorelines of San Francisco Bay.[49]

The demise of the schooner building trade finally came in the late 1920s as roads were improved and truck shipping became more viable. The slow and steady schooner was becoming obsolete. Some retrofitting with gasoline-powered engines helped these crafts compete, but their relative instability under wind power made them highly unsuitable for the faster pace afforded by modern combustion engines. The early days of the Great Depression further weakened the schooner market. Some yards consolidated and specialized in boat repair and wooden pleasure craft. Most disappeared for good. Today only two boatyards remain visible along the India Basin shoreline: the Anderson & Cristofani and Allemand Brothers yards (see Figure 12).[50]

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[49] Roger and Nancy Olmsted, Historical Consultants, San Francisco Bayside Historical Cultural Resource *Survey, 1982*, pp. 131-132
[50] Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008. p. 44.

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Figure 11. Sailing ship Jas. F. McKenna, a gas schooner. This boat represents a typical scow schooner of the late 19th Century. Photo is undated. Photo used with permission from the San Francisco History Room, San Francisco Public Library.

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Figure 12. Anderson & Cristofani and Allemand Brothers yards as viewed from the end of Arelious Walker Drive. Photo by Circa: Historic Property Development, July 2007.

Spring Water and Breweries

South of India Basin, along the northern slope of Hunters Point Hill, is a sizable natural spring. It was tapped by the Hunter brothers as a source of fresh drinking water for both themselves, and any individual willing to pay them for it. As early as 1855, they sold the water rights to Independent Water Company of San Francisco for $50 per month. This company shipped out kegs of water to barges in India Basin for transport to downtown

San Francisco. The Hunter brothers also ran an early “bottled” water venture where ships would get a full supply of fresh water before heading out to sea.[51]

The ample supply of fresh drinking water, combined with a concentration of European immigrants, made India Basin and Third Street a prime location for small brewery operations. One of the most famous of these was the Albion Brewery at 881 Innes Avenue in India Basin (see Figure 13.) Englishman John Burnell started the Albion Ale and Porter Brewery in 1870 after purchasing the Hunters’ spring. There he set about crafting a traditional English beer, which was stored in the tunnels he excavated deep into the serpentine rock of the hillside. Burnell constructed an imposing limestone building complete with a tower and vast storage facilities. Being a sound businessman, Burnell also bottled the spring water for sale as part of the Albion Water Company. These popular businesses continued after his death in 1890, when his widow and sons took over operations. The end strike for this and the other breweries in the area was Prohibition in 1919. The site was abandoned shortly thereafter.[52]

The site was in ruins when French sculptor Adrien Alexander Voisin (1890-1979) purchased the property in 1933 and began a lifelong mission of rebuilding the “castle” and fashioning his elaborate gardens. Voisin and his heirs owned the property until 2005 when it was sold at auction. Today it continues to be used as a private residence and is listed as San Francisco Historical Landmark No.60.[53]

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[51] Ibid., p. 16.
[52] Ibid.
[53] The site was designated on April 5, 1974.

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Figure 13. Albion Brewery, later the Albion Spring Water Company, at 881 Innes Street. This photo was taken sometime between 1920 and 1933. Photo used with permission from the San Francisco History Room, San Francisco Public Library.

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Shrimp Camps

Many Chinese came to the United States initially to work on the railroads, but a good number were experienced fisherman. The Chinese fishermen sought out the best locations for their efforts, including the northern slope of Hunters Point Hill. Shrimp fishing on San Francisco Bay began with Chinese harvesting bay shrimp sometime around 1870. The crustaceans were considered delicacies in China and most of the haul was intended for export. Eventually American settlers came to appreciate the dried shrimp as well, adding to demand. Because fishing for bay shrimp was a long and arduous process, there was little competition by European fisherman and the Chinese shrimping grounds were largely left alone.[54]

Shrimp camps were well established around the Bay by the 1880s. The most productive grounds were along the west side of the Bay at Hunters Point, Point San Bruno and Point San Mateo, and in the shallow coves of the northern Bay near San Rafael at Point San Pedro.[55] At Hunters Point, most were concentrated in the protected shallows along the northern shoreline of Hunters Point Hill, although some were reportedly along the south shore as well. They were typically arranged into camps of less than 50 men under a manager who oversaw the selection of fishing grounds and processing of the harvest. The men used large, funnel-shaped nets that were 18 feet high and up to 30 feet long, set out in the Bay along a line up to a mile long. Forty crews of five men each would work two full tidal cycles to catch the shrimp on the ebb and flow of the tide. It was difficult work lasting 12 to 14 hours a shift.[56]

[54] Roger and Nancy Olmsted, Historical Consultants, *San Francisco Bayside Historical Cultural Resource Survey*, 1982, p.119.
[55] Ibid.
[56] San Francisco Chronicle, July 23, 1893.

When the harvests were collected on shore, the shrimp were boiled in weak brine until they became pink, then laid out in the sun to dry. Customers could come to the camps, or the dried shrimp were packaged for sale in San Francisco or for export.

With little development pressure in the area, the shrimp camps continued well into the 20th century. The 1930 Census notes at least one shrimp camp in India Basin, housing approximately 30 workers.[57] It appears that tension was building around the shrimp camps, however. In 1939 the City undertook a “clean-up” campaign of the India Basin shrimp camps. At this time, the City deemed them unsanitary, had them condemned and the San Francisco Fire Department set ablaze the shrimp camps as the owners and their families stood by watching (see Figure 14.)[58]

Along with the shrimp camps, at least one commercial fishery was known to have existed in India Basin. Sanborn maps and photographs of the early California Dry Docks Company at the eastern end of Hunters Point Hill, identify a fish drying enterprise immediately adjacent to the drydock on the north side of the point. It had a series of buildings, including a bunkhouse, mess hall and drying shed.[59] It was slated for removal by 1913 when Drydock 3 was being planned. (See Chapter IV for more information about the construction of Drydock 3.)

As a relatively isolated community, most of the public services extended to India Basin were the result of related projects in the larger area. For instance, the first basic water service to the residences and businesses of India Basin did not occur until 1924 when the Spring Valley Water Company built a main line along a portion of Innes Avenue. Sewers soon followed, but neither water nor sewers extended up the slope of Hunters

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[57] Kelly and VerPlanck, Historical Consultants*, India Basin Historic Survey*, 2008. p. 28.
[58] San Francisco Public Library Historical Photograph Collection, *Shrimp Camp on Fire in Hunters Point*, April 20, 1939.
[59] Sanborn Fire Insurance Map: San Francisco, Volume 5, 1899, Sheet 616 and Volume 8, 1913, Sheet 816. The evolution of the ownership of the drydocks at Hunters Point can be found in Chapter VI.

Figure 14. Photograph of the 1939 burning of the shrimp camps at India Basin. Photo used with permission from the San Francisco History Room, San Francisco Public Library.

Point Hill where several isolated residences continued to utilize wells and septic tanks. Paved roads were nonexistent until 1938 when a single route from Third Street to the Union Iron Works Drydocks was regraded and tarred.[60] This began to change when the Navy showed genuine interest in acquiring the drydocks for a major military base in the early 1930s.[61]

[60] Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008. p. 29.
[61] It was purchased by the U.S. Navy in 1939 but not occupied by them until 1941.

WORLD WAR II (1941 – 1945)

After the United States entered World War II, the hillside blocks around India Basin were rapidly transformed. What was rocky land with a scattering of haphazardly sited residences became tidy rows of identical war dwellings. Circulation through the area was improved and expanded, with new streets and street patterns. Traffic increased substantially and the shoreline to the east was filled and reshaped. (See Chapters VI and VII for further discussion on the impact of World War II on the Shipyard and the development of housing.) In the middle of all this development, however, the physical changes to the specific blocks within the India Basin sub-area were limited. There are many houses, commercial and community facilities that remained as islands of the past and are covered in the earlier sections of this chapter.

POST – WWII (1941 – PRESENT)

By 1950, use or redevelopment of the war dwellings surrounding India Basin forever changed the community atmosphere. The demographics and social character of the area were much different than the boatwright community of before the war. In spite of this, several boatyards, including the Anderson & Cristofani Boat Building Co. (at 900 Innes Avenue) continued to operate and expand, demolishing several old structures and constructing a new warehouse, storage, administrative, woodworking and smithing shops. This operation became a vital link to the past for the remaining pre-war India Basin population. As a result, while much of the land in the area was being filled or planned for fill, this stretch of India Basin remained in its natural state.[62]

[62] In 1965, many of the lots north of Hudson between Griffith and Earl were filled with debris from the construction of I-280. This was done to avoid pending restrictions on the practice from the Bay Conservation and Development Commission (BCDC); Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008. p. 38.

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PACIFIC GAS AND ELECTRIC

The Pacific Gas & Electric Company (PG&E) power plant at Hunters Point was originally constructed in 1929 by Great Western Power Company. Over the years it has been expanded to keep up with improvements in power generation techniques as well as to increase capacity. The following historical background is excerpted from the 2006 National Register eligibility assessment completed by Roland-Nawi Associates.

> "The development of electrical power in both the form of hydroelectric and steam generated production was a major technological innovation of the late 19th and early 20th Centuries. Its ramifications were enormous for the industrial sector of the economy and affected the way thousands of people lived. In California, especially northern California, Pacific Gas and Electric Company played a major role in the development and expansion of electric power generation and distribution. It has constructed a large system of power generating and transmission facilities throughout northern California from the late 19th Century until the present. In the 20th Century, the company had two important periods of expansion, each tied to a specific technology of electrical power generation. In the late 19th and early 20th Centuries the development of hydroelectric facilities dominated the industry. After 1950 there was a shift to modern steam generation and facilities designed for its production.
>
> "The first period of major expansion was 1900-1920. From the 1890s until World War II, power generation in California and the western United States concentrated on the exploitation of water resources. In California, major river systems originating in the Sierras provided a widely available and cheap source of energy. Private power corporations, including Great Western Power and PG&E, developed a number of dams, powerhouses,

substations, and transmission systems along these rivers. The great increase in the availability of hydropower during this period drove the need to establish a network of local distribution facilities in towns and cities served by the companies. In San Francisco, the 1906 earthquake destroyed most of the city's existing electric power infrastructure. As a result, a large number of hydroelectric substations had to be constructed in the city, with PG&E playing an important role in this rebuilding. During this period steam generation was a minor source of auxiliary power for the big power companies. Coal to fuel steam plants had to be imported from the Northeast and could not compete with water power.

"Following World War II a greatly increased demand for electrical power in California led to another period of facility expansion and a change in technology. In Northern California this expansion was led by PG&E which had become the primary supplier of electrical power in this part of the state. As noted above, prior to the war, steam generation was viewed mainly as a form of back-up in periods of low water supply. By the late 1940s the limits on potential new hydro sites and the development of technologies that made steam generation more efficient and more economical turned PG&E increasingly to this form of power. In the 1950s PG&E expended over one billion dollars in construction of new facilities, most concentrated on steam generation These plants were designed and engineered differently than past facilities to both cut costs and consolidate plant operations and control. The first part of this expansion was the development of four new power plants: Kearn (175 megawatts), Hunters Point (200 megawatts), Moss Landing (330 megawatts), and Contra Costa (330 megawatts). The Kern, Moss Landing and Contra Costa plants were new plants, while the Hunters Point plant was an addition to the existing facility.

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Figure 15. The Hunters Point PG&E plant during deconstruction, July 2007. The entire plant was removed by July 2008. Photo by Circa: Historic Property Development.

> "The PG&E Station P at Hunters Point includes a portion of the building from the 1920s period of expansion and a large portion that was constructed in the immediate post-war period."[63]

The post-war construction included an expansion in 1948 to house plant turbines, further modifications in the early 1950s for a steam generation unit and again in 1958 to

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[63] Roland-Nawi Associates, PG&E Hunters Point Station P: Evaluation of Eligibility for Listing in the National Register of Historic Places, the California Register of Historical Resources, and for City of San Francisco Landmarks Designation, September 2006.

house another multi-story steam generator. An office wing has since been removed and replaced with a new office addition. The plant was closed in 2006 and demolished by 2008. The PG&E site is currently undergoing remediation (see Figure 15).

PROPERTY TYPES

Today, the India Basin sub-area consists of a mix of early residential and commercial buildings, along with open space and industrial uses. It is a mixed community that is transitioning from commercial and industrial uses, to a greater density of residential development. Most of the parcels slated for further historical evaluation in later phases of this project are either open space or devoid of any architectural elements.

Building, structure and object types related to the discussion above would include, but are not limited to:

- Warehouses
- Community properties – churches, schools, halls, etc.
- Wharfs
- Boat conveyances
- Early residential buildings
- Sheds
- Public housing
- Public staircases
- Development/siting patterns
- Street grid

The majority of the sub-area has been previously surveyed for historical resources.[64] Most studies have identified several residential and commercial buildings that are associated with the boat building industry and the early European immigrant community.

[64] For a more thorough and complete assessment of the historical context and related resources in India Basin, see Kelly and VerPlanck, Historical Consultants, *India Basin Historic Survey*, 2008.

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However, within the Project, no such resources remain. At this time, no architectural resources associated with the shrimp camps have been identified.

Buildings within the boundaries of the India Basin shoreline plan are investigated, presented and evaluated more fully in Volume II of this report. This document, *Bayview Waterfront Plan Historic Resources Evaluation, Volume II: Resource Survey and Report*, also prepared by Circa: Historic Property Development, should be referenced for further information regarding specific buildings or architectural styles found within the Project.

CONCLUSIONS

India Basin is most significant for its associations with the early maritime trades that once flourished along the entire San Francisco coastline. The relative isolation of India Basin, combined with its unusually close proximity to deep water channels, allowed these industries to survive for a much longer period of time than the residential neighborhoods that were slightly further south and west. Today, it is an enclave that represents what was a common grouping of residences built around a central commercial business. These businesses were often reflective of the nationalities of the surrounding communities – truck farms with Portuguese, Italian, and Chinese owners and workers, Butchertown with its Irish and Italian workers, etc. These communities each formed associations, churches, schools and social groups. India Basin is the last remaining vestige of the area prior to the radical transformation of World War II.

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VI. HUNTERS POINT SHIPYARD

INTRODUCTION

Hunters Point Shipyard (Shipyard) occupies the eastern end of Hunters Point Hill. What was originally a narrow, steeply sloped finger of bedrock extending into San Francisco Bay has been transformed over the years into a flat expanse of reclaimed land. Part of the reclamation was accomplished through the leveling of portions of the original landform. Today, the Shipyard covers approximately 936 acres, of which approximately 493 acres are dry land and approximately 443 acres are under water.[65] By the time the Navy closed the Shipyard in 1974, the Shipyard contained over 337 industrial buildings, 57 housing and non-industrial buildings, 24,000 linear feet of pier, wall and wharf space, 21 repair berths, 10 additional deep water berths, 6 drydocks and a 225-ton crane (modified from the former 450-ton crane.)[66] As of July 2009, only a fraction of the original buildings and structures remain on the nearly 500 acres of available land.

The Shipyard has traditionally played a primary role in the development and definition of the Bayview and Hunters Point neighborhoods. In its early days as a private drydock, it was the largest single commercial entity in the Project vicinity as well as the largest and most modern drydock on the Pacific Coast.[67] This early enterprise represented a new era in maritime history, spanning from large wooden shipping craft to new steel-hulled vessels (see Figure 16.) After Navy acquisition in 1939, it brought national attention to the district and eventually resulted in the complete transformation of the economy and demographics of the area.

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[65] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR,* certified February 8, 2000, File No.1994.061E, pp. ES-1.
[66] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Study Options for Future Us*e, June 1974, p. 2-12.
[67] “San Francisco Dry Dock: Its Location, Dimensions, Machinery, Etc.,” *Daily Alta California*, April 16, 1867.

Figure 16. St. China in the Hunters Point Drydocks, c.1901. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Naval interest in Hunters Point corresponded to a dramatic expansion in the size and important of the United States Navy, as well as a general increase in the military's presence on the West Coast. Continued Pacific military campaigns (Philippine War, World War I, World War II) only emphasized the importance of West Coast military facilities. As part of this, the Navy became affiliated with the Hunters Point drydocks during this period, first as a client of the privately held shipyard then as owner of the shipyard. The continued expansion and successful operation of Naval campaigns in the Pacific Ocean was dependent on the availability of ship-servicing capacity. In 1939, when the Navy purchased Hunters Point, the facility became only the third Naval shipyard on the West Coast and the only one south of Puget Sound capable of handing modern military ships.[68] It retained this status until well after World War II when the Navy changed its policies to rely on private shipyards instead of maintaining its own facilities.

As important as Hunters Point was to the World War II Naval campaigns, it gained significance in its own right in the post-war period through its role as home to the Naval Radiological Defense Laboratory (NRDL). This facility was borne out of necessity in the latter war years and grew into a major research facility dedicated to studying the physiological impacts of radiological exposure as well as the detection of and protection from such nuclear hazards. This facility was established at Hunters Point Shipyard because of its many geographic, political and logistical advantages, and operated there from 1944 to 1969. It was one of the only facilities of its kind in the United States in either private or military control, was recognized as a leading research facility on a national scale and played a major role in every U.S. nuclear weapons test during its 25-year history.

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[68] Twelfth Naval District, Physical Properties Facilities and Services: naval Activities and Principal Offices, June 1948.

Together, these areas of importance are reflected in the built environment. There are a small number of buildings that pre-date the Navy and comprise an already identified potential historic district near Drydocks 2 and 3. The rest of the Shipyard building stock was historically almost evenly split between World War II era construction and post-war era construction, although recent demolitions have left more World War II structures at the expense of the post-war buildings. While not as impressive architecturally as the earlier drydock buildings, these later military buildings and structures carried out operations critical to the United States' success during World War II. After the War, the shipyard continued to contribute to the success of military campaigns both as a shipyard as home to RADLAB.

BRIEF MILITARY HISTORY IN SAN FRANCISCO BAY

Shortly after the discovery of San Francisco Bay, the Spanish began fortifying the headlands around the Golden Gate. The first of these establishments was the Presidio, started as a Spanish encampment in 1776 to protect the entrance to the Bay, and to guard the Mission several miles away. When Mexico won its independence from Spain in 1821, it set about further fortifying its new holdings in Alta California. In 1850, the United States took control of the Presidio. By the 1860s, they were constructing a naval base at Mare Island, the first such facility on the West Coast.

In 1885, President Cleveland's administration saw San Francisco Bay as second only to New York Harbor as vital to the nation's security.[69] The result was a number of small batteries and encampments along the coast and Bay shorelines. After the Spanish-American War (1898-1902) America's naval strength became a top national priority and San Francisco's strategic naval importance could not be denied. As a result, a massive expansion of military facilities throughout the region occurred during the first half of the

[69] United States Commission on Navy Yards and Naval Stations, *Additional Navy Yard on the Pacific* Coast: Message from the President of the United States transmitting report no.5 of the Commission of Navy Yards and Naval Stations, 1918.

20th Century. Part of this buildup included increased capacity for shipbuilding and repair, and hence the increased interest in the private drydocks at Hunters Point in the years leading up to World War II.

EARLY HISTORY AT THE SHIPYARD – PRE-1941

What became Hunters Point Naval Shipyard was originally two separate regions at the end of Hunters Point Hill: a small residential neighborhood and the drydocks. While most of the information contained in this document concentrates on the contributions of the drydocks to the overall development of the Shipyard it is important to recognize the residential portions of the military facility that pre-dated World War II. Information on the early residential development of the land within the Project is included after a brief discussion of the history of the drydocks.

CALIFORNIA DRY DOCK COMPANY

What would become the heart of Hunters Point Shipyard began in 1864 as the brainchild of A.W. Von Schmidt, a German engineer. He approached the South San Francisco Homestead and Railroad Association with the idea that a drydock in such close proximity to their land would bring industry (and workers needing housing) to the area. They readily agreed and donated ten acres to the project.[70] However, financing for the construction was more difficult to secure. Eventually, Von Schmidt partnered with a number of investors, including William Ralston and Lloyd Tevis, to form the California Dry Dock Company.

The drydock was largely cut from solid rock at the northeastern tip of Hunters Point (see Figure 17.) It was completed in late 1867 and brought great praise from local real estate speculators and promoters. The Hunter brothers built a small hotel at the tip of the point near the drydocks in anticipation of a flood of new settlers drawn by employment

[70] Roger and Nancy Olmsted, Historical Consultants, San Francisco Bayside Historical Cultural Resource *Survey*, 1982, pp. 93-94.

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Figure 17. Hunters Point Drydock under construction, c.1867. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

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Figure 18. Hunters Point Drydock, c.1870. This photo appears to be from the first decade of the drydock operations at Hunters Point. Note the cluster of houses in the background, near center. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

opportunities at the drydocks. Around the hotel several residential and commercial buildings were erected (see Figure 18.)[71]

SAN FRANCISCO DRY DOCK COMPANY

The California Dry Dock Company operated through the end of the 19th century supported by a significant number of government contracts and also acted as a primary repair facility for U.S. Navy ships returning from various Pacific military missions. Around 1901, the company changed its name to the San Francisco Dry Dock Company and commenced construction of a second drydock, Drydock 2 (see Figure 19.) Completed in 1903, the facility became the most modern drydock on the Bay. While it was busy with increased business, its location was gaining the attention of military personnel in Washington, D.C. It was also attracting the attention of Charles Schwab (of Bethlehem Steel) who was concerned that his Potrero Point (Pier 70) shipbuilding operation was becoming inadequate to handle the most lucrative types of naval shipbuilding and repair contracts. In 1907, as he considered building additional facilities at Potrero Point, Schwab met William Babcock, president of the San Francisco Dry Dock Company.

A year later, Schwab purchased all the company stock for $1.875 million, becoming the sole owner of the drydocks at Hunters Point.[72] His close connections with President Woodrow Wilson and his position as director-general of the Emergency Fleet Corporation meant his shipyard and drydock facilities in San Francisco, as well as his shipyards in Alameda, were well placed in the years leading up to World War I.

The combination of the shipyard at the Potrero Point site and the drydocks at Hunters Point made the San Francisco Yards of Bethlehem Steel one of the largest combined facilities in the world.

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74 John Haskell Kemble, *San Francisco Bay, A Pictorial Maritime History*, photograph, 1868, p. 63.
72 "Hunters Point Dry Dock Merged With Union Iron Works," *San Francisco Call*, November 12, 1908

Figure 19. View of the Hunters Point drydocks as seen from Hunters Point Ridge, 1924. Drydock 2 is to the right in the image. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

NAVAL INTEREST INCREASES

After the Spanish-American War, President Theodore Roosevelt sent a fleet of U.S. Navy ships on a circumnavigation tour to demonstrate the power of the U.S. Navy. It was commonly referred to as the *Great White Fleet* and it served to establish the naval dominance of the United States as well as to show the technological capabilities of American engineers and shipyards. From a political standpoint, the 1907-1909 tour also built up domestic support for the development of naval bases on both coasts. At the time, the Navy had only two shipyards on the West Coast – Puget Sound Naval Shipyard in Bremerton, Washington and Mare Island Naval Shipyard in Vallejo, California.[73] If the U.S. was to dominate the seas with military might, it needed new facilities large enough to handle the massive steel ships then being manufactured. For the time being, the Navy contracted out the manufacture and maintenance of its fleet to shipyards such as Bethlehem Steel's San Francisco Yards.

In the Bay Area, Mare Island Naval Shipyard was seen as an important base, but it was incapable of handling the larger ships. It was plagued with shallow drafts as the result of decades of mining tailings being washed into the northern San Francisco Bay as well as by limited geographic space for physical expansion. Additional facilities were needed and various locations in and around San Francisco Bay were high on the Navy's list of considerations. In 1916, during World War I, Congress authorized the creation of a commission to further study locations for Navy Yards in the San Francisco Bay Area. It became known as the Helm Commission after its chair, Rear Admiral J. Helm.[74]

The commission looked at a variety of locations, including Alameda, Goat Island (now Yerba Buena Island), Richmond and Hunters Point. In spite of the strong, long-standing Naval tradition at Hunters Point, the commission ultimately voted in favor of Alameda as

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[73] JRP Historical Consulting Services, Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard, September 1997, p. 11.
[74] Ibid.

the preferred location of the new shipyard. This recommendation was never acted upon, and the site eventually became the Naval Air Station at the western end of the island of Alameda.

In the meantime, the Navy compromised by further solidifying its relationship with Bethlehem Steel's drydocks at Hunters Point. It subsidized construction of new, larger facilities at Hunters Point in exchange for prioritized access to the privately owned site.[75] This arrangement enabled Bethlehem Steel to construct Drydock 3 in 1918.[76] This drydock was built by enlarging Drydock 1 (1867) and it greatly increased the ship repair capabilities of the Hunters Point facility.

The almost exclusive U.S. Navy access to the drydocks at Hunters Point worked out well during peacetime. However, following World War I, it became apparent that the size and destructive power of the world's navies had increased dramatically. As the ships became more sophisticated, so too did the repair facilities that kept them afloat. Realizing that they would eventually have to develop their own west coast facilities, the U.S. Navy once again began searching in earnest for the right locations.

The pressure for an established shipyard, capable of handling the world's largest fighting machines, increased dramatically as hostilities in Europe began to escalate at the end of the 1930s. To address the situation, the Navy purchased the Bethlehem Steel drydocks at Hunters Point in 1939 (see Figure 20.)

At the time, the entire site was approximately 48 acres and contained two drydocks. Anticipating involvement in the growing conflicts in Europe and the Pacific, the Navy began construction of supply buildings and storehouses along the drydocks (see Figure 21.) This construction was rather limited in size and scope due to extreme shortages of

[75] NAVSEA, Hunters Point Shipyard: Final Historical Radiological Assessment: History of the use of General Radioactive Materials, 1939-2003. 2004, p. 6-2.
[76] JRP Historical Consulting Services, Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard, September 1997, p. 12.

Figure 20. Hunters Point Drydocks, 1940. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Updated: July 2009

Figure 21. Aerial view of Hunters Point, c. 1941. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

emergency construction money and materials. All construction during this period at Hunters Point was done as money became available and used what were considered inexpensive materials to build temporary structures.[77] Improvements from this early-Navy period included a new assembly building just south of Drydock 2, latrines, a 50-ton crane and an 800-foot quay wall just south of Drydock 2, as well as smaller service-oriented buildings near the point (now since removed.)[78] The Bureau of Yards and Docks, a branch of the U.S. Navy, took on these projects. This bureau was responsible for the building and maintenance of the yards and Drydocks, as well as all support facilities related to ship construction, repair and maintenance. The majority of the Hunters Point Shipyard buildings of this pre-war period were built using standard plans developed by the Bureau of Yards and Docks. These early projects were still under construction when the Government terminated its lease to Bethlehem Steel in October 1941. The Navy took full control of the facility on December 18, 11 days after the bombing of Pearl Harbor.[79]

PRE-NAVY COMMUNITY

To handle the immediate need for barracks and residential accommodations, in 1942, the Navy acquired an entire neighborhood at the end of the ridge as part of the Hunters Point Naval Shipyard expansion. (This area was wholly contained within Parcel A of the Phase I Project.) The roughly 75-acre, flag-shaped area was bounded by Donahue Street to the west, Galvez Avenue to the north, Hill Drive to the east and Kirkwood Avenue to the south.[80] In total, 86 homes and 23 businesses became Naval property.[81]

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[77] Hunters Point Naval Shipyard Association, untitled report, c.1974, p. 6. Included as an appendix to Hunters Point Naval Shipyard: A Historical Analysis by Karl F. Kimbrough, August 1978.

[78] Ibid. p. 15.

[79] NAVSEA, Hunters Point Shipyard: Final Historical Radiological Assessment: History of the use of General Radioactive Materials, 1939-2003. 2004, p. 6-2.

[80] Environmental Protection Agency: *Region 9: Superfund, Hunters Point Naval Shipyard* website, http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/vwsoalphabetic/Hunters+Point+Naval+Shipyard!OpenDocument#_Section2; City and County of San Francisco, Redevelopment Agency, website, *Hunters Point Shipyard Redevelopment Project Area Map*, http://www.sfgov.org/images/sfra/landusemap.gif.

The buildings were used for married officers' housing, military clubs and other social and recreational uses. Over the years, the Navy added several 1950s era residential buildings to this area as well.

Not much is known about the small community that lived on the end of Hunters Point Hill, overlooking the shipyards, drydocks and fishing operations. This neighborhood was the result of increased business at the Bethlehem Steel drydocks at Hunters Point (discussed in the preceding sections). According to a 1997 report, "the bulk of the houses in this area [dated] to the 1908-1939 period, with more being constructed during the 1930s than any other decade." The report noted 31 homes were constructed between 1909 and 1939, with 20 of these constructed in the 1930s.[82] Within these 20th Century buildings, there apparently were two earlier structures that were tentatively dated to the 1890s or early 1900s. Together, they formed an eclectic grouping of mostly one- and two-story revival-style homes.[83]

WORLD WAR II – 1941-1945

Hunters Point Shipyard was not initially intended to serve as a stand-alone facility. When first acquired, and throughout World War II, it was designated as an annex to the Mare Island Naval Shipyard.[84] To this end, the early work at Hunters Point was completed by servicemen stationed at Mare Island. As its role as a repair facility for large ships became more heavily in demand, Hunters Point Annex grew accordingly. Because Mare Island could not accommodate these larger ships, Hunters Point was a vital part in the Navy's shipyard facilities in San Francisco Bay. When Mare Island's

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[81] *San Francisco News*, March 10, 1942

[82] JRP Historical Consulting Services, Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard, September 1997, p. 9.

[83] DPRa forms were recorded for each of these houses in 1997 as part of the JRP report. Full descriptions of the homes and their 1997 conditions are included in these documents.

[84] Karl F. Kimbrough, Hunters Point Naval Shipyard: A Historical Analysis, August 1978, p. 9.

capacity for submarine repair was strained by the War, additional facilities were constructed at Hunters Point. Its role and importance as a separate facility was not established until December 1945, near the end of the war.[85] At this time the mission of the Shipyard was still highly focused on the repair and servicing of large ships (209 during World War II), even though it had expanded capabilities to handle smaller craft and submarines and had limited capabilities for the construction of new ships (4 during the World War II period.)[86]

In fulfillment of its role as an annex to Mare Island, Hunters Point was developed as a highly specific facility. It did not have the extensive administrative support buildings, personnel or training facilities of Puget Sound or Mare Island. It did not need such facilities with Mare Island so close by and with its historical relationship to this other Naval base. Instead, it continued to be developed as the most modern large-capacity shipyard on the West Coast. This is evidenced in the construction of Drydock 4, the largest drydock in the world at the time of its construction in 1943, and the erection of the 450-ton Bridge Crane (1948), also the largest in the world at the time of its construction.

DEVELOPMENT AND EXPANSION

Between 1939 and 1945, due to the anticipated involvement in World War II and subsequent battles along the Pacific Rim, Hunters Point Naval Shipyard was expanded from 48 acres to 583 acres.[87] This was accomplished by moving over 8 million cubic-yards of earth from the end of Hunters Point Hill to the shallow areas immediately north

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[85] Ibid. p. 12. The Mare Island Annex at Hunters Point was then renamed the San Francisco Naval Shipyard.

[86] Mare Island produced 17 submarines, four submarine tenders, 31 destroyer escorts, 33 small craft, and over 300 landing craft. Many more were docked for repairs during this time and an exact figure could not be found. National Parks Service, “World War II in the San Francisco Bay Area,” http://www.nps.gov/history/nr/travel/wwIIbayarea/mar.htm. This is compared to 50 built and 384 total dockings at Puget Sound. National Parks Service, *National Register of Historic Places Nomination: Navy Yard Puget Sound*, December 1991.

[87] Building the Navy’s Bases in World War II: History of the Bureau of Yards and Docks and the Civil Engineer Corp, 1940-1946, Volume 1. 1947, p. 198.

and south of the drydocks. The northern area became the submarine servicing area and the southern portion formed what was to become the bulk of the Shipyard's usable land. (Figures 22-26 illustrate the rapid changes to the land mass in 1942.) These major dredging and engineering projects were completed simultaneously with dozens of other, more traditional construction projects completed in record time.

In 1941, $675,000 was appropriated for the construction of a new quay wall. However, the project was started in January 1942, immediately after the United States entered the war. In April 1942, the installation of 10 miles of sewer pipe and 10 miles of fresh-water lines was begun on the lands being leveled. The utility systems were further expanded in 1942 when connecting crane tracks were laid from old Drydocks 2 and 3 to those of the new 1092-foot drydock (Drydock 4), under construction at the time.

One of the major infrastructure projects during the World War II period was the laying of miles of railroad track within the Shipyard. These tracks allowed the massive ship propulsion and operational equipment to be moved from storage to installation facilities, as well as to transport such equipment from off-site foundries to Hunters Point. Even today, rail lines, spurs and beds remain scattered as reminders of the importance of the railroad to the everyday functioning of the Shipyard.

Beginning in 1942, the Navy commenced an extensive building campaign at the Shipyard. The bulk of the site's development took place during the emergency period of World War II and the majority of the buildings remaining at the Shipyard date to this period. The use of standardized designs and easily produced, readily accessible construction materials enabled military planners during the war to build a large number of buildings in highly condensed timeframes for the least amount of money.[88] According to a 1997 study of buildings and structures at Hunters Point Shipyard, nearly all of the

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[88] JRP Historical Consulting Services, Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard, September 1997, p. 17.

Updated: July 2009

Figure 22. Aerial view of the Shipyard shortly after the Navy took over full control of the drydocks, March 11, 1942. Photo used with permission from the San Francisco History Center, San Francisco Public Library and the United States Navy.

Updated: July 2009

Figure 23. Aerial view of the Shipyard shortly after the Navy took over full control of the drydocks. This photo was taken at approximately the same time as Figure 30. Photo used with permission from the San Francisco History Center, San Francisco Public Library and the United States Navy.

Updated: July 2009

Figure 24. Aerial view of the Shipyard shortly after the Navy took over full control of the drydocks. This photo was taken a short time after Figures 30 and 31. Note the completed construction of the quay wall and the advanced leveling of the ridge in the background. Photo used with permission from the San Francisco History Center, San Francisco Public Library and the United States Navy.

Updated: July 2009

Figure 25. Aerial view of the Shipyard after completion of reclamation, c.1945. Photo used with permission from the San Francisco History Center, San Francisco Public Library and the United States Navy.

Updated: July 2009

Figure 26. Aerial view of the Shipyard after World War II with most of the available berths in use, December 17, 1948. Photo used with permission from the San Francisco History Center, San Francisco Public Library and the United States Navy.

buildings at Hunters Point were constructed using these Bureau of Yards and Docks standardized plans.[89]

The World War II-era buildings at Hunters Point are a mixture of temporary, semi-permanent and permanent construction types. Because of the restricted use of critical materials, most of the structures completed during this time were temporary or semi-permanent facilities. All of the barracks, toilet facilities, and nearly all of the shops and warehouses were built according to standard plans. These plans, however, could be modified somewhat during and after construction to accommodate specific programmatic needs.[90] A number of structures built after the Second World War, including some large-scale industrial shop buildings and the basic facilities of the Naval Radiological Defense Laboratory, were designed as permanent buildings.

Shipyard Design

Though standardization was a key component in the rapid World War II-era Shipyard expansion, not all Shipyard buildings are of a standard Bureau of Yards and Docks plan. Throughout the course of the war, the Corps of Engineers and Bureau of Yards and Docks worked together to both develop designs that could be mass-produced, and, in an effort to provide federal employment opportunities during a time of scarce private construction projects, administering both architect-engineer (A&E) and construction contracts. The actual layout of individual buildings as well as plans for entire military bases commonly was turned over to private A&E firms. These firms could, and frequently did, use Navy or Army standardized plans, adapting them as needed to accommodate specific conditions at each individual base.[91] The main administration building (Building 101) for example is essentially a compilation of numerous modules,

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[89] A review of drawings held at local Navy archives confirms these findings.
[90] JRP Historical Consulting Services, Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard, September 1997, p. 17.
[91] Ibid, p. 18.

each derived from standard Navy plans. Further, the warehouses in the 400-series section of the South Shipyard are essentially identical, though minor variations in plan and design are visible.[92]

A small number of important buildings were not constructed using standardized plans though still adhere to longstanding design traditions of the Navy and industrial manufacturing buildings in general. The designs for Buildings 253, 231 and 411, for example, were not specifically derived from standardized plans but nonetheless retain several features common to large manufacturing shops built by the Navy throughout the United States since the early 20th century.[93]

During the World War II-era, a variety of A&E firms were contracted by the Navy at HPS as well as at other military facilities throughout the Bay Area and the United States. The scarcity of civilian contracts during the war, and abundance of military design work for both architects and engineers, resulted in work for nearly every practicing architect in the state during that time. Many prominent architects and engineers were contracted by the military for design work during WWII owing to the profusion of Federal contracts available in support of the war effort. At Hunters Point Shipyard, buildings and structures were designed and built by a variety of nationally prominent and well-known Bay Area architects, engineers and contractors including: John H. Devitt (architect), Barrett & Hilp (contractors), Austin Willmott Earl (engineer), Albert Kahn Associated Architects, Timothy Pflueger (architect), Ernest J. Kump Co. (contractors), and Walter L. Huber & Edward K. Knapik. Many of these firms are well known for their work both before and after the World War II period.

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[92] JRP, 17-18. Also see Sedway/Cooke, *Hunters Point Shipyard Study: Options for Future Use*, San Francisco: June 1974.
[93] JRP, 18.

Barrett & Hilp

The San Francisco-based contracting firm of Barrett & Hilp was awarded the master cost-plus-fixed-fee (CPFF) contract for Hunters Point Shipyard by the Navy.[94] As such, this firm constructed the majority of the buildings on the shipyard; most were built using standard Bureau of Yards and Docks plans. J. Frank Barrett and Harry H. Hilp founded the construction company in 1912 with $450 in capital. The firm grew along with the Bay Area, constructing schools, office buildings, subdivisions and public buildings in addition to the anchorages for the Golden Gate Bridge. An advertisement for Barrett & Hilp in the November 1943 issue of *Architect and Engineer* indicates that the firm had constructed war housing, industrial plants for the war effort, dams and aqueducts, dry docks, hospitals, cantonments and one complete shipyard.[95] The firm split into two companies in 1953 and J. Frank Barrett passed away in 1959.[96]

Harry H. Hilp, a San Francisco native, began his construction career as a carpenter with Southern Pacific Railroad shortly after the 1906 earthquake. His 1976 obituary notes that the firm of Barrett & Hilp received governmental awards for the firm's emergency work at Mare Island, the South San Francisco Shipyard [Hunters Point] and elsewhere.[97] Both men were also highly active in civic and social affairs within San Francisco and the Bay Area.

W. L. Huber and E. K. Knapik

Walter L. (Leroy) Huber collaborated with Edward K. Knapik, both civil engineers, on Building 134 at Hunters Point Shipyard. A San Francisco native, Huber graduated from the University of California in 1905 and was fully involved in the massive post-earthquake rebuilding campaign a year later. In the 1920s he served as the structural

[94] The exact date of this awarded contract could not been verified.
[95] *Architect & Engineer*, November 1943, p. 11. Which shipyard the firm had completed by 1943 was not stated.
[96] "J. Frank Barrett Dies at 70," *San Francisco Chronicle*, 12 January 1959.
[97] "Civic Leader Harry H. Hilp Dies at 88," *San Francisco Chronicle*, 26 October 1976.

engineer for the University of California Medical Center, the Roosevelt Junior High, Balboa High and Alamo Schools in San Francisco and YWCA's in Oakland, Long Beach and Riverside. Huber died in 1960.[98] Archival research did not produce any biographical information on Edward K. Knapik.

Ernest J. Kump Co.

In 1944, the Navy issued an A & E contract to the firm of Ernest J. Kump Co. to design a new optical and Ordinance Shop to be joined to the 1942 Shipfitter's Shop (Building 211). Bay Area architect Ernest J. Kump, a San Joaquin Valley native, designed a number of buildings for the Navy and other military branches during WWII and was otherwise known for designing buildings, primarily schools, in the Fresno and Bakersfield areas. He gained national attention, however, in the immediate post-war period for his influential community college campus designs at Foothill and De Anza on the Peninsula, which were credited with being not only important achievements in school design but also seen as precursors of corporate "campus" layouts.[99]

Kump was also awarded an honor award for outstanding examples of American Architecture in 1955 by the AIA for the North Hillsborough School.[100] In addition to Kump's work for the Navy at Hunters Point, he designed a storage building at McClellan AFB in Sacramento (1940); defense housing in Vallejo (presumably for the Navy in relation to Mare Island) (1941); buildings at the Army Sierra Ordnance Depot, Susanville (1941); a second housing unit at Vallejo (1942); and a building for the Army Corps of Engineers in Suisun (1944), among others.

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[98] "Engineer W. L. Huber Dies at 77," *San Francisco Chronicle*, 31 May 1960.
[99] JRP, p.6-7 on Building 253 and 211 DPR set.
[100] "Peninsula Architect Wins Top Honor," *San Francisco Chronicle*, 24 April 1955.

Albert Kahn Associated Architects, Inc.

The firm of Albert Kahn Associated Architects, Inc. consulted Building 411, the Shipfitters, Welders and Boilermakers shop. Based in Detroit, the firm, founded by noted industrial architect Albert Kahn, was likely hired for its expertise in the construction of large industrial manufacturing buildings, a building type pioneered by Kahn in the early 20th centuries. Building 411 was completed in 1947. Architect Albert Kahn died in 1942.

John H. Devitt

John H. Devitt, a San Francisco-based architect and acting architect for the City in the post WWII period, was contracted to design two restaurant buildings at Hunters Point Shipyard. Archival research located no other biographical information on Devitt.

Timothy Pflueger

Timothy Pflueger was one of the Bay Area's most famous architects through the 1920s, 1930s and until his early death in 1946, known for his extravagant designs in a wide variety of architectural styles. Earlier studies have indicated that Pflueger was one of the many architects to receive a contract for work at the shipyard during WWII. He was suspected to have designed Building 110, a barracks building, because of its vaguely streamlined design, which was unlike other barracks buildings remaining at the shipyard. However, research revealed that contractors Barrett & Hilp built this building from Bureau of Yards & Docks plans (Drawing #184767). One document found in the Navy's on-site archives at HPS indicates that Pflueger was involved in the design of the Beauty Salon and Chaplain's office additions to the rear of Building 505, the Navy Exchange Building in the South Shipyard area. The rest of this building is thought to have been designed using standard Bureau of Yards & Docks plans.

Navy records also indicate that Pflueger assisted in the design of a restaurant building at the shipyard, three of which are still extant (Buildings 125, 228 and 252). Archival research indicates that John H. Devitt was the primary architect for Buildings 125 and 228. Plan drawings for Building 252 were not located to confirm Pflueger's involvement in the design; however, the teardrop-shaped restaurant building is constructed with common materials and, beyond its unusual plan shape, is architecturally undistinguished, especially when compared to other extant Pflueger buildings in the Bay Area.

Austin Willmott Earl

Retained as the consulting structural engineer for a number of projects at Hunters Point Shipyard, Austin W. Earl received the Civilian Merit Award for his work during World War II for the Navy's Bureau of Yards and Docks. A 1906 graduate of the University of California, Earl became a recognized authority on waterfront and was responsible for the engineering of many industrial structures at Mare Island, Hunters Point and Port Chicago. At Hunters Point he served as the consulting engineer on such projects as the massive Shipfitters, Welders and Boilermakers shop (Building 411), the Paint and Oil Storage building (Building 810), and on the general tracks plan for the railroad craned and tracks, which ran throughout the shipyard. Earl was the founding president of the Consulting Engineers Association of California, which later helped organize the Consulting Engineers Council, a national organization.[101]

Circulation

As the Shipyard was expanded, two main entrances were created to provide access to the facilities, one on either side of Hunters Point Hill. At the north, the Main Gate was on King Avenue, just east of the intersection with Donahue Street. To the south, the South Gate was on Crisp Avenue, near the junction with Griffith Street. The hill created a

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[101] "Austin Earl Dies – Noted Engineer," *San Francisco Chronicle*, 22 February 1965.

major natural barrier to quick access from one side of the Shipyard to the other. Consequently, uses were generally segregated and some facilities were duplicated to better serve their immediate surroundings and to improve general efficiency. Even so, the area around Fischer Avenue became a bottleneck as "[a]ll automobile, truck, crane and train traffic has to pass through this single corridor."[102]

ZONES OF USE

The overall site plan for the Shipyard was a direct product of the World War II expansion. Prior to the war effort, the sparse amount of available land at the site did not necessitate a comprehensive site planning strategy. However, with an increased amount of land made available through the reclamation process, site planning became a necessity and the result was an orderly arrangement of buildings and structures in functional groupings. The first and most important influence was access to the water. Since the primary charge of Hunters Point Shipyard during World War II was the repair and retrofit of ocean-going military vessels, access to the various berths had a large impact on the location of storage, shops and administration buildings. Of secondary concern was the movement of equipment and personnel between buildings. Rail lines traced throughout the Shipyard, following wharfs and extending into warehouses. The sometimes massive scale of equipment and materials required the use of cranes and motorized transportation mechanisms to move objects from ships to repair facilities and back again. The consequence of these influences was a compartmentalized base with specific use zones, reflected largely in the numbering system. In general, these zones were:

- Administration
- Submarine Repair
- Ship Repair and Outfitting

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[102] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Study Options for Future Use*, June 1974, p. 2-10-11.

- Warehousing, Supply and Industrial Support
- Residential
- Radiological

The numbering system, still in place, was instituted during the World War II period. Each series of numbers generally refers to a specific functional grouping of buildings. The 100 series of buildings were chiefly administrative buildings, located near the Main Gate, as well as the submarine repair-related buildings along the northern pier. Many of the administrative buildings in this series have been demolished though many of the submarine repair-related shops in the north portion of the Shipyard are still extant.

The 200 series is largely comprised of industrial shops and ancillary buildings between Drydocks 2 and 4 in the Ship Repair and Outfitting portion of the shipyard. This area was dedicated to the repair and overhaul of larger surface vessels and located between the most active drydock facilities (Dry Docks 2, 3 and 4), requiring minimum movement of ships and materials between the industrial shop buildings and waterfront operations.[103]

The 300 and 400 series buildings are industrial and warehouse buildings located in the Warehousing, Supply and Industrial Support area of the south Shipyard. This area was used for long period conversion work, new ship construction and for storing inactive vessels, all of which required less travel to and from the major shops.[104] A few large shop buildings, numerous supply storehouses and smaller industrial support facilities dominate this grouping of buildings.

There are relatively few remaining buildings in the 500, 600, 700, 800, and 900 series; these buildings were located along the western boundary of the Shipyard, generally

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[103] Hunters Point Naval Shipyard Association, untitled report, c.1974, pp. 15-16. Included as an appendix to *Hunters Point Naval Shipyard: A Historical Analysis* by Karl F. Kimbrough, August 1978.
[104] Ibid.

north and south of the 400 series buildings.[105] The 500 and 600 series buildings were largely dedicated to residential and related uses in the south Shipyard and the 700 and 800 series buildings were either used for industrial support or storage purposes or for NRDL-related activities. Though no 900-series buildings remain at the Shipyard, records indicate that they included an Officers' Mess Building, various greenhouses and garden sheds, a bank and garage facilities.

Within these zones, a relative uniformity of building types, styles and materials existed. As the focus of the shipyard changed from Navy repairs to commercial ventures, some of this organization was lost. However, the general arrangement of buildings today still reflects the order imposed by World War II-era requirements and planning and a great deal of the original spatial organization is discernable in the built fabric.

WWII Period Summary

All of this construction was centered on the stated mission of Hunters Point Shipyard:

"For all classes of vessels: interim docking, shaft and propeller repairs, repairs of major underwater damage; for carriers: interim overhaul of about three to four weeks comparable to overhaul by repair vessels afloat."[106]

In general, that is what occurred. However, sometimes Hunters Point Shipyard was used to load and outfit ships prior to embarkation. This was the case on July 15, 1945, while the USS Indianapolis was docked at Hunters Point awaiting orders. On this day, components of the atomic bomb "Little Boy" were loaded aboard the Indianapolis for transport to the South Pacific. It was reported to have contained half of the available uranium in the United States, valued at over $300 million at the time. The ship left Hunters Pont at 6:30 AM the next morning but was held in San Francisco, awaiting the

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[105] JRP Historical Consulting Services, Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard, September 1997, p. 17.
[106] Ibid, p. 15.

results of the first atomic weapons test in New Mexico. The test was a success and the Indianapolis sailed out of the Golden Gate at 8:30 AM.[107] On August 6, 1945, the bomber Enola Gay dropped "Little Boy" on Hiroshima, essentially ending World War II.

POST-WWII – 1946 - PRESENT

The end of hostilities did not signal and end to construction or military duties at Hunters Point Shipyard. Many projects were underway when the war was starting to draw to a close. Consequently, the momentum of construction continued in 1944 and through 1945 and included most of the larger buildings on the site. Infrastructure was also added during this time and included wharfs, cranes, rail spurs and other facilities. Even after the end of hostilities with Japan, several projects were underway, including further increases in the land area through more leveling of the Hunters Point Hill.

Most immediately after the end of World War II, Hunters Point Shipyard, like the other deep-water shipyards, became one of the primary berthing sites for ships returning from the Pacific campaigns. Photographs from the time show dozens of ships of all sizes moored and tied up several deep at the various wharves, piers, docks and quay walls (see Figure 27.) The immediate task was to perform routine maintenance and ready the ships for a return to service. Those deemed beyond repair were salvaged for parts and disposed of. In spite of all the work that needed to be done, this process was abruptly suspended in the summer of 1946 when Hunters Point Shipyard became the domestic base for handling the aftermath of Operation Crossroads.[108] It required the formation of a special radiation safety office and program to handle radiologically contaminated vessels.[109] Hunters Point Shipyard was chosen because it was already the center for the Navy's radiological science research and it was close to the developing nuclear expertise at both the University of California at Berkeley and Stanford University. These

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[107] NAVSEA, Hunters Point Shipyard: Final Historical Radiological Assessment: History of the use of General Radioactive Materials, 1939-2003. 2004, p. 6-4.
[108] Ibid. p. 6-5.
[109] Ibid.

Figure 27. The Submarine Repair Area, 1946. Photo used with permission from the San Francisco History Center, San Francisco Public Library (United States Navy Photograph.)

strategic advantages, and the results from Operations Crossroads, would change the history of the facility.

OPERATION CROSSROADS[110]

“Operation Crossroads” was the code name for a series of atomic weapons tests conducted at Bikini Atoll in the Marshall Islands in the middle of 1946.[111] It was designed to study the effect of atomic weapons detonation on ships and personnel, mainly for the purposes of developing effective defensive and detection measures. The tests included the detonation of two Nagasaki-sized atomic bombs under various conditions to study their impacts. Operation Crossroads was a major undertaking, involving approximately 42,000 personnel and more than 240 ships. Some ships were used as target vessels and some were used for support. The target vessels were placed as specified distances from the detonation site to determine what physical damage would be caused under various conditions. It was expected that some ships would be completely destroyed, while others would remain operational. The support ships were placed at what was thought to be safe distances for observation of the tests as well as for data collection after the explosions.

Test 1 was called Shot Able and it was dropped by plane and detonated above a specified target ship. Unfortunately it missed its mark and fell a half-mile from the intended target, sparing the brightly painted target ship from complete annihilation. Overall, while the concussion blast caused extensive physical damage to the target ships, the radiological contamination was relatively minor and much less than anticipated.

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[110] The entirety of this and following relevant sections are paraphrased from Hunters Point Shipyard Historical Radiological Assessment, Section 6, unless otherwise noted.

[111] The Marshall Islands are a small Micronesian archipelago just west of the International Date line and just north of the equator in middle of the Pacific Ocean. They were occupied by the United States after World War II and used for extensive nuclear testing. The Republic of the Marshall Islands became self-ruling in 1979.

Test 2 was called Shot Baker. It was detonated 60 meters below the surface of the water, immediately under the target vessel. The results were wholly unexpected. The detonation spawned a massive steam bubble that generated a shockwave of water over 90 feet in height. It rolled over the land, the target ships and the support ships, contaminating everything with radioactive coral, sand, fissure material and unused plutonium. To this initial contamination was added additional damage when the support ships went in to survey the area and processed the radioactive water of Bikini Atoll's lagoon through their filtration systems.

The limited amount of shipyard support, expertise and equipment at Bikini Atoll was almost useless to address the massive decontamination problem. Work was begun to develop standards for the decontamination procedures while the remaining ships were moved to Kwajalein Atoll. The most heavily contaminated ships were sunk at Kwajalein Atoll. The rest underwent preliminary decontamination but the amount of work demanded a full shipyard to deal with the problem. Hunters Point Shipyard was chosen because it was already the center for the Navy's radiological science research and it was close to the developing nuclear expertise at both the University of California at Berkeley and Stanford University.

The prospect of hundreds of radiologically contaminated ships arriving at Hunters Point necessitated a great deal of planning and coordination. Many of the ships were anchored out in the Bay near Hunters Point while methods for testing, monitoring and carrying out decontamination were developed. Eventually several methods were used.

Decontamination by wet sandblasting was carried out where the contaminated surfaces were exposed and readily accessible. The sand was then either collected and packaged in 55-gallon drums, or it was deposited back into the Bay at ebb tide with no further treatment. For harder to reach places, such as pipes and systems components, an acid solution was used to remove any surface coatings. All this work was carried out in the largest Drydocks 3 and 4 as well as the smaller drydocks on the north side of the shipyard (6 in particular) and at other berthing stations if the work did not require strict containment. All in all, 18 target ships and 61 support ships returned to Hunters Point Shipyard for treatment.[112]

NAVAL RADIOLOGICAL DEFENSE LABORATORY (NRDL)[113]

Concurrent with the development of nuclear weapons, the Federal Government recognized the need to develop protection devices to shield soldiers and civilians from the ill effects of prolonged exposure to radioactivity. This included detection devices for those working with and exposed to radioactive materials as well as handling procedures for equipment containing radiological materials. Such devices were common throughout the Navy and included everything from radioluminescent paint to exit signs. Originally formed as one of the support teams for Operation Crossroads, the group charged with the development of protective and monitoring devices was called the Radiological Safety Section, or RSS for short. The RSS was tasked with the "development of radiation detection instrumentation, equipment for protection of personnel onboard ships, and development of methods and equipment for decontamination of ships."[114] All Bureaus of the Navy were assigned responsibility for support and implementation of the proposed organization. While the original charter was intended to support Operation Crossroads, the mission was soon expanded and the RSS became unofficially known as the RADLAB.

Hunters Point Shipyard was chosen as the base for the RSS because of its strategic location near both Berkeley and Stanford and the nuclear research being conducted at these campuses. Also, at the time, San Francisco was viewed as a "natural staging

[112] NAVSEA, Hunters Point Shipyard: Final Historical Radiological Assessment: History of the use of General Radioactive Materials, 1939-2003. 2004, p. 6-17.
[113] Ibid., pp. 6-22–6-33.

[114] Ibid., p. 6-22.

point for future Pacific Weapons tests."[115] Hunters Point Shipyard was also close to a major metropolitan area and had easy access, something the other testing facilities in the Southwest certainly lacked.

After Operation Crossroads decontamination was completed in 1948, the RADLAB was formalized as the Naval Radiological Defense Laboratory (NRDL) with an expanded mission that included "practical and applied research into the effects of radiation on living organisms and on natural and synthetic materials, in addition to continued decontamination experimentation."[116]

For the first few years, the NRDL operated under the command of the Commander of Hunters Point Shipyard. As the research objectives expanded and NRDL's role grew beyond addressing the needs of other shipyard operations, it was given a separate command in October 1950. The mission continued to broaden from its origins in ship decontamination and at the time NRDL was disestablished in 1969, the mission of NRDL was, "to perform research, development [sic], test, and [evaluate] the effects of nuclear explosions, natural and controlled nuclear processes, nuclear accidents and incidents, and related fields of science and engineering."[117] This came to embody the development of defensive measures for ships, personnel and shore installations. Over the course of the next decade, NRDL personnel were involved in all atomic weapons tests between 1950 and 1958, providing test support, primarily related to radiation safety and monitoring. In the process, NRDL became a pioneer in the development and use of radiation sources for detection and research means. Unlike most other military research facilities from this period, such as Los Alamos National Laboratory and Lawrence Livermore National Laboratory, NRDL was primarily concerned with gaining

[115] United States Navy, History of N.S. Naval Radiological Defense Laboratory: 1946-1958, p. 2.
[116] NAVSEA, Hunters Point Shipyard: Final Historical Radiological Assessment: History of the use of General Radioactive Materials, 1939-2003. 2004, p. 6-23.
[117] United States Navy, Disestablishment Report for Naval Radiological Defense Laboratory, San Francisco, California, March 1969, p. 1.

knowledge rather than producing hardware and weaponry.[118] Its staff members actively published and largely developed their own research plans to address the physiological impacts of the radiological hardware and devices being developed in other research facilities. NRDL continued to operate at Hunters Point Shipyard until 1969.

In addition to advancing the understanding of the effects of radiological exposure, the NRDL work directly influenced national, state and local public policy. "Many organizations, including the California Department of Public Health, California Highway Patrol, Office of Civil Defense, U.S. Public Health Service and the Atomic Energy Commission used the expertise of the NRDL and its personnel to develop regulations and controls governing the growing use of radioactive materials in the public sector.[119] In war preparedness, NRDL was a leader in the continued study of nuclear fallout, its properties, distribution, effects and remediation. To this end, at least one full-scale bomb shelter was constructed as a test platform for social, psychological, physiological and organizational experiments using volunteers. The most widely publicized event occurred in December 1959 when 100 men spent 14 days in the test bomb shelter. The results were used to fine tune emergency rationing and organizational recommendations throughout the country.[120] (The shelter's location, historical or actual, has not been determined. Its current status is unknown.)

While NRDL continued to expand in the post-World War II period, the rest of the facility maintained its original mission to support U.S. Navy ship-related needs. To this end, Hunters Point Shipyard continued to see improvements in the immediate postwar years.

[118] United States Navy, History of N.S. Naval Radiological Defense Laboratory: 1946-1958, p. 5.
[119] NAVSEA, Hunters Point Shipyard: Final Historical Radiological Assessment: History of the use of General Radioactive Materials, 1939-2003. 2004, pp. 6-24-25.
[120] United States Navy, History of N.S. Naval Radiological Defense Laboratory: 1959, p. 3.

Updated: July 2009

THE NAVY CLOSES HUNTERS POINT SHIPYARD

By the end of World War II, the Navy was developing Hunters Point as a compact, highly specialized facility that could use the broader range of services of the surrounding naval bases if necessary. It was exactly this highly specialized development that left it open to closure when its areas of expertise were no longer seen as useful, or had been superceded by development on other bases during the Korean and Vietnam war periods.

After the 1951, as the NRDL took over many of the buildings in the southern half of the facility, the maritime portions of Hunters Point Shipyard became primarily used for submarine repair. Work continued to decline in the 1960s and early 1970s as the Navy shifted back to using private shipyards and contractors rather than maintaining its own yards.[121] Some parts of the shipyard were converted to “peacetime” activities and were leased out to individual vendors and businesses. The Shipyard continued to employ between 5000 and 8000 people, mostly from the surrounding communities.[122] While this was a significant decrease from wartime highs, it still represented the largest employer in the southern areas of San Francisco. During this time, there was continual speculation concerning the closure of the facility. After years of study and last minute reprieves, the Navy officially closed the shipyard in June 1974.

In July of that same year, the City of San Francisco received a grant to fund a one-year reuse study for the Shipyard. Efforts were made to contact over 500 potential tenants throughout the United States and Canada, for the purposes of establishing a private ship repair venture at Hunters Point.[123] As a result, by 1976, the Navy entered into a long-term lease with Triple A Machine Shop. Triple A controlled most of the property

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121 United States Navy, History of N.S. Naval Radiological Defense Laboratory: 1946-1958, pp. 6-5.
122 Karl F. Kimbrough, Hunters Point Naval Shipyard: A Historical Analysis, August 1978, pp.15-16
123 Ibid, p. 54.

until 1986 when the Navy reclaimed the property for the purposes of environmental remediation with the eventual goal of removing the property from Federal ownership.

HUNTERS POINT SHIPYARD TODAY

Today, what remains of the Shipyard is used for a multitude of purposes. On the north side of Hunters Point Shipyard Phase II are a series of artists studios housed in former dormitory buildings near the former submarine drydocks. Several large warehouse structures are also present on this side of the sub-area as well as the remains of Drydocks 5, 6, and 7 and what remain of the rail spurs that served the drydocks. At the eastern end of the peninsula is the previously identified National Register eligible Commercial Drydocks District, including the masonry pumphouse for Drydocks 2 and 3, as well as Drydocks 2 and 3. Immediately south of Drydock 2 is Building 231, one of the first buildings to be constructed by the Navy on the site. This potential district was identified in 1988 as part of a cultural resources survey of Bay Area Navy properties commissioned by the Navy.[124]

Immediately south of this potential district is the glass and steel Building 253. Most of the other buildings in this 200-series area are wood or steel framed shop buildings and support structures. South and west of Drydock 4 is the 450-ton crane, the Gun Mole Pier and a series of wood and steel frame shop buildings, warehouses, and assorted other World War II and post-World War II buildings. Some are used by various industrial concerns; others are vacant. The San Francisco Police Department maintains facilities in a new building in this area.

Most of the buildings are in usable condition and are fairly rectilinear in form. Constructed for industrial use, the warehouses and shops continue to be used for

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[124] Bonnie Bamburg, Urban Programmers, Historical Overview of Hunters Point Annex, Treasure Island Naval Base and Descriptions of Properties that Appear to Qualify for Listing in the National Register of *Historic Places*. 1988, as citied in JRP Historical Consulting Services*, Historic Context and Inventory and* Evaluation of Buildings and Structures: Hunters Point Shipyard, September 1997, p. 2.

storage or operation of heavy machinery. The smaller scale dormitory and administrative buildings on the north side of HPS are currently used for office and artist work space purposes. These buildings are primarily wood frame with wood and asbestos shingle cladding and remain in serviceable condition in spite of worn appearances.

One building of particular note, just outside the HPS, near the South gate of the Shipyard is Building 815, former home to RADLAB. This building was designed and constructed specifically to house the main NRDL laboratory facilities. It contained different levels of experimental rooms, animal control facilities, offices, and administrative rooms. Today it is owned by Datasafe Record Storage and Information Management, and is operated as a document storage warehouse.

PROPERTY TYPES

PRE-1941

Building, structure and object types related to the discussion above would include, but are not limited to:

- Early residential buildings including farmhouses and other detached buildings
- Street patterns
- Retaining walls
- Restaurants
- Retail shops
- Commercial buildings
- Early dry docks
- Industrial buildings used to house mechanical equipment
- Early Navy constructed warehouses

When the Navy purchased the Shipyard in 1939, they gained a fully functioning commercial facility. When they expanded this during World War II, they gained control of a distinct residential neighborhood as well as several commercial structures that provided services for that neighborhood. As such, there are pre-1941 properties within the Project.

The residential area transferred to the City of San Francisco in 2004 and was designated Parcel A in 2005 as part of the current Project. This area has since been cleared, graded and prepared for redevelopment. No pre-1941 residential properties remain within the Project boundaries. However, commercial buildings, including those related to the original dry docks, do remain. They are primarily constructed of brick, although the former restaurant (Building 109) is a wood frame and stucco clad building. Dry docks 2 and 3 and the rest of the Hunters Point Commercial Drydock Historic District are prime examples of the industrial development from this period. Building use types from this period include:

WORLD WAR II (1941-1945)

- Administrative – long rectangular wood frame buildings with wood siding, built from standard plans
- Residential – barracks, houses and related community buildings (churches, cafeterias, latrines, etc.) These could be simple wood frame buildings, concrete high rises, or metal Quonset huts.
- Utility – relatively small, simple, concrete buildings
- Later dry docks – smaller dry docks for submarines and larger for ship repair
- Warehouses – Wood or steel frame with corrugated metal cladding, often rectangular with monitor roofs
- Mechanical Shops – used for welding, equipment storage, etc. Similar in design to warehouses but smaller

- Shipbuilding and repair – shops, warehouses, equipment storage. These buildings would take various forms from standard plans to custom designed buildings. They range from steel frame buildings with wood or metal cladding to glass curtain wall structures that were architect-designed.
- Other/infrastructure: railroad and crane tracks, light standards, circulation patterns, etc.

After the United States entered into World War II, the Navy commenced a tremendous building campaign at Hunters Point Shipyard. The land was reconfigured: hills were leveled and water was replaced by dry land. The scarcity of materials during this period meant that most buildings were constructed of wood, were constructed quickly, and were designed for multiple functions. Most were built from standard Navy plans while local architects individually designed a few buildings. At the start of this study in 2007, most of the World War II era buildings remained in their original locations, however some have been demolished. See volume II of this document for further discussion of extant resources.

POST WORLD WAR II (1945-PRESENT)

- Administration and Support – more compact footprint, mostly concrete, includes offices, vehicle servicing stations, water and sewage treatment plants, etc.
- Ship repair and outfitting – mechanical sheds, warehouses, cranes, Butler buildings.
- Radiological Laboratories and support buildings - Very few buildings were constructed specifically for RADLAB but many existing buildings were utilized by the facility. They could include any of the above building types.

Building during the post-World War II period was somewhat limited though a number of buildings remain from this period. Immediately following the war, construction continued because the Navy was unable to complete their plans during the timeframe of the war. Projects already underway were completed and new ones were slow to begin. One exception to this was a few large concrete buildings dedicated to RADLAB uses – all have been demolished except for Building 815. Other exceptions were continued improvements to the dry docks and construction of at least one large crane (the 450-ton Bridge crane) for ship repair and unloading.

Buildings from these periods within the Shipyard boundaries and within the boundaries of the Project are investigated, presented and evaluated more fully in Volume II of this report. This document, *Bayview Waterfront Plan Historic Resources Survey Report*, also prepared by Circa: Historic Property Development should be referenced for further information regarding specific buildings or architectural styles found within the Project.

CONCLUSIONS

Hunters Point Shipyard is significant as a snapshot of the evolution of ship repair facilities on the West Coast. As originally constructed, it serviced wood-hulled ships of various sizes as well as early steam powered vessels. Subsequent improvements in 1901 and 1918 expanded the capabilities of the facility to address the largest steel-hulled commercial and military vessels of the time. This corresponded to a dramatic expansion in the size and important of the United States Navy, as well as a general increase in the military's presence on the West Coast. Continued Pacific military campaigns (Philippine War, World War I, World War II) only emphasized the importance of West Coast military facilities. In 1939, when the Navy purchased Hunters Point, it became only the third Naval shipyard on the West Coast and the only one south of Puget Sound capable of handling modern naval warcraft. For a period of nearly 50 years, (1901- post-World War II) Hunters Point was the primary Naval ship repair facility in California.

After World War II, Hunters Point gained significance in its own right through its role as home to the Naval Radiological Defense Laboratory (NRDL). This facility was borne out of necessity in the latter war years and grew into a major research facility dedicated to studying the physiological impacts of radiological exposure as well as the detection of and protection from such nuclear hazards. This facility was established at Hunters Point Shipyard because of its many geographic, political and logistical advantages, and operated there from 1944 to 1969. It was one of the only facilities of its kind in the United States in either private or military control, was recognized as a leading research facility on a national scale and played a major role in every U.S. nuclear weapons test during its 25-year history.

As space and building availability increased, so did its role in the advancement of military operations. Hunters Point Shipyard played a major role in the military and civilian use of radioactive materials during the period of most intensive nuclear research. NRDL was associated with all above-ground atomic testing from 1950-1958 as well as the development of practical detection devices and public policies that continue to influence the regulation of radioactive materials in the public sector today. It was a unique and highly respected facility, arising from Hunters Point Shipyard's strategic location, its state-of-the-art facilities, and its successful contributions during World War II. As a result, it continued to impact society well into the post-war years.

Today, a portion of the built environment from all three periods remains: pre-WWII, WWII and post-WWII. Drydocks 2 and 3 as well as their associated pump houses and support facilities, built in the pre-WWII period, have been determined eligible for listing on the National Register in previous studies as part of the Hunters Point Commercial Drydocks Historic District. Outside of this district, only Building 109 remains from the pre-World War II community that once occupied the end of the Point near the drydocks. From the World War II-era, many of the warehouses, shops, residential and other buildings and structures remain, particularly between Dry docks 2 and Drydock 4, and in the southern portion of the Shipyard. From the post-war period, most of the NRDL buildings and facilities have been removed as part of recent environmental remediation efforts. However the main NRDL building, Building 815, remains, although it is just outside the study area. Taken as a whole, the history of the Shipyard is still generally represented in its built environment, although some key portions, critical to the

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understanding of the shipyard as a whole, have been removed. Light industrial uses, artist studios, police training facilities, community storage, and some ship repair-related uses are currently found at the HPS.

VII. PUBLIC HOUSING

The Alice Griffith public housing (1962) is generally bounded by Carroll Avenue (north), Arelious Walker Drive (east), Gilman Avenue (south) and Hawes Street (west). A guard kiosk secures the property's Fitzgerald Avenue entrance at Cameron Way. The housing stock consists of 33 apartment buildings, constructed from standardized plans using five slightly different building types. The six Type A apartment and eight Type B buildings contain six apartments each, the four Type C buildings and seven Type E buildings have ten apartments per building, and the eight Type D buildings each contain seven apartments.

Alice Griffith public housing represents a cross between the first (pre-1941) and second (late 1960s-1970s) waves in public housing architecture in San Francisco; it was constructed in the same organizational and architectural manner of earlier projects, but was completed with stricter budgetary requirements put forth in a later period. It is indicative of the types of developments that were completed at Hunters Point on former military housing land. However, these developments differ greatly from those in other parts of the City built in the same period. The Bayview-Hunters Point public housing developments were planned to address an immediate shortage of housing that used existing, if temporary, housing units – the military dwellings. Over time, these projects were redeveloped and renamed but occupied the same sites. Their architecture is most similar to older forms of public housing; however, they were expected to function under a different set of expectations that were developing at the time.

To understand the present context for Alice Griffith public housing, it is important to first look at the institutional history of public housing in the United States. The roots of today's public housing were established in the early years of the Great Depression under the auspices of the New Deal programs. From this starting point, early public housing evolved into a rather codified system. This system was stripped down to its basic parts during World War II to provide for tens of thousands of temporary housing units for defense workers. After 1945, much of this temporary housing reverted to public housing, but the social and political climate had changed. Alice Griffith public housing represents a combination of the influences of these eras.

THE FIRST GENERATION OF PUBLIC HOUSING

THE BEGINNING – PUBLIC WORKS ADMINISTRATION (PWA)

The Great Depression put an extraordinary strain on the country's urban housing stock. With little money to invest in repairing or building new housing to accommodate the influx of people moving from rural areas to urban centers for work, the existing residential conditions went from marginal to deplorable in many cases. To combat rising unemployment and improve the economy though the construction of public highways and buildings, in June 1933, the Federal government passed the National Industrial Recovery Act (NIRA). Under this act, several key New Deal agencies were established to simultaneously provide jobs and improve the country's infrastructure. Title II of the act appropriated $3.3 billion for the creation of the Public Works Administration (PWA).[125] Under this agency, a special housing division was created to construct residential buildings that showcased the benefits of modern living. This agency's prime directive was to provide jobs while building housing for low-income families. It was not as concerned about economies of scale or economic design and construction.

In its brief history, the PWA completed seven low-income housing projects, all on the east coast. They were heavily influenced by European, specifically German, cooperative design and were fairly modern in their use of materials and arrangement. The designers were given wide latitude to develop creative solutions for layout, program and choice of materials. The results were well-designed, high-quality homes that, unfortunately, were

[125] Paul R Lusginan, "Public Housing in the United States, 1933-1949," *Cultural Resources Management* Bulletin, No. 1, 2002, p. 36.

out of the price range of most low-income families. In fact, only one of these original seven projects met the low-income tenant objective.[126]

1937 HOUSING ACT

In 1937, Congress passed the first United States Housing Act. This act established the United States Housing Authority (USHA) as a part of the Department of the Interior. It was this act that created the decentralized public housing governance structure that is still in existence today. It put the Federal government in the funding role while giving governance of the resulting housing to local housing authorities. "Under this decentralized program, local public housing authorities were given primary responsibility for initiating, designing, building, and operating their own housing projects, while the newly created United States Housing Authority provided program direction, financial support, and technical and design assistance."[127] This was done by issuing low-interest, 60-year loans for up to 90 percent of the development costs for public housing and slum clearance.[128] San Francisco was one of the first cities to apply for the Federal program, establishing the San Francisco Housing Authority (SFHA) in 1938.[129] This initial Federal program was highly influential on the modern public housing governance system even though it was short-lived. It resulted in over 370 projects throughout the country over the course of its three-year term.

The emphasis on design and modern living in the PWA projects created a strong backlash from social critics who saw the program as wasteful and the extras as luxuries that should not be included in public housing. Powerful lobbyists for the real estate industry also posed strong opposition to the act because they saw it as a threat to real estate and rental values near housing projects. Their fear was the low costs and low

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126 Ibid, p. 37.
127 Ibid.
128 Fred L. McGhee, National Register Nomination: Santa Rita Courts, Austin, Travis County, Texas. 1990, p. 7.
129 Carey & Co., Inc., Historic Resource Evaluation for Hunters View Housing Development, San *Francisco, California*, Prepared July 26, 2001 and updated September 10, 2007, p. 9.

rents of the projects would force the entire local market down.[130] As a result of the 1935 District Court ruling in United States v. Certain Lands in the City of Louisville, influential lobby groups, and other cost-conscientious interest groups, were able to affect strict expenditure limits on all USHA-funded construction to make sure it could not compete with the open rental market.[131] The ruling limited the power of the Government to exercise eminent domain to acquire land, which in turn, limited the funds available for the design and construction of the projects. As a result, strict limits were placed on costs. Projects were funded under the terms of $1000 per room or $4000 per dwelling unit, including all construction and land acquisition costs. These strict guidelines virtually mandated that systematic, "cookie cutter" design be used and that cost minimizing measures become paramount to maximizing the number of dwelling units that could be built. Individual designs for single-family dwellings gave way to more rectilinear, apartment-style residences all constructed in a similar form with simple details. However, in spite of this, the early public housing projects displayed a surprising quality of material, craftsmanship, and design.

Even in 1938, land values in San Francisco were discouragingly high. Meeting the required $1000/$4000 limits established by the USHA proved to be impossible even within the depressed real estate market. Therefore, from the beginning, SFHA had to rely on a combination of Federal and City money to acquire and develop public housing.[132] As a result, the first housing projects took longer to reach completion than in many early adopting cities on the east coast. However, in spite of the delay, in 1940 Holly Courts opened in the Bernal Heights neighborhood of San Francisco, becoming the first public housing project completed west of the Rocky Mountains under this system.[133]

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[130] Ibid, p. 8.
[131] Alexander Garvin, *The American City*, 2002, p. 207.
[132] Ibid, p. 4.
[133] "Beginning of the Housing Projects," *Hunters Point Beacon*, October 22, 1943.

Generally, site planning was considered an economical way to make the developments attractive and distinctive. At the time, two major types of planning predominated public housing design: the super-block and the court plan. The super-block was a common planning concept promoted in the European Modernist literature. In this plan, large parcels of land were bordered by streets that became the primary vehicular circulation paths to and around the area. Small, very limited vehicular access was sometimes provided to the interior of the block, but most often, the interior was only accessible by foot or bicycle. In this way, the bulk of the experience within the super-block was free from the noise, pollution and danger of traffic, creating a peaceful residential space. Most of the building mass was concentrated as well to leave as much of the super-block as possible open to public parks and communal spaces and to provide for uninterrupted vistas from residential windows and balconies.

The court plan traded the openness of the super-block for more intimate arrangements. In this plan, the buildings were placed along the periphery of the property, or arranged throughout the property, to create small courtyards between the building sections. These spaces were often protected from vehicular access, and were also thought to provide for a peaceful, more personal residential space. The courts were shared by the residents in the surrounding units, rather than by the entire project and allowed for easier supervision of children in the public spaces.

To guide the local housing authorities on site planning, design, management and maintenance issues, the USHA published numerous brochures and pamphlets on a variety of subjects from design to tool maintenance. Some public housing projects from this early era incorporated the suggested styles and layouts exactly and others had a more liberal interpretation. The whole program was viewed as a positive, socially responsible, progressive step to address poor living conditions throughout the country. Many prominent social critics, architects, planners and designers of the time either worked on or wrote about the public housing being built. In general, the expectation was for the units to serve as transitional housing for whole family units to move from poverty to the middle-class. The selection criteria were created to promote this ideal, and included interviews of the prospective tenants in their current living quarters as well as minimum income guidelines. People had to be gainfully employed and meet a certain level of self-sufficiency to qualify.[134]

The USHA was initially authorized for a period of three years. In 1939, when the process to extend the bill was starting to gain steam, Congress felt that the economy was improving sufficiently enough that it no longer needed the extra building stimulus provided by the USHA programs. It was not renewed. Instead, the government began to shift its focus from providing public housing to building defense-related housing in preparation for entering World War II.

WORLD WAR II AND WARTIME HOUSING

As part of the country's shift to a wartime condition, all housing construction was stopped to conserve construction materials for the war effort. This included all public housing projects then underway. Special provisions were made to those housing projects in strategic locations near defense bases and industrial zones. There, the housing projects were allowed to finish with the provision that all unoccupied units be made available for war housing. In this way, many public housing projects throughout the United States became part of the war effort. In most cases, these housing units were the best constructed and most comfortable of all the subsequent war housing options because they were constructed to last at least as long as the 60-year loan period. In San Francisco, Potrero Terrace and Sunnydale initially were used for wartime purposes when they opened in 1941, with Westside Courts and Valencia Gardens following in 1943.[135]

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[134] Amy Howard, Northern Shelter: Community, Identity and Spatial Politics in San Francisco Public *Housing, 1938-2000*, Dissertation, College of William and Mary, 2005, p. 12.
[135] "Beginning of the Housing Projects," Hunters Point Beacon, October 22, 1943.

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More war housing was desperately needed after the United States officially entered World War II in 1941, construction for war housing went into overdrive. By early 1942, to cut costs and minimize materials, the Armed Services built only "temporary" housing. It was estimated that utilizing such methodologies would cost only 20% of permanent housing construction.[136] However, even this level of construction effort became too time-consuming and costly in the most stressed areas, especially at Hunters Point. Demountable housing was the next option. In this method, all the building parts were constructed offsite and shipped as a unit. Once on site, they were unpacked and assembled in a matter of hours. Most utilized single-board construction and were one-story in height. This was most typically used for the single-workers housing. In mid-1944, when demountable housing could no longer be accommodated and "a limited duration need was definitely known, a minimum portable dwelling unit was utilized, which approximated an improved trailer-type accommodation."[137] Those workers and soldiers in the metal camping trailers shared the communal dining and social facilities in the single-workers' dormitories, although some small families were also assigned to the portable trailers.

The mandates for extreme speed and economy in war housing construction were handed down by provisions in the 1940 Lanham Act. This act appropriated $150 million to the Federal Works Agency to provide defense-related housing in the most congested and stressed cities. The provisions also placed strict limits on construction costs, with average costs per dwelling unit to less than $3750 per family unit, with no single unit exceeding $4500.[138] To emphasize the temporary nature of the housing authorized under the Lanham Act, it was amended in July 1943 to require that all housing built with its funding be demolished within two years after the war was over. This amendment

[136] Ibid.
[137] Building the Navy's Bases in World War II: History of the Bureau of Yards and Docks and the Civil Engineer Corp, 1940-1946, Volume 1. 1947, p. 376.
[138] Robinson & Associates and Jeffery Shrimpton, Draft: Public Housing in the United States, 1933-1949: *A Historic Context*, August 14, 1997, p. 80.

Specifically forbade the units to be used as subsidized housing for low-income families after the end of World War II.[139] Between 1940 and 1944, the Lanham act was responsible for the construction of over 625,000 housing units.[140] Of these, over 580,000 units were considered temporary construction. The idea was that these units would be of such low construction quality that they would have to be removed from the housing market after the war, thus posing no long term competition to the existing housing markets in the effected cities.[141]

WAR HOUSING IN THE BAYVIEW-HUNTERS POINT AREA

Throughout World War II, Hunters Point Shipyard served as an annex to the naval facilities at Mare Island. When the shipyard was initially occupied by the Navy in 1941, housing for the shipyard workers was not an issue as most of them were stationed at Mare Island, lived in the area or commuted from other parts of San Francisco. Most were local residents or at least locally stationed. As Hunters Point Shipyard increased production it soon became a vital Navy property that was essential to the Pacific theater and it needed many more workers.

To house the workers, San Francisco's public housing projects were converted to defense-worker housing. Special permission was granted to the SFHA to finish construction on Valencia Gardens and Westside Court to provide housing for the rapidly increasing wartime population near Hunters Point. This was a temporary solution as these units were full almost immediately.

The first of the war housing construction projects to open was the Middle Point War Housing complex, along the Bay between Evans Avenue and Innes Avenue, in early 1943. In the next six months, five more war housing complexes opened on the north

[139] Ibid, p. 82.
[140] Paul R Lusginan, "Public Housing in the United States, 1933-1949," *Cultural Resources Management* Bulletin, No. 1, 2002, p. 37.
[141] Robinson & Associates and Jeffery Shrimpton, Draft: Public Housing in the United States, 1933-1949: *A Historic Context*, August 14, 1997, p. 79.

and south slopes of Hunters Point Hill, at the eastern end of the point near the shipyard and in the flat lands near the Bay further south, including the Double Rock War Dwellings, the precursor to Alice Griffith public housing (see Figure 28.)

The family dwellings were all constructed according to very similar plans. Generally, they consisted of groups of two-story rectangular buildings with eight apartments to a building. There was a range from one to three bedrooms and they came either furnished or unfurnished. The families rented the apartments by the month for between $27.50 for a two-room, unfurnished unit to $42 for a furnished five-room unit.[142] Most of the complexes had at least one elementary school, childcare facilities and a community center that doubled as a health center for routine checkups and minor illnesses.

Ridge Point was the largest of the developments and occupied the ridge and both slopes of Hunters Point Hill. It was originally designed to have 250 buildings, each with eight apartments. The expected occupancy was 2000 families. To provide for these families in an area of the city notorious for its lack of services, the Navy constructed three elementary schools, three childcare centers and a community center, all dedicated to this single complex.

Other family-specific complexes included the Double Rock and Candlestick Cove War Dwellings. The Double Rock complex was designed for 69 buildings with a total capacity of 552 families. This project was located just south of Yosemite Slough between Donner Avenue and Gilman Avenue along the Bay. Candlestick Cove was larger, holding 118 buildings for 944 families. This site was just south of Candlestick Point. It was a desired spot for families with children because the project boasted its own beach. However, it also suffered from repeated minor landslides. That portion of Candlestick Point was eventually leveled by the Navy to prevent any more damage to the occupied units.

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[142] *Hunters Point Beacon,* June 1, 1944. All prices are in 1944 dollars.

Figure 28. Hunters Point housing dedication ceremony, November 27, 1943. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Dormitory facilities were constructed for the single men and women who came to work at the shipyard. These were segregated by sex, as was the convention of the day. Both Harbor Slope near India Basin and South Gate along Oakdale Avenue, originally had seven long rectangular buildings. Each building was constructed of two wings connected by a central unit containing a cafeteria and common spaces.

Even the rapid six-month construction period of these housing complexes for over 2500 families failed to meet demand. Before they were finished in early 1944, money was appropriated for annexes to Double Rock (256 families), Middle Point (224 families) and South Gate (1000 more beds). However, this was not enough. However, by July 1944, the Navy was authorized to purchase camping trailers to place on 33 newly reclaimed acres of land in the southwest corner of Hunters Point (see Figure 29.) In the 12-month period between September 1943 and September 1944, the civilian population housed at Hunters Point Shipyard rose from 1550 to 12,245. In October 1944, 3000 more family units were planned and the annexes to the various housing complexes were reaching

Figure 29. This image shows the trailers that were used at Hunters Point as housing for shipyard workers. Similar accommodations were used at other shipyards in the Bay area. Compared with the private shipyards, the facilities at Hunters Point were relatively clean and sanitary with adequate bathing and restroom facilities in the immediate vicinity. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

their limits (see Figure 30.) In the midst of all the construction, living conditions were mixed. People had clean, if basic, accommodations but little in the way of site improvements (see Figure 31).

AFRICAN-AMERICANS AT HUNTERS POINT – THE BEGINNING OF A CULTURAL SHIFT

In 1900, Italian families were the predominant ethnic and social group in the Hunters Point vicinity. This continued through the onset of World War II when the demographics of the area were dramatically altered. As a result of the tremendous recruiting efforts in the rural south for war industries employment, the Bayview-Hunters Point area saw a major increase in its African-American population. It is important to understand how dramatic a change this was for the area to provide some context for the current and historical social landscape, especially as it relates to the public housing communities.

Figure 30. Aerial view of Hunters Point, August 14, 1945. Most of the shipyard housing complexes can be seen in this image. Hunters Point Hill is at the bottom of the image and Candlestick Point is at the top. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

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Figure 31. Even the military families living on the shipyard had to become accustomed to living in a constant construction zone, February 18, 1948. Here the Quonset huts were used for military family housing. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

PRE-1941

While there was a small African-American community in San Francisco before 1906, it lived in relative obscurity. Most were either freed slaves or children of freed slaves who came from the southern states. A smaller population was from northern states and born into freedom. In total, their numbers were small enough that the white majority did not see them as a viable threat, choosing instead to focus their racial aggressions on other ethnic groups, primarily the Chinese. While instances of discrimination were common before 1941, most African-Americans in San Francisco experienced more general freedoms than in other major metropolitan areas.[143]

At the turn of the 20th Century, 1,654 African-Americans lived in San Francisco.[144] This was actually a *decrease* from the prior decade. The job opportunities at this time were not a sufficient enough draw to entice people to leave their homes and strong social networks to make the long and expensive journey to the West Coast. Relative to Midwestern cities, San Francisco was geographically isolated, making travel more difficult. There was also more competition in San Francisco from other minority groups for unskilled and semi-skilled jobs.[145] When looking to move to urban environments for jobs or improved opportunities, Midwestern and Northeastern cities were closer, more accessible and better known to most southern African-Americans. Those who did make the journey often settled in Oakland or Los Angeles where the economic climate was more hospitable for people of color and there were more established African-American communities.

However, from 1910 to 1930, the African-American population of San Francisco grew by 131 percent with an additional change of 26 percent in the decade before World War

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143 Albert Broussard, Black San Francisco: The Struggle for Racial Equality in the West, 1900-1954, 1993, pp. 15, 19-20.
144 Ibid. p. 21. The total population of San Francisco in 1900 was around 340,000.
145 Ibid.

II.[146] While there were no specific “Black” neighborhoods, as the population increased, people started to concentrate in downtown, south of Market Street, North Beach and the Western Addition near Fillmore Street. By 1930, Fillmore Street had become “the hub of black life.”[147]

While Hunters Point was considered an undeveloped industrial backwater, it was a relatively open and welcoming community to southern African-Americans who came to work as porters for the Southern Pacific Railroad. At a time when many were openly faced with restrictions on where they could work and live, this predominantly Italian neighborhood left them in peace.

During the Great Depression of the 1930s, the African-American communities were hit harder than most other groups. This was because of the relatively tenuous employment situation in which many men found themselves. They were not allowed to join unions and were actively barred from many occupations and from all positions of authority. Coupled with the small numbers of Blacks in the area, this left them with no leverage to fight for change in a meaningful way. Consequently, when the New Deal came to San Francisco, African-Americans were disproportionately over-represented in most of the relief programs.[148]

WORLD WAR II

World War II created a sudden demand for all kinds of skilled and unskilled laborers. In theory, the demand was so great that traditional ethnic and racial segregation hiring and union membership policies were set aside. In reality, more creative ways to circumvent anti-discrimination mandates became prevalent. (See below for more information on the various Executive Orders prohibiting racial discrimination in wartime hiring.) In his study

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[146] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR, Appendix E*, certified February 8, 2000, File No.1994.061E, p. E5.
[147] Albert Broussard, Black San Francisco: The Struggle for Racial Equality in the West, 1900-1954, 1993, pp. 30.
[148] Ibid, p. 121.

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of California's wartime labor, Davis McEntire, a professor at the University of California School of Social Work, "confirmed that Black workers were indeed 'slow to gain a foothold in the war industries, but as the manpower shortages intensified, the area of acceptance [was] steadily enlarged.'"[149]

Legally, the courts system put an end to labor union segregation policies in 1944. Joseph James, a Black shipyard worker and president of the San Francisco NAACP branch, spearheaded charges against the Boilermakers Union to challenge the constitutionality of their auxiliary unions.[150] In 1944, the Supreme Court of California upheld the ruling of the Marin Superior Court in the case of *James vs. Marinship*. That ruling stated that Blacks "must be admitted to membership under the same terms and conditions applicable to non-Negroes unless the union and the employer refrain from enforcing the closed shop agreement against them."[151]

In the middle of union battles on the waterfront and at the shipyards, more workers steadily poured into the area as a result of active recruitment by the Federal Government and by private industry occurred throughout the country. The most prolific of these recruitment entities was the War Manpower Commission.

From its establishment in 1942 through 1945, the War Manpower Commission was directly responsible for shifting 1.8 million American workers and their families to the West Coast. Between 1940 and July 1944, California (primarily the San Francisco and Los Angeles regions) saw an overall population gain of over 1.8 million people, by far

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[149] Ibid, p. 144.
[150] Under the auxiliary system, Unions set up special chapters (auxiliaries) that were open to all minorities. The auxiliary members paid union dues and were sometimes hired for union jobs, but they received none of the collective bargaining or other benefits afforded to full Union members. In essence it was a second-class, separate but not-really equal arrangement that allowed the parent Unions to claim non-discrimination while practicing selective hiring practices.
[151] James vs Marinship Corp., 1944, as presented in full at http://www.claralaw.cpda.org/om_isapi.dll?hitsperheading=on&infobase=cases2.nfo&record=%7B2B4E4%7D&softpage=Document_Document, 2008

the largest increase in the country during the same period.[152] San Francisco saw its African-American population rise from approximately 5000 people in 1940 to over 43,000 by 1950.[153] Many of these new arrivals settled in Hunters Point, in defense-worker housing near the shipyard jobs.[154]

By 1943, nearly 16,000 African-American workers came to the Bay Area shipyards. In San Francisco, the number of Black families rose from 2,000 to over 12,000 in the same period. Much of this population growth occurred at the Hunters Point Shipyard where the total labor force grew from roughly 8,000 to over 18,000 by 1945.[155] To put this into perspective, this five-year population increase was "larger than the combined totals of every decennial census of San Francisco's black population in the previous nine decades."[156] By 1942, the Black population in the area began to rival the Italian population, at least in terms of raw numbers.

POST-WAR PERIOD

At the war's end in 1945, the shift was complete as African-Americans became the largest demographic group in Bayview-Hunters Point, a fact that remains today. Many current residents trace their families to this mid-century migration.

THE NAVY AND HOUSING SEGREGATION

For many of the white officers and shipyard workers, Hunters Point was the closest they had ever come to working and living with African-Americans. Strict racial segregation

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[152] War Manpower Commission, Region XII San Francisco. *Pacific Coast Manpower Programs geared to* Pacific War, Jobs for Veterans and V-Day Employment Plans. Press Release, c.1944.
[153] Albert Broussard, Black San Francisco: The Struggle for Racial Equality in the West, 1900-1954, 1993, p. 133.
[154] The United States Fair Employment Practices Committee (FEPC) "stated unequivocally in its *Final Report* that by September 1945, 'more than twenty-six percent of the Negro working force were engaged in shipbuilding or ship repair'" in the San Francisco Bay Area. Ibid. p. 145.
[155] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR, Appendix E*, certified February 8, 2000, File No.1994.061E, p. E6.
[156] Albert Broussard, Black San Francisco: The Struggle for Racial Equality in the West, 1900-1954, 1993, p. 135.

housing policies were still the norm, even though small advances were being made in the workforce. This was true throughout the Bayview-Hunters Point wartime housing projects. This initially resulted in high tensions on all sides because of the rapid influx of people and the many unknown circumstances that arose as the Navy tried to deal with thousands of new workers and their families arriving every month. For security, a community police force was created. It was separate from the San Francisco Police Department but was only marginally affiliated with the Navy. At first it was composed of only white men, which was a point of contention for many of the Black residents and workers.

To combat these potential problems, the Navy and the SFHA added positions for African-American housing officers. Additionally, the Navy required all of its officers to undergo special training on race relations to raise awareness of the concerns of the Black community. These small efforts paid off and the Hunters Point housing became a model of “progressive” racially integrated (relatively) wartime housing.[157]

POST-WWII – A NEW ERA IN PUBLIC HOUSING

The restrictions of the Lanham Act enabled it to provide for many more units of housing than would have been possible under previous legislation. However, the nature of these housing units prevented them from doing more than addressing short-term housing needs. After the war, there were still a large number of people who lived in sub-standard housing but had no alternatives because the money slated for public housing construction had been diverted to temporary defense worker accommodations. Critics of the Lanham Act were quick to point out that temporary housing units had an uncanny ability to become de facto permanent housing for those who desperately needed shelter of any kind. They predicted that the temporary wartime housing would create the exact housing conditions that they were fighting – substandard, dangerous, urban slums.

[157] Albert Broussard, Black San Francisco: The Struggle for Racial Equality in the West, 1900-1954, 1993, pp. 174-176.

Unfortunately, their words came to fruition within just a few years, spawning a new era of public debate surrounding the public housing issue.

In 1949, Congress passed the Housing Act. This Act renewed federal subsidies to local housing authorities and once again closely linked public housing construction to urban development and slum clearance. In many cases, it was used to relocate families displaced by highway and urban renewal projects. Because many of the anticipated social benefits of public housing (moving families from poverty to the middle class, "improving" character for the children, etc.) failed to materialize, critic began to attack the public housing programs.

At the same time the USHA changed its federal polices regarding public housing and "SFHA began to shift away from its aim of creating public housing communities…By the 1960s, the SFHA, like the Federal government, has abandoned all facets of its initial plan for public housing to serve as a stepping-stone to middle-class 'respectability'."[158] The architecture began to reflect these changing views and utilized construction materials and methods that most economical. The result was projects with higher densities even in areas where land values did not necessarily require such developments. In many urban areas, this gave rise to a new construction type – the high-rise concrete developments of 1950s and 1960s.[159]

As this was taking place in the political and academic realm, there still existed an immediate need for housing, at all income levels, in the very early post-war years. Private development was building scores of housing developments for these families under the auspices of the National Housing Authority's financing programs and the G.I. Bill's loan provisions. However, much of this housing was not ready in time for the floods of veterans returning home. This shortage had been predicted well in advance,

[158] Amy Howard, Northern Shelter: Community, Identity and Spatial Politics in San Francisco Public *Housing, 1938-2000*, Dissertation, College of William and Mary, 2005, p. 12.
[159] Ibid, p. xiii.

but the materials and labor were not available to adequately address the problem. As a short-term solution, the government authorized the use of defense housing to be used by veterans awaiting other accommodations. This was considered a wartime use and the majority of these units remained under the control of the Federal government. This housing crisis was so great that even those units constructed under the Lanham Act as temporary housing was put into service. These were used not only for housing veterans, but also for sheltering other people displaced by wartime activities.

TRANSITION FROM WAR HOUSING TO PUBLIC HOUSING

By August 1945, over 10,000 units of temporary wartime housing had been constructed to serve the Hunters Point Shipyard. Special restrictions on building materials continued after the war until the material shortages could be overcome. Veterans and low-income housing remained some of the only viable construction options for private developers. This, combined with the Veterans Administration (VA) low-interest loans provided as part of the original 1944 Servicemembers' Readjustment Act (G.I. Bill) and the Federal Housing Administration (FHA) incentives, brought home ownership into the realm of possibility for thousands of people. By the time this first program ended in July 1956, over 2.4 million veterans had taken advantage of the home loan program.[160] As with the era of homestead associations of the 19th Century, Bayview-Hunters Point again became a place of speculative real estate, this time aimed at the working-class shipyard workers and returning veterans.

Rows of simple two-story, five-room Moderne houses appeared throughout the district (see Figure 32). Developers and real estate agents advertised in the community newspapers within the wartime housing complexes, for open houses, easy financing terms, and modern conveniences. This helped to shift some of the wartime workers into other sections of the neighborhood, while others moved elsewhere in the City or

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[160] United States Department of Veterans Affairs Website, *History of the G.I. Bill*, http://www.gibill.va.gov/, 2008.

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Figure 32. Arial photo of the Bayview neighborhood showing the rows of single-family homes that became the standard housing type in the area in the post-WWII period. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

returned home. This initial post-war phase happened fairly quickly, with families dispersing to new homes or to other regions. During this transition period, the Ridge Point war housing complex was used for Japanese-Americans returning from the internment camps. The Japanese Relocation Authority used the facility as a staging ground for those local Japanese who chose to return to the San Francisco peninsula (see Figure 33.)[161]

As the post-war period progressed, many of the temporary housing units were already showing signs of their impermanence. In spite of these conditions, in areas like San Francisco, housing was in such short supply that the Housing Act of 1950 provided for the transfer ownership of defense worker housing to local housing authorities rather than require their immediate demolition (as was originally required in the Lanham Act provisions.)[162] These units continued to operate as temporary and low-income housing well into the 1950s, being replaced only as funding became available.

The defense worker housing was officially transferred from the Federal government to the SFHA in 1954.[163] In this same year, SFHA received its first challenge over the quality of the housing projects in the Bayview-Hunters Point area.[164] In light of citizen protests and the undeniably poor conditions in Hunters Point, the SFHA began work with the Mayor's Citizens' Committee to address the process for disposing of the temporary housing within the City.[165] This process was slow and only partially addressed the rapidly deteriorating conditions in much of the Hunters Point housing units. By 1960, four of the original "temporary" housing complexes were still being used,

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[161] War Relocation Authority Photographs of Japanese-American Evacuation and Resettlement, The Bancroft Library, University of California, Berkeley.
[162] Ibid, p. 88.
[163] Planning and construction for the deposition of the temporary housing had begun prior to 1954 even though official ownership of the war housing had not yet been transferred.
[164] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR, Appendix E*, certified February 8, 2000, File No.1994.061E, p. E17.
[165] San Francisco Housing Authority, Road to the Golden Age: A Report on the First Twenty Years of Operations, 1940-1960, c.1964, p. 9.

Figure 33. "Temporary housing units at Hunters Point in San Francisco, where returning evacuees may remain until they have found permanent homes." Photograph from the "War Relocation Authority Photographs of Japanese-American Evacuation and Resettlement collection, used with permission from the Bancroft Library, University of California, Berkeley.

including the Double Rock War Dwellings.[166] A state law further extended the legal use of the Lanham Act buildings, allowing for demolition by 1970.[167] This was over two decades beyond the buildings' intended lifespan.

Indeed, a 1964 study of low-rent housing in San Francisco confirmed that all of the remaining war housing was substandard. Part of the problem was that operational funds for public housing in San Francisco were generated almost solely by rent receipts. Since the minimum income requirement had been abandoned as part of President Johnson's Great Society reforms, the profile of the public housing tenants had changed. Where the early projects were designed for traditional two-parent family units where the father was employed, these newer units were being increasingly occupied by single-mothers on some form of public assistance.[168]

The people who were in the greatest need were living in the worst conditions with little chance of improving their living situation without some increase in their rents.[169] In total numbers, there were over 2,600 people living in relinquished war housing in 1964; 36 percent were found to be living in "overcrowded conditions" and 90 percent of this total population was African-American.[170] This represented over half of the substandard dwelling units in the City at the time.

SFHA AND HOUSING SEGREGATION

African-Americans comprised much of the former war housing tenancy for several factors. The first was an increase in segregation policies within the general San

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[166] Ibid
[167] San Francisco Regional Office, Public Housing Administration, *A Study of the Current Public Low-Rent* Housing Market in San Francisco, July 1964, p. 1.
[168] Amy Howard, Northern Shelter: Community, Identity and Spatial Politics in San Francisco Public *Housing, 1938-2000*, Dissertation, College of William and Mary, 2005, p. 12-footnote 23.
[169] It should be noted that 70% of the eligible families living in the war housing (already determined to be sub-standard) would experience a rent increase of 50% or more if they were moved into new low-income public housing. Ibid, p. 7.
[170] Ibid. p. 4.

Francisco rental market. The second was the result of restrictive placement policies by SFHA. This policy followed established "neighborhood patterns," meaning they allowed settlement within the housing projects only if the applicant reflected the predominate ethnicity of the neighborhood, or if they were white. This resulted in a large number of African-Americans who were unable to find housing on the open market and were excluded from many neighborhoods with public housing. They became the largest demographic group in need of decent living quarters, but only one permanent housing project was open to them.[171] The "neighborhood pattern" policy affected not only low-income African-American families but gainfully employed, middle-income families as well. While some of the housing was relatively clean and modern, most was already being categorized as old and substandard. In spite of this, compared to the conditions found in the Fillmore District, the temporary wartime housing at Hunters Point was a significant improvement.[172]

The SFHA "neighborhood patterns" policy was the City's way to segregate housing in practice while condemning the practice in theory. It was not universally supported though. Longtime SFHA board member Alice Griffith resigned her post over the matter and became a voice opposing the policy in public debate.[173] It was in the early 1950s that the policy was legally challenged in the case *Banks vs. the San Francisco Housing Authority*. In this case, Mrs. Banks, an African-American woman, sued the SFHA when she and her family were denied housing at a new project in North Beach, a predominantly white neighborhood. The case went through a number of appeals. Eventually the District Court of Appeals upheld the State Superior Court's ruling in Mrs. Banks' favor in 1953. When the State Supreme Court refused to hear the case, the

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[171] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR, Appendix E*, certified February 8, 2000, File No.1994.061E, p. E15 and Albert Broussard, *Black San* Francisco: The Struggle for Racial Equality in the West, 1900-1954, 1993, p. 222. This "black" housing project was located in the Western Addition.

[172] Albert Broussard, Black San Francisco: The Struggle for Racial Equality in the West, 1900-1954, 1993, p. 174.

[173] Ibid, p. 177.

District Court's ruling became binding, essentially ending the unofficial segregation policies of the San Francisco Housing Authority.[174] It did not, however, do much to improve the living conditions in the Hunters Point wartime buildings.

The SFHA recognized that there was an extreme shortage of quality housing in the City. Their first priority after the war was to complete the remaining six public housing projects designed before the war. This phase of construction included Ping Yuen in Chinatown, North Beach Place in North Beach, and Bernal Dwellings in the Mission. These complexes were all designed prior to World War II and were constructed of reinforced concrete and tended to be higher density arrangements because of the limited land availability in their respective neighborhoods.

The second phase of construction dealt with the problem of the temporary war dwellings. Publicly, SFHA considered "the replacement of war housing in the Hunters Point area with permanent post-war housing [to be] a definite part of the planning program."[175] In the Bayview-Hunters Point area, there was greater land availability, therefore the housing pattern tended to be of lower density. Increases in construction costs in the post-war period brought about a change in SFHA policy, to use wood frame with stucco construction, rather that reinforced concrete.[176] The first units to be replaced were part of the Navy Point War Dormitories at Kirkwood Avenue and Earl Street, in 1953. This complex was built under the new construction policy and was called simply "Hunters Point." It consisted of 317 apartments in a series of two- and three-story apartment buildings. This design became the standard for the area. In 1956, Hunters View and Harbor Slope opened up with 576 units, replacing the Middle Point and Harbor Slope War Dwellings along Innes Avenue. These units were largely constructed on existing foundations remaining from the demolition of the temporary war buildings.

[174] Ibid, p. 225.
[175] San Francisco Housing Authority, Road to the Golden Age: A Report on the First Twenty Years of Operations, 1940-1960, c.1964, p. 16.
[176] Carey & Co., Inc., Hunters View Housing Development: Historic Resource Evaluation, July 26, 2001 and updated September 10, 2007, p. 11.

The Alice Griffith Garden Homes replaced the Double Rock War Dwellings in 1962.[177] The South Basin war dwellings were razed and replaced with various light industrial buildings. Candlestick Cove was removed during the construction of Candlestick Park.

1966 – A PIVOTAL YEAR

By 1966, unemployment was reaching new levels within the Hunters Point community. The shipyard continued to lay off workers and few new local employment prospects moved into the area. At the same time, the living conditions in the various Hunters Point public housing projects continued to deteriorate as the last of the temporary wartime housing was still being occupied as low-income housing. Tensions were high when the San Francisco Housing Authority chose to evict Ollie Wallace and his young family. Growing social awareness and community empowerment throughout the 1960s in the African-America community brought a renewed sense of action to improve the deteriorating housing and economic situation around them. The Wallace family's predicament served as a rallying point for the Hunters Point projects community. Residents staged protests and mass sit-ins against the San Francisco Housing Authority Board of Directors. The unified efforts surprised not only City officials, but some in the larger Hunters Point community as well. In an area that had struggled to find a common identity or purpose, the seemingly unjust treatment of one young family served to highlight the general frustration of many families in the district.

The momentum continued to grow when a larger demonstration was organized to force the SFHA to review a much longer list of complaints by the residents of the Hunters Point housing. Media was alerted and for the first time, the plight of the residents in the public housing projects in Hunters Point was brought into the public view.

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[177] Alice Griffith Garden Homes was the original name of the public housing development. Today it is commonly referred to as Alice Griffith public housing, the term used in most of this document.

City-wide, several other important civil-rights related events also served to bolster the Black community's sense of empowerment and determination to challenge the systems that were failing them. Earlier in 1966, the City enacted an ordinance prohibiting discrimination in firms contracting with the City. The NAACP staged a nationwide protest called Black Monday, to support Black employment in the construction unions.[178] Both directly impacted the predominately African-American Hunters Point and Fillmore neighborhoods, giving their residents support from other areas of the City and the country.

Within the community, the list of demands by the public housing residents was supported by other, newly formed community action groups, including the churches and the regional Economic Opportunity Council.[179] Their demands were modest – jobs, fair rent, improved infrastructure, and full economic and social enfranchisement – and represented the basic entitlement that most communities enjoyed without question. However, because such a large portion of the Hunters Point community depended in some capacity on City-sponsored or subsidized programs, they had to engage the City as a member of their community. Even at the time, the general African-American population acknowledged that "no single factor [had] contributed as much to unity and solidarity of San Francisco's negro population as had the intolerable housing condition that has been allowed to develop and continues to exist."[180]

PUBLIC HOUSING TODAY

The policy changes in the 1960s that lowered the income requirements of public housing tenants also contributed to an increased isolation of these communities. Most of the commentary from the period appears to dismiss the housing communities, and

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[178] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR, Appendix E*, certified February 8, 2000, File No.1994.061E, p. E37.
[179] Ibid.
[180] Albert Broussard, Black San Francisco: The Struggle for Racial Equality in the West, 1900-1954, 1993, p. 174.

fails to give credit to the strong social networks that often developed.[181] Bad press, political corruption, increasing crime rates and other negative factors changed the public perception of public housing, attaching to its residents a debilitating social stigma.

Recent efforts have been made to reverse these decades-old trends. In 1992, the Federal government began the HOPE VI (Housing Opportunities for People Everywhere) program with the goal of encouraging local housing authorities to partner with community groups to improve the most troubled public housing locations. HOPE VI supports redevelopment of public housing projects into mixed-use communities that provide a greater mix of economic and social strata within the larger community. Facilities for residents and non-residents would bring in a broader mix of people and reduce the negative connotations associated with public housing. In San Francisco, five HOPE IV grants were received from 1994 to 1999. They were used to redevelop SFHA projects in North Beach, the Mission, the Western Addition, Hayes Valley, and Bernal Heights.[182] This included the demolition and reconstruction of one of San Francisco's first public housing projects, Valencia Gardens. While the success of these projects has yet to be determined, the philosophies are now the predominant ones used in the planning of public housing. They are seen as a way to respond to the isolation that developed in the 1960s through the 1980s as well as a means to address the economic disparities and lack of community amenities that often found in traditional public housing complexes.

PROPERTY TYPES

Within the Project, only Alice Griffith Public Housing is present. It represents a combination of Pre-WWII and Post-WWII design philosophies. It is smaller than the projects constructed after the war, but has may of the stylistic traits of the pre-WWII

[181] Amy Howard, Northern Shelter: Community, Identity and Spatial Politics in San Francisco Public *Housing, 1938-2000*, Dissertation, College of William and Mary, 2005, p. 13.
[182] Rachel Peterson, *Hope IV in San Francisco*, San Francisco Planning and Urban Research Association Newsletter, March 2005.

designs, with more open space, small groups of units, etc. In general, these aspects are explored further in Volume II of this report. This document, *Bayview Waterfront Plan Historic Resources Evaluation, Volume II: Resource Survey and Report*, also prepared by Circa: Historic Property Development, should be referenced for further information regarding specific buildings or architectural styles found within the Project.

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VIII. CANDLESTICK POINT

The Long-billed Curlew is a large North American shorebird that was common along the shoreline of San Francisco in the early part of the 20th Century. Locally it was known as the Candlestick Bird and it is after this waterfowl that Candlestick Point was named.[183] Prior to being known as the site of a professional sports stadium, it was a quarry, a landfill and a proposed site for a quarantine hospital. At the time, it seemed a likely place, far from major settled areas, to put such an institution. 50 years later it was again at the center of controversy as it became the site for San Francisco's first professional sports facility. Today, the area has a sports stadium, as well as a state park, an executive park and a small number of residences.

EARLY DEVELOPMENT

Around 1910, the City proposed Bay View Hill (now known as Candlestick Point) as the site of a new Detention Hospital for quarantining individuals with communicable diseases. The Crocker estate, who still retained ownership of the land from the 19th Century, opposed the project. They bargained with the City and donated the land for use as a public park to prevent the construction of the hospital near land they hoped to sell for subdivision when the time proved most profitable.[184] The park was dedicated in 1915 and was the first official City park in the Bayview-Hunters Point area.

During World War II, the hill lent its name to a housing complex known as the Candlestick Cove War Dwellings. These units were intended for families and boasted

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[183] San Francisco Department of Parks and Recreation website, *Welcome to Monster Park,* http://www.parks.sfgov.org/site/recpark_index.asp?id=18977, 2008.

[184] David Chavez & Associates, Archaeological Resources Investigation for the Bayview-Hunters Point Redevelopment Plan, San Francisco, California, Oakinba and South Basin Activity Nodes, May 2004, p. 8. and Roger and Nancy Olmsted, Historical Consultants, *San Francisco Bayside Historical Cultural* Resource Survey, 1982, p. 12.

views and private beaches for its residences. The complex was located on the south side of the point, right along the San Mateo/San Francisco County border.[185]

CANDLESTICK PARK

BASEBALL AND SAN FRANCISCO

Baseball has always been popular in San Francisco. For a long time the City sported several semi-professional teams that competed with other teams throughout California and the West Coast. The San Francisco Seals, enjoyed a long-lasting following in the first half of the 20th century. However, when the time came to lure a major league baseball team to San Francisco, the need for a new stadium was apparent. The largest stadium in the City at the time could seat only 18,600 people, nowhere near the capacity of other stadiums in other cities (see Figure 34.)[186] If San Francisco wanted a professional team, they needed to provide state-of-the-art facilities.

In 1954, voters approved a $5 million bond measure for the construction of a Major League Baseball stadium. This was done before any team had committed to moving to San Francisco. It was a major political gamble that was soon to pay off. When Major League Baseball approved an expansion of teams west of the Rocky Mountains, they opened the door to the eager San Francisco fans. Ultimately, the owner of the New York Giants agreed to move his team from New York City, where they competed with two other major league teams, to San Francisco where they would be the biggest show in town. At that same time, the Brooklyn Dodgers, agreed to move to Los Angeles, thus bringing their rivalry to California.

The San Francisco Giants began their relationship with the City in 1958, playing their first two seasons at Seals Stadium at 16th Street and Bryant Street. During this time, fill,

[185] See Chapter VI for further information on World War II housing at Candlestick Cove.
[186] Ballparks of Baseball, *Seals Stadium*, http://www.ballparksofbaseball.com/past/SealsStadium.htm 2008.

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Figure 34. Seals Stadium, 1958. The Giants spent their first two season in San Francisco playing in this 18,600 seat stadium in the Mission District. It was demolished immediately after the last game of the MLB season in 1959. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Updated: July 2009

Figure 35. Candlestick Park under construction, 1959. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Updated: July 2009

Figure 36. Demolition of Seals Stadium, January 7, 1960. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

grading and construction began at Candlestick Point (see Figure 35.) Designed by architect John Bolles, Candlestick Park was the first baseball stadium to be entirely constructed out of reinforced concrete. The baseball stadium was finished at the end of the 1959 season, becoming the first Major League Baseball stadium on the west coast.[187] It was also reported to be one of the last dual use (baseball/football) stadiums built in the United States (for baseball and football). As soon as the season ended, the Giants left Seals Stadium to the bulldozers. Demolition began in November 1959 and was completed in early 1960, before the Giants had finished a single practice on their new field (see Figure 36.) Vice President Richard Nixon threw out the first pitch on April 12, 1960 at the Giants home opener. The Oakland Raiders football team played their 1961 season at Candlestick Park and the San Francisco 49ers football team made it their permanent home in 1971.

CONSTRUCTION

Then-Mayor George Christopher began investigation of possible stadium sites as early as May 1957. Charles Harney, one of San Francisco's most well known contractors offered his property on Candlestick Point to the City for $2.7 million. When studies showed that a site closer to the downtown was more expensive, the City took up Harney's offer and hired him as contractor for the project. The park was referred to as "Harney Stadium" during construction. However, a 1960 naming contest sponsored by the San Francisco City Recreation and Parks Commission resulted in the official name of "Candlestick Park."[188]

From opening day, Candlestick Park began to acquire a reputation for its harsh environment for both spectators and players alike. Strong gusts caused serious problems for the players during the 1961 All Star game. At that game, some of the

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[187] Dodger Stadium was completed in 1962.
[188] Jones & Stokes, Bayview Transportation Improvements Project-Evaluation Exemption for Monster *Park*, May 15, 2007, p. 6.

nation's best ball players committed seven errors and the relief pitcher was nearly blown off of the mound.[189] This prompted the architect and the City to plan for various modifications to the stadium in attempts to improve conditions.

"In 1960, the seating capacity was 43,765 and by 1993, it has increased to 58,000. Originally the grandstand consisted of two main seating decks. The lower deck extended from behind home plate down the first base line to the right field foul pole, and down the third base line and around the left field foul pole into left center field. The upper deck extended from home plate down both the first and third base lines. A small section of bleachers was located in right center field. The field surface was bluegrass and the scoreboard was located above the hitter's backdrop in center field. Behind the bleachers on the north elevation was an employee parking area" (see Figure 37.)[190]

Bolles began working on plans to accommodate football games, expand the stadium and enclose the outfield as early as 1966. As part of the redesign, attempts were made to reduce some of the wind-contributing flaws of the initial construction. The stadium was enlarged in 1970-71 to accommodate the San Francisco Forty-Niners.[191] This expansion extended the grandstand seating, enclosed the outfield of the baseball park and installed retractable seating in right field. The bluegrass field was replaced with Astroturf. The modifications resulted in the stadium's current footprint. The 49ers played their first season in Candlestick Park during the 1971-1972 season, winning a NFC West title that year. At the time, the stadium could seat 58,000 football fans plus an additional 3,000 on the retractable seating, making it the largest stadium in the National League at the time (See Figure 38.)[192] In 1994, the stadium was further enlarged to accommodate up to 71,000 football fans. The stadium continued to do double duty as

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[189] Ibid., p. 7.
[190] Ibid.
[191] Since 1946, the 49ers had played their games in Kezar Stadium near Golden Gate Park.
[192] San Francisco Department of Parks and Recreation website, *Welcome to Monster Park,* http://www.parks.sfgov.org/site/recpark_index.asp?id=18977, 2008.

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Figure 37. Candlestick Park in its original configuration for the 1961 All-Star Game, July 12, 1961. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

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Figure 38. Candlestick Park in its current configuration, c.1975. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

home to the Giants for seven months of the year and for the 49ers for four months after. Often, during football preseason games or because of baseball playoffs, the field hosted both teams simultaneously. In the early 1990s, the Giants began to campaign for a new, baseball-only stadium closer to downtown San Francisco. They moved into their new stadium at Mission Bay in 2000 and remain there today. The 49ers continue to play football at Candlestick Park but are under negotiations for a new stadium.

JOHN S. BOLLES[193]

"In 1958, prominent Bay Area Architect John S. Bolles designed the stadium. Born in Berkley on June 25, 1905, Bolles obtained his bachelor's degree in Engineering from the University of Oklahoma in 1926, and graduated from Harvard with a Master's degree in Architecture in 1932. During the 1930s, he worked as a structural engineer in Oklahoma and as an archaeologist for the Oriental Institute of the University of Chicago on the excavations at Persepolis, the ancient capital of Persia, and for Washington's Carnegie Institute on a comprehensive study of one of the most important Mayan sites in the Yucatan.

"In the late 1930s, Bolles moved back to the Bay Area and joined his father's architectural firm. Father and son designed the Temple of Religion and the Christian Science Monitor building on Treasure Island for the 1939 Golden Gate International Exposition. In 1941, he passed the State of California Architectural license examination and between 1943 and 1945 Bolles served as project engineer for the Federal Public Housing Authority in San Francisco. During this time he also began collaborating with architect Joseph Francis Ward, a New Zealander, who has been associated with architect Albert Farr since 1922. Together, Bolles and Ward designed several residences in San Francisco during the 1940s and early 1950s. In 1954, Bolles began

[193] Jones & Stokes, Bayview Transportation Improvements Project-Evaluation Exemption for Monster Park, May 15, 2007, pp. 6-7.

working independently on commercial, industrial, and residential buildings. A Modernist, Bolles' work often displayed a bold incorporation of modern art and sculpture. Eventually he started his own firm in San Francisco called John S. Bolles and Associates. Noteworthy designs by Bolles in San Francisco include the 1959 Ping Yuen Annex housing project, Embarcadero Park, and the Anna Wadden Library (Bayview Branch of the San Francisco Public Library) built in 1969. He also designed a number of buildings in Northern California including the McGraw-Hill complex in Navato, the General Motors assembly plant in Fremont, Gallo Winery in Modesto, Downtown Plaza in Sacramento and several Macy's department stores. Additionally, Bolles designed the IBM campus in San Jose of which IBM Building 25 was found eligible for the [National Register of Historic Places, California Register of Historic Resources,] and is a San Jose Landmark candidate. While his work throughout Northern California is extensive, he is best known for designing Candlestick Park. Bolles died in 1983."

BEYOND SPORTS

Candlestick Park has played an important cultural role in the lives of San Franciscans beyond its nearly 40-year relationship with the Giants. It served as the site for numerous concerts, public events and other great sporting moments. On August 29, 1966, it hosted the Beatles last live concert. It is the only stadium in the United States to host six National Football Conference championship games, three NFL Western Division Championships, 12 National Football Conference West Conference Games, two MLB World Series, and MLB two All-Star games. It was just before Game 3 of the 1989 World Series between the Oakland Athletics and the San Francisco Giants that the Loma Prieta earthquake was broadcast to millions of homes around the world. Remarkably, the 7.1 magnitude earthquake caused minimal damage to Candlestick Park and none of the 65,000 spectators were injured. The World series was delayed 10 days while engineers verified the safety of the stadium.

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CANDLESTICK POINT STATE RECREATION AREA

Candlestick Point State Park sits on land that was once covered by shallow Bay waters. The land was partially reclaimed as part of the Navy's ever expanding housing development in 1946. Parts of this land were reclaimed in anticipation of further shipyard needs, but were never used for improvements. The land was left open even as Candlestick Park grew up beside it. In 1973, the California legislature appropriated $10 million for the purchase of the land edging Candlestick Point. It was established as the first urban state recreation area in California in 1977.[194]

PROPERTY TYPES

Building, structure and object types related to the discussion above would include but are not limited to:

- Stadiums and recreational facilities
- Features associated with stadiums such as parking lots, gates, fencing
- Land grading and modification caused by reclamation projects
- Signage

Buildings found within the boundaries of the Project are investigated, presented and evaluated more fully in Volume II of this report. This document, *Bayview Waterfront Plan Historic Resources Evaluation, Volume II: Resource Survey and Report*, also prepared by Circa: Historic Property Development, should be referenced for further information regarding specific buildings or architectural styles found within the Project.

[194] California State Parks Website, *Candlestick Point* SRA, http://www.parks.ca.gov/default.asp?page_id=519, 2008.

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IX. CONCLUSIONS

The Bayview Waterfront Project encompasses contains a number of distinct geographic locations that share a common early history, but have evolved in different ways as a result of World War II. The period between 1941 and 1945 was a delineator in the development of the area, shaping the current identities of the various locations. It is important to understand the common background, although most of the architectural record from this period is scattered and not within the bounds of the current Hunters Point Shipyard Phase II Project. Of more importance, however, is the impact of World War II on the area and the physical reminders of the war years.

BEFORE 1941

CANDLESTICK POINT

At Candlestick Point, no architectural elements from the pre-1941 period have been identified. This area was largely created from fill after World War II. Those areas that were upland in the pre-war period were sparsely settled and largely used for industrial purposes.

ALICE GRIFFITH PUBLIC HOUSING

The current site of Alice Griffith public housing was mostly a swamp prior to its development during World War II. Some fringe areas of the property may have been used as part of the Bay View Park race track and hotel complex. However, nothing from this period remains.

HUNTERS POINT SHIPYARD

At HPS, several pre-World War II buildings remain. They are clear representatives of the commercial importance of the shipyard when it was solely contained within the bounds of the Bethlehem Steel drydocks at Hunters Point. Portions of the drydocks area remain from the 19th Century. These elements have previously been determined eligible for listing on the National Register and as such, are the most important resources within the Project boundaries. However, they are not the only resources that remain from the pre-World War II period. Building 109 and several large warehouse buildings near the drydocks were constructed prior to the war years.

INDIA BASIN

Most of India Basin dates to the pre-World War II period. The boatyards were established throughout the late 19th Century, mostly by northern European immigrants. Today there remains several intact architectural reminders from this period, including the Anderson-Cristofani boatyard and 900 Innes Avenue. Many other boatyards and fisheries were once found along this shoreline, but few have any visible physical presence as of 2008.

WORLD WAR II ERA (1941-1945)

CANDLESTICK POINT

During World War II, Candlestick Point was developed as a large multi-family housing complex for shipyard workers. These buildings were located along the southern shore, at the base of Bay View Hill. Landslides from the poorly graded and unstable hillside plagued the development and excavation was needed periodically to keep the units free from danger. Some areas to the east of the hill were filled in at this time, however much of the fill was not completed until the construction of Candlestick Park (see below.)

ALICE GRIFFITH PUBLIC HOUSING

A war housing complex was built on the shoreline near a dual rock outcropping just north of Candlestick Point, known as Double Rock, this eventually lent its name to the housing complex that was constructed nearby. Like the Candlestick Cove facilities, the Double Rock War Housing had its own schools, community centers, medical centers and play spaces for the children. It extended over the current Alice Griffith public housing site and further west. When the Double Rock Annex was completed around 1944, war housing extended approximately a block south and a block west from the current Alice Griffith public housing site. War housing complexes near Hunters Point, including Double Rock and Candlestick Cove, once contained over 12,000 living units of various types.

HUNTERS POINT SHIPYARD

The World War II period brought the most profound physical changes to the shipyard. The land was significantly increased while Hunters Point Hill was dramatically leveled. Rail lines were laid, warehouses built, and the largest drydock in the world were constructed in record time. Hundreds of ships were repaired and returned to battle and thousands of workers worked around the clock to meet the demands of the Navy and its ships. Most of the built fabric remaining in 2008 dates to this period. The buildings range in size from weighing stations to large warehouses and multiple level manufacturing facilities. It should also be noted that a large number of buildings at the Shipyard have been demolished since 2007.

INDIA BASIN

World War II greatly affected all the areas around India Basin, but there was relatively little effect on the built environment within India Basin. The boatyards continued to operate, although at a reduced capacity. The demand for larger ships resulted in the closing of the smaller yards and the consolidation of the remaining facilities. Those that survived into the post-WWII period did so by becoming specialty outfitters

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AFTER 1945

CANDLESTICK POINT

Candlestick Point was transformed in the late 1950s when the New York Giants relocated to San Francisco. A new baseball stadium was constructed on filled land just east of Bay View Hill. Candlestick Park Stadium was designed by a well-respected local architect John Bolles and it is considered one of the high points of his work. Unfortunately, the stadium was poorly sited and suffered from inhospitable weather patterns. Alterations in the post-war period include enlarging the seating, enclosing the stadium and reconfiguration of the stands to accommodate football and well as baseball.

ALICE GRIFFITH PUBLIC HOUSING

Public housing in San Francisco struggled in the post-war period to meet the incredible demand by the post-WWII population. War housing was built to be temporary, however it became a permanent solution for many African Americans who could find no other housing alternative in San Francisco. Changes in public attitudes toward public housing brought about less support, both politically and financially, making construction of new, adequate housing facilities even more difficult. What is today known as Alice Griffith public housing was constructed in this era of turmoil and adjustment. It is designed according to older policies concerning public housing, but was meant to serve a very different population from similarly designed complexes built before World War II. Over the years, little has changed within the complex and some residents still remain from its opening in 1964.

HUNTERS POINT SHIPYARD

Hunters Point Shipyard continued to function as a Navy repair facility in the post-war period. It did not, however, continue to receive the same level of attention from the

Navy. Other, newer shipyards were developed in Southern California during the 1950s and 1960s. By 1974, HPS had become obsolete.

In the post-WWII period the Shipyard became home to the Navy's Radiological Defense Laboratory, NRDL. NRDL came to dominate much of the space on the shipyard, at one time occupying over three-dozen different buildings. In 1955, these operations were partially consolidated in the newly constructed Building 815. The research and scientific advancements that occurred as a result of experimentation within Building 815 had a direct impact on development of practical uses for nuclear materials as well as protective measures and public policy regarding exposure and handling of such materials. NRDL was a unique and highly influential enterprise that brought a new level of renown to Hunters Point Shipyard.

INDIA BASIN

The shoreline of India Basin, its commercial enterprises and residential building stock have seen few changes since World War II. It remains a small pocket of late 19th Century and early 20th Century architecture amidst recent development. The hills above India Basin were first developed in World War II for housing. In the post-war years, much of the housing was transferred to public housing uses. Today, some of this remains but is interspersed with new development as the neighborhood continues to evolve.

SUMMARY

The geographic extent of the Project cannot be understood in a linear history like some neighborhoods. It contains a wide variety of building types, historical uses and colorful characters that still shape its development today. In some cases all that remains from the early days is the street grid and the street names (Bayview District.) In other cases, the early days remain as the most visible and obvious identifier (India Basin.) Several areas within the Project boundaries didn't exist until World War II (most of the Shipyard), or later (Candlestick Point.) The one unifying historical factor is the impact of World War II. Today's community and architectural identities are largely shaped by the changes brought about because of World War II, and how those changes evolved in the post-war period. The result is a series of unique modern histories, forever linked by a common past.

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Appendix J2 CIRCA, Historic Resources Survey, October 2009

BAYVIEW WATERFRONT PLAN HISTORIC RESOURCES EVALUATION, VOLUME II: FINAL HISTORIC RESOURCE SURVEY AND TECHNICAL REPORT

Prepared for

PBS&J on behalf of the San Francisco Redevelopment Agency

Prepared By

CIRCA: HISTORIC PROPERTY DEVELOPMENT

CIRCA Historic Property Development

1 Sutter Street #910, San Francisco, California

OCTOBER 2009

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I. INTRODUCTION

Circa: Historic Property Development was contracted by the San Francisco Redevelopment Agency and PBS&J in May 2007 to complete the Historical Context and Survey Report for the Bayview Waterfront Project (BWP) Environmental Impact Report (EIR). This project encompasses Candlestick Point, Hunters Point Shipyard and the India Basin Shoreline areas of San Francisco. The Candlestick Point-Hunters Point Shipyard Phase II Development Plan contains Candlestick Point State Park, Candlestick Stadium, the Alice Griffith public housing and most of Hunters Point Shipyard. The India Basin Shoreline plan includes parcels from the boundaries of Hunters Point Shipyard up to and including the Pacific Gas & Electric Hunters Point Plant, now under demolition. The purposes of this document are to provide historical background material (see *Bayview Waterfront Plan Historic Resources Evaluation, Volume I: Historic Context Statement for full historic context*) for the evaluation of potential historic resources within the Project and to inform the relevant sections of the Environmental Impact Report for the BWP. Evaluations for identified potential historic resources within the survey areas of the BWP can be found in Section V (Survey Results).

This survey report is focused on the existing built environment within the Candlestick Point, Hunters Point Shipyard (HPS), and India Basin Shoreline survey areas (see subsequent sections for specific location maps). In general, this study evaluates all areas where construction activities are planned. The survey report describes existing conditions with respect to known or potential historical resources in the project area and identifies the project's potential impacts. Findings from this technical study will facilitate preparation of the environmental impact report for the project being prepared by the San Francisco Redevelopment Agency (SFRA) pursuant to CEQA.

For a parallel discussion of prehistorical and historical archaeological studies and contexts, please see the archaeological context statement and survey report for the Project prepared by Archeo-Tec: Consulting Archaeologists.

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PROJECT DESCRIPTION

The following project description is quoted from Section II: Project Description of the Bayview Waterfront Project, Administrative Draft EIR I (June 2009). See Appendix A for full Project Description.

> "The Bayview Waterfront Project ("Project") proposes new plans for the Candlestick Point, Hunters Point Shipyard ("HPS"), and India Basin Shoreline areas of San Francisco. The Project encompasses an approximately 764-acre area east of U.S. 101 in the southeast area of the City and occupies the waterfront area from India Basin to the approximate western edge of Candlestick Point. The Project is comprised of two primary components: (1) the Candlestick Point – Hunters Point Shipyard Phase II Development Plan ("CP-HPS Development Plan" or "Development Plan") and (2) the India Basin Shoreline Plan ("India Basin Plan").

CANDLESTICK POINT – HUNTERS POINT SHIPYARD PHASE II DEVELOPMENT PLAN

> "The CP-HPS Development Plan is a project-level development being proposed by Lennar Urban; this EIR evaluates the Development Plan's environmental effects at a project level of detail. The Development Plan proposes a mixed-use community with a wide range of residential, retail, office, research and development, civic and community uses, and parks and recreational open space. A major component would be a new stadium for the San Francisco 49ers, a National Football League team. Additionally, new infrastructure would serve the development as necessary. This Development Plan is organized under two major sub-components: Candlestick Point and Hunters Point Shipyard Phase II (HPS Phase II).

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INDIA BASIN SHORELINE PLAN

"The Project also includes new land use controls for the India Basin Shoreline, also known as Bayview Hunters Point Redevelopment Survey Area C. The San Francisco Planning Department and the San Francisco Redevelopment Agency are the Project Sponsors for the India Basin Plan. Although the India Basin Shoreline was included in the BVHP Survey Area, it was not part of the BVHP Redevelopment Plan adopted in 2006. During the adoption process of the 2006 BVHP Redevelopment Plan amendment, it was determined that further community-based planning would be necessary before the India Basin Shoreline could be added into the *BVHP Redevelopment Plan*. As a result, the India Basin Shoreline remained a redevelopment survey area.

"Plans for the India Basin Shoreline would allow a largely industrial zoned area to support a mix of residential, commercial, and light industrial uses. The Project would amend the *BVHP Redevelopment Plan* to include Area C, other amendments to the existing *BVHP Redevelopment Plan*, amendments to the *General Plan*, and new zoning controls and design guidelines for the area. Taken together, these components constitute the India Basin Plan. The Plan assumes that various private parties would develop the India Basin area over time."[1]

PROJECT LOCATION

The following project location description has been quoted from Section II: Project Description of the Bayview Waterfront Project, Administrative Draft EIR I (June 2009). Figure titles have been altered for the purposes of this report. Maps indicating the boundaries for each survey area can be found in elsewhere in this report.

[1] PBS&J for SFRA, Bayview Waterfront Project, Administrative Draft EIR – June 2009, p. II-1 – II-3.

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Figure 1. Map showing regional overview of Project site. Figure prepared by Archeo-Tec and excerpted with permission from their companion document, *Historic Context for the Archeology of the Bayview Waterfront Project, San Francisco, California.*

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REGIONAL LOCATION

"Candlestick Point, HPS Phase II, and the India Basin Shoreline, comprise the southeasternmost portion of San Francisco; taken together, they are bordered by major features such as Heron's Head Park on the north, the Executive Park area and San Mateo County line on the south, Bayview Hill, the Bayview neighborhood, Yosemite Slough, and Hunters Point Hill on the west, and San Francisco Bay on the east. Figure 1, illustrates the regional location of the Project and the location of the Project within San Francisco. [The] Development Plan would comprise approximately 688 acres. The India Basin Plan area would comprise 76 acres. The sites together comprise approximately 764 acres, occupying the waterfront from the northern boundary of the India Basin Shoreline area to the western edge of Candlestick Point, and extending inland from the waterfront."[2]

CANDLESTICK POINT – HUNTERS POINT SHIPYARD PHASE II DEVELOPMENT PLAN

"The Candlestick Point area of the Development Plan is immediately east of Executive Park, with the Bayview neighborhood to the north, the HPS to the north and east, and Candlestick Point State Recreation Area (SRA) along the Bay frontage, shown in Figure 2. The Candlestick Point area of the Development Plan is generally bounded by Hawes Street to the northwest, Candlestick Cove and the San Francisco Bay to the south, South Basin to the east, and Jamestown Avenue to the southwest. The northern boundary of Hawes Street is limited to the San Francisco Housing Authority's (SFHA) Alice Griffith public housing site between Gilman and Carroll Avenues, which extends north from Arelious Walker Drive.

[2] PBS&J for SFRA, Bayview Waterfront Project, Administrative Draft EIR – June 2009, p. II-10 – II-12.

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"The HPS Phase II area is to the southeast of the Bayview Hunters Point neighborhood. As shown in Figure 2, the HPS Phase II area is generally bounded by the San Francisco Bay to north, south and east. The south end of the western boundary extends from Yosemite Slough along Arelious Walker Drive to approximately Crisp Avenue, excluding the University of California San Francisco (UCSF) property. The northern boundary generally extends along Crisp and Spear Avenues. The northernmost end of the HPS Phase II area is contiguous with Earl Street and the southeastern boundary of the India Basin Shoreline area."[3]

INDIA BASIN SHORELINE PLAN

"The India Basin Shoreline area is immediately north of the HPS Phase II. As shown in Figure 2, the India Basin Shoreline area is bounded generally by Jennings and Newhall Streets and Heron's Head Park to the north, the SFHA Hunters View public housing site and Innes Avenue to the west, and Earl Street to southeast. India Basin and San Francisco Bay forms the northeastern border."[4]

DOCUMENT ORGANIZATION

This document is organized into ten sections. Section I, the Introduction, provides project background and overview information and a summary of findings. Section II provides a more specific overview of the survey process including a discussion of the three survey sub-areas and methodology. A summary of historical background information is provided in Section III, though the full historic context is located in Volume I of this document. National, State and local guidelines and procedures for documenting and evaluating historical resources are outlined in Section IV Evaluative Framework and the findings of this survey are documented in Section V. Impacts and Mitigations are identified in Section VI, followed by Recommendations in Section VII.

[3] Ibid.
[4] Ibid.

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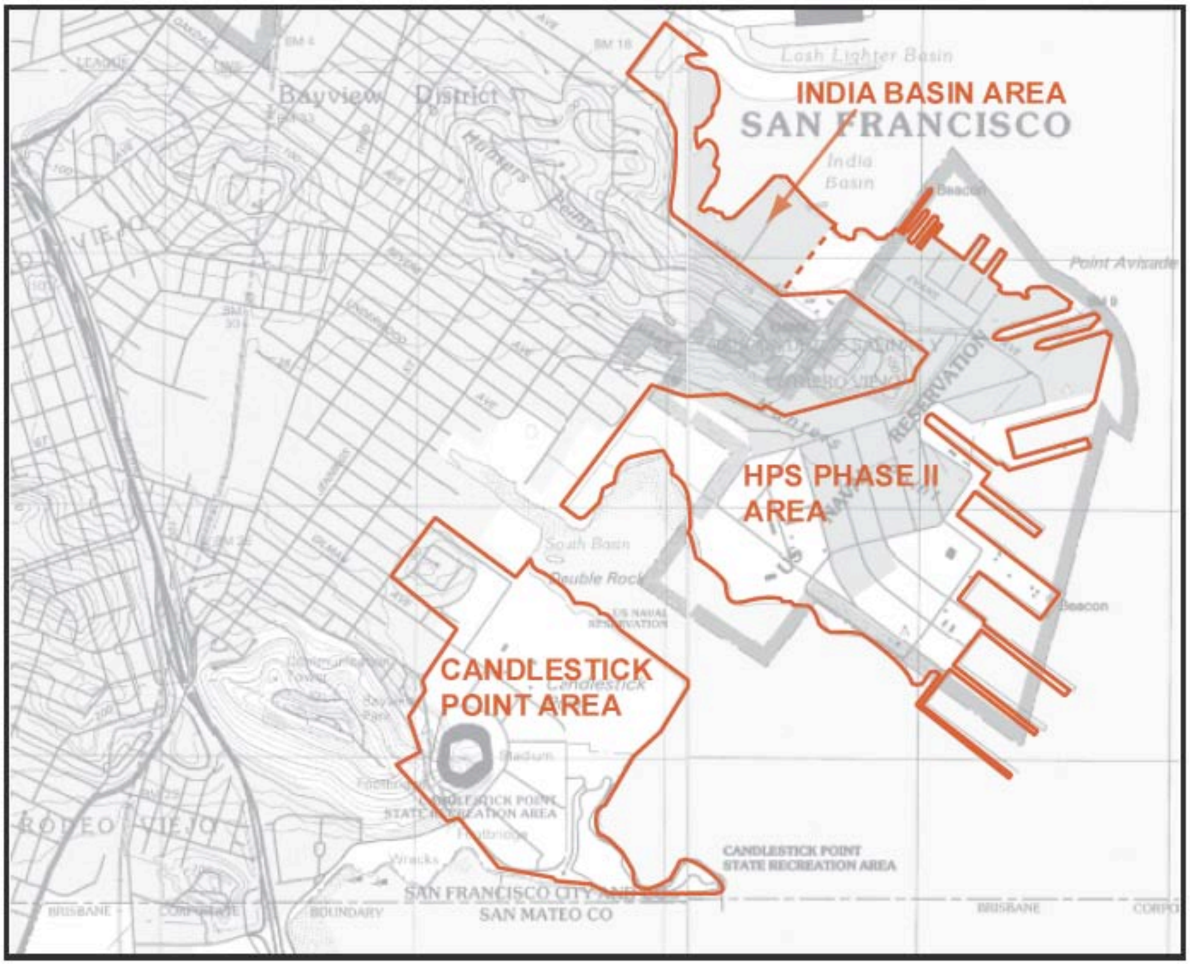

Figure 2. Map showing overview of Project site and survey sub-areas. Figure prepared by Archeo-Tec and excerpted with permission from their companion document, *Historic Context for the Archeology of the Bayview Waterfront Project, San Francisco, California.*

The Bibliography & Resources (Section VIII), Preparer's Qualifications (Section IX), and Appendices (Section X) conclude the report.

EXECUTIVE SUMMARY

Circa surveyed three different sub-areas within the Bayview Waterfront Project Area to identify potential historic resources. The following summarizes survey findings for each sub-area.

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INDIA BASIN

A number of parcels within the India Basin survey area had recently been surveyed and evaluated by Kelley & VerPlanck: Historical Resources Consulting. The study identified four properties that appear to be eligible for listing on the California Register of Historical Resources: 702 Earl Street, 900 Innes Avenue[5], 911 Innes, and 967 Innes Avenue. The former Albion Brewery building at 881 Innes Avenue was found to appear eligible for listing on the National Register of Historic Places. The India Basin survey also identified a potential California Register-eligible historic district, the India Basin Boatyards.

Also located within the India Basin survey area boundaries is the site of the former Pacific Gas & Electric (PG&E) plant. This building, constructed in 1929, was determined not to be a historic resource by the San Francisco Planning Department staff in 2006 and the building demolished in 2008. The remaining parcels within the India Basin survey area are comprised of unimproved public shoreline open space, India Basin Shoreline Park, and vacant land. No other buildings or structures over 45 years old were identified.

CANDLESTICK POINT/ALICE GRIFFITH SURVEY AREA

The Candlestick Point survey area encompasses the Candlestick Park sports stadium (formerly Monster Park), the Alice Griffith Public Housing site and Candlestick Point State Recreation Area. Circa evaluated the Alice Griffith Housing site and found it ineligible for listing on the NRHP, the CRHR or as a local landmark. With exception of Candlestick Park stadium, no other resources over 45 years of age exist within the survey area.

Jones & Stokes completed a recent evaluation of Candlestick Park sports stadium and found the property to be ineligible for listing on the NRHP. The property has not been evaluated for California Register eligibility and has not been previously included or listed

[5] In early 2008, the Shipwright's cottage at 900 Innes Avenue became San Francisco Landmark #250.

in any local survey of historic properties. It was beyond the scope of this project to conduct any additional review of the Candlestick Park stadium, however, Circa recommends that the property be evaluated for eligibility for listing on the California Register of Historical Resources and for local listing.

HUNTERS POINT SHIPYARD

In 1997, an inventory and evaluation of buildings and structures at Hunters Point Shipyard identified approximately 225 extant buildings and structures. All buildings on Parcel A, with exception of Buildings 101 and 110, were demolished in 2006-2007 as part of Hunters Point Shipyard Phase I. In July 2007, Circa: Historic Property Development began work on the development of a historic context and historic resources survey and inventory of extant buildings and structures at the Hunters Point Shipyard. A total of 134 buildings and structures were identified as existing properties at the shipyard in 2007. Since that time four buildings are known to have been demolished and a total of 130 buildings and structures were known to be extant at the conclusion of Circa's evaluation work in April 2009. Out of this total, a potential California Register eligible historic district was identified that contains five buildings and two structures previously determined eligible for the National Register of Historic Places (NRHP), as well as four additional buildings previously unevaluated for listing on the California Register of Historical Resources (CRHR). The potential Hunters Point Commercial Dry Dock and Naval Shipyard Historic District is comprised of the following resources:

- Dry Dock 2 (Previously determined eligible for NRHP by SHPO in 1998)
- Dry Dock 3 (Previously determined eligible for NRHP by SHPO in 1998)
- Building 140 (Dry Dock No. 3 Pump House) (Previously determined eligible for NRHP by SHPO in 1998)
- Buildings 204 (Gate and Pump House) (Previously determined eligible for NRHP by SHPO in 1998)
- 205 (Dry Dock No. 2 Pump House) (Previously determined eligible for NRHP by SHPO in 1998)
- Buildings 207 (Latrine building) (Previously determined eligible for NRHP by SHPO in 1998)

- 208 (Shop Service, Tool Room and Canteen Building)
- Building 211 (Shipfitters/Electronics Shop)
- Building 231 (Inside Machine Shop)
- Building 253 (Optical, Electronics and Ordnance Building)
- Building 224 (air raid shelter, NRDL Annex)

In addition, Circa found that Dry Dock 4 retained a good degree of integrity enabling it to remain eligible for individual listing on the NRHP.

Of the 121 remaining buildings on the shipyard, 11 were less than 45 years old and six were found to lack integrity; these properties were not evaluated for significance. The remaining 104 buildings and four structures were evaluated for eligibility for listing at the national, state and local levels. None of the remaining buildings or structures were found to be individually eligible for listing on the NRHP, the CRHR or as San Francisco Landmarks. Further, they were not found to be eligible as contributors to a national, state or local historic district.

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II. SURVEY OVERVIEW

The historic resources survey areas included specific parcels, as specified by the San Francisco Redevelopment Agency and PBS&J/EIP. Locations and boundaries of each survey area are represented in Figure 2 (page 7). Individual survey area maps identifying parcel and survey boundaries for each survey area are located in Section V of this report.

METHODOLOGY

The methodology used for completion of this historic resources survey and inventory included a literature review of all related existing information, completion of a historic context, field survey work and additional property-specific research. Each of these methodologies is described below. The SFRA, PBS&J, and members of the project team conducted an initial "kick-off" tour of the project areas on July 12, 2007, which included an overview introduction to the general project area and brief tours of each specific study area.

INFORMATION GATHERING AND REVIEW

An extensive review of existing documents was conducted prior to and concurrent with the survey fieldwork. Primary and secondary source research, including review of historic maps, newspaper archives, historic photographs and plans, utility records, military records, and U.S. census data was conducted. Property information data, CHRIS/NWIC search results[6], previous survey and evaluation reports, historic context statements and other related documents were provided by the SFRA, PBS&J/EIP and the San Francisco Planning Department for incorporation into the historic context statement. Some properties within the survey area have been evaluated for historic significance by other historic preservation consultants in recent years; these evaluations are discussed further in Section V of this report.

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[6] NWIC/CHRIS search conducted by Archeo-Tec (Access Agreement Number 07-1277, March 7, 2008) and resulting materials provided to Circa for review.

Updated: October 2009

Following review of existing documentation, additional property specific research was conducted to further develop the historic context. Research and other repositories consulted for the purposes of this study include the following (see Bibliography for complete list of resources):

- San Francisco Public Library (SFPL) – Main Branch and Bayview/Anna E. Walden Branch Library
- San Francisco History Center and Historical Photograph Collection, SFPL
- California Historical Society Archives
- J. Porter Shaw Library, San Francisco Maritime National Historic Park
- Navy BRAC Program Management Office West– Treasure Island
- Hunters Point Shipyard – Navy BRAC Drawing/document storage area (Building 383)
- National Archives and Records Administration (NARA) – San Bruno and College Park, MD
- University of California, Berkeley Libraries
- The Bancroft Library
- Environmental Design Archives and Library
- Earth Sciences and Map Library
- Engineering Library
- Navy Department Library, Naval Historical Center – Washington, D.C.
- San Francisco Planning Department

AGENCY CONSULTATION

See Appendix F for Agency Consultation/Notification list.

HISTORIC CONTEXT STATEMENT

An Administrative Draft of the Historic Context Statement was issued to PBS&J/EIP and SFRA for review in July 2008. The document was reviewed by the EIR consultant and by staff from the Historic Preservation division of the San Francisco Planning Department and all subsequent comments and changes have been addressed by Circa.

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The final draft is attached as *Bayview Waterfront Plan Historic Resources Evaluation, Volume I: Historic Context Statement.*

SURVEY FIELDWORK AND DOCUMENTATION METHODOLOGY

Prior to commencing fieldwork, Sheila McElroy, Principal, Circa: Historic Property Development; Becky Urbano, Preservation Services Manager with Garavaglia Architecture, Inc., and Sarah Hahn, Architectural Historian, Garavaglia Architecture, Inc., conducted an additional overview tour of Hunters Point Shipyard on May 7, 2008 to assess general conditions and to determine the general numbers and types of buildings and structures extant within the shipyard study area. Sheila McElroy and Sarah Hahn conducted specific site investigation of all survey areas in June 2008. At each site where buildings, structures, or objects were located, and as access was permitted, the consultants walked the site. Each building and structure was photographed and approximate dates of construction, architectural styles, primary character-defining features, conditions, and integrity were recorded. The consultant used survey maps and property information matrices provided by PBS&J and the SFRA to confirm whether potential resources were located within or adjacent to the study areas and to confirm addresses and other property data.

Circa then determined levels of condition and integrity for each property, comparing similar property types in order to organize extant buildings and structures into categories with high, medium and low integrity. Buildings with no to low integrity were not further researched or evaluated. Buildings with a medium to high degree of integrity were researched further as to use, the number remaining of that type, architectural merit and comparison to similar properties within the Hunters Point Shipyard and the Bay Area. These properties were also then evaluated to determine significance levels and whether they met National, California or local criteria for eligibility as historic resources. All properties were recorded on DPR Primary Record forms. Properties found to be significant were documented with District or Building Structure and Object Records. Though the Alice Griffith housing development was not found to be a historic resource, both Primary and BSO Record forms were prepared as requested (see Appendix A for all DPR forms).

Certain portions of the Shipyard were not accessible during the course of preparing this document due to hazardous waste remediation efforts and decontamination activities (see Figure 3.) Buildings and structures within these designated areas were identified and photographed by authorized Navy personnel. The photographs were then provided to Circa for use in the survey and evaluation process.

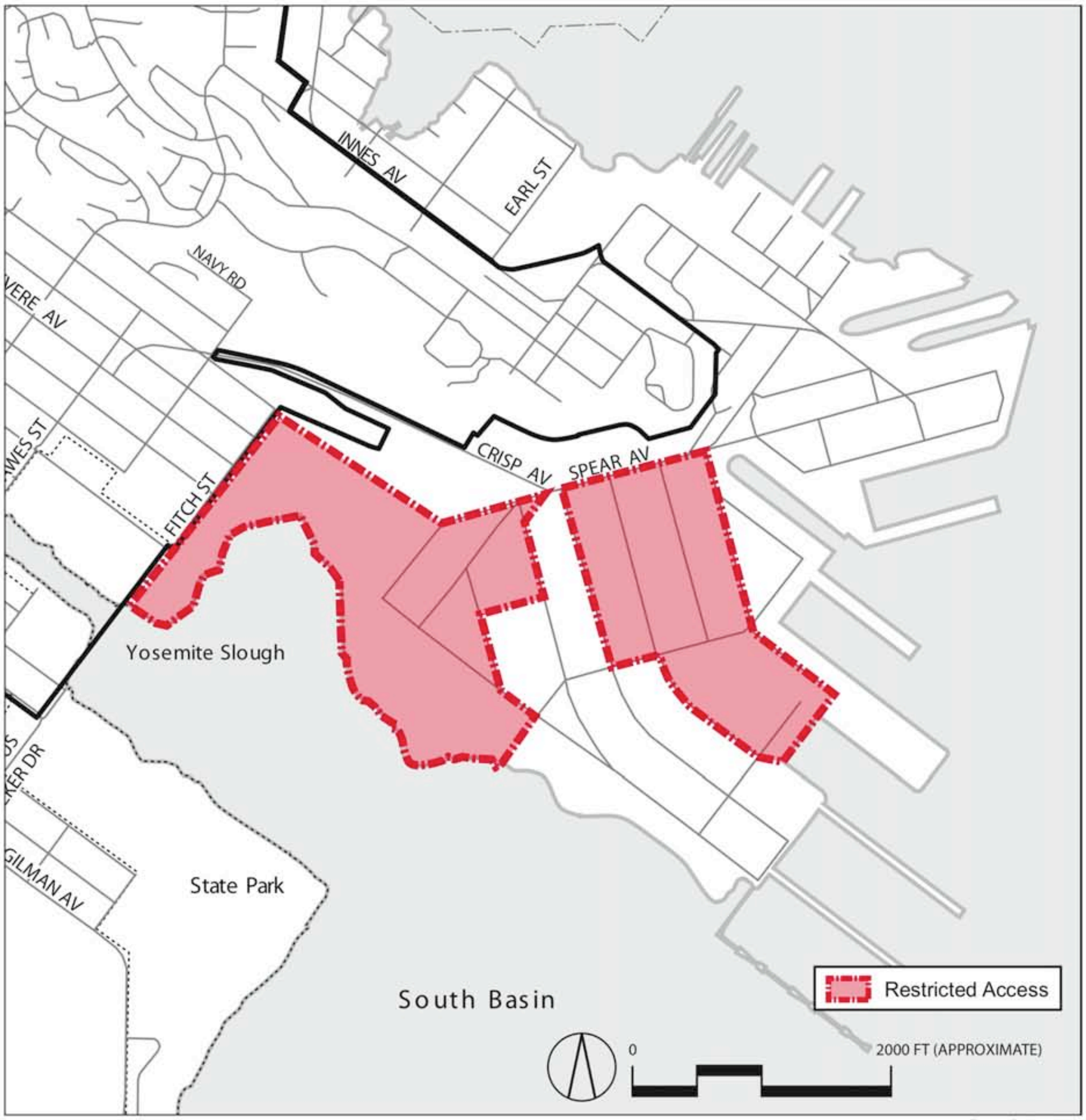
During the course of researching and preparing this technical report, four Shipyard buildings and some site features have been demolished as part of Navy environmental cleanup efforts. Most of what is discussed in the following sections is based on what remained of the built environment as of April 2009. This may or may not represent the state of the built environment as of the publishing of this report.

ADDITIONAL RESEARCH AND EVALUATION

Following completion of the *Bayview Waterfront Plan Historic Resources Evaluation, Volume I: Historic Context Statement*, Circa: Historic Property Development completed additional research related to supposed architect involvement in the design of certain buildings and structures at Hunter's Point Shipyard was conducted in April 2009 at the request of Planning Department staff. The following repositories were consulted to retain additional building-specific information:

- Navy Department Library/Naval Historical Center - Washington DC
- U.S. National Archives and Records Administration, College Park, MD and San Bruno, CA
- J. Porter Shaw Library, San Francisco Maritime National Historical Park
- Online Archive of California – Bancroft Library/UCB library holdings
- The California State Military Museum catalog
- Navy BRAC Program Management Office West– Treasure Island and Hunters Point Shipyard Drawing/document storage area (Building 383)
- San Francisco Public Library

Updated: October 2009



Source: US Navy BRAC PMO West, 2009.

Clement Designs, 2009.

OFF LIMIT AREAS AT HUNTER'S POINT SHIPYARD

FIGURE 3

Figure 3. This map indicates the restricted access areas within the boundaries of the Naval controlled shipyard property. Map courtesy of PBS&J.

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Efforts were also made to locate a specific document by Edwin G. Schmidt titled *The History of the Development and Operation of a Naval Repair Yard at Hunters Point During World War II* (c.1946), which is referenced in existing documents related to Hunters Point Shipyard. Circa contacted and/or searched the local and national repositories listed above regarding the document, however a copy of the report was never located.

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III. HISTORICAL BACKGROUND

Please find more detailed historic context information in *Bayview Waterfront Plan Historic Resources Evaluation, Volume I: Historic Context Statement* of this document. The following Historical Background information is provided below for summary purposes.

INDIA BASIN SURVEY AREA

India Basin is composed of approximately ten full and partial blocks ranging from Earl Street to the former Pacific Gas & Electric plant site along Jennings Street. Many of these blocks are occupied by small, light industrial enterprises and residential buildings. The area has historically been a small boatbuilding community since the middle of the 19^{th} Century. This community was fairly self-sufficient, establishing their own churches, schools and social support network. Economically, they were dependent on the Bay for their livelihoods, whether they were involved with boat building or fishing. Today, several of the early religious institutions remain, as does at least one working boatyard and several residences from the 19^{th} Century and early 20^{th} Century.

Most of India Basin dates to the pre-World War II period (pre-1941). The boatyards were established throughout the late 19^{th} Century, mostly by northern European immigrants. Today there remains several intact architectural reminders from this period, including the Anderson-Cristofani boatyard and 900 Innes Avenue. Many other boatyards and fisheries were once found along this shoreline, but few have any visible physical presence as of 2008.

The Pacific Gas & Electric Company (PG&E) power plant at Hunters Point was originally constructed in 1929 by Great Western Power Company. Over the years it has been expanded to keep up with improvements in power generation techniques as well as to increase capacity. The plant was closed in 2006 and demolished by 2008. The PG&E site is currently undergoing remediation.

World War II greatly affected all the areas around India Basin, but there was relatively little effect on the built environment within India Basin. The boatyards continued to operate, although at a reduced capacity. The demand for larger ships resulted in the closing of the smaller yards and the consolidation of the remaining facilities. Those that survived into the post-WWII period did so by becoming specialty outfitters.

The shoreline of India Basin, its commercial enterprises and residential building stock have seen few changes since World War II. It remains a small pocket of late 19th Century and early 20th Century architecture amidst recent development. The hills above India Basin were first developed in World War II for housing. In the post-war years, much of the housing was transferred to public housing uses. Today, some of this remains but is interspersed with new development as the neighborhood continues to evolve.

CANDLESTICK POINT/ALICE GRIFFITH SURVEY AREA

CANDLESTICK POINT

The Long-billed Curlew is a large North American shorebird that was common along the shoreline of San Francisco in the early part of the 20th Century. Locally it was known as the Candlestick Bird and it is after this waterfowl that Candlestick Point was named.[7] Prior to being known as the site of a professional sports stadium, it was a quarry, a landfill and a proposed site for a quarantine hospital. At the time, it seemed a likely place, far from major settled areas, to put such an institution. 50 years later it was again at the center of controversy as it became the site for San Francisco's first professional sports facility. Today, the area has a sports stadium, as well as a state park, an executive park and a small number of residences.

At Candlestick Point, no architectural elements from the pre-1941 period have been identified. This area was largely created from fill after World War II. Those areas that

[7] San Francisco Department of Parks and Recreation website, *Welcome to Monster Park,* http://www.parks.sfgov.org/site/recpark_index.asp?id=18977, 2008.

were upland in the pre-war period were sparsely settled and largely used for industrial purposes.

During World War II, Candlestick Point was developed as a large multi-family housing complex for shipyard workers. These buildings were located along the southern shore, at the base of Bay View Hill. Landslides from the poorly graded and unstable hillside plagued the development and excavation was needed periodically to keep the units free from danger. Some areas to the east of the hill were filled in at this time, however much of the fill was not completed until the construction of Candlestick Park.

CANDLESTICK PARK

Candlestick Point was transformed in the late 1950s when the New York Giants relocated to San Francisco. A new baseball stadium was constructed on filled land just east of Bay View Hill. Well-respected local architect John Bolles designed Candlestick Park Stadium and it is considered one of the high points of his work. Unfortunately, the stadium was poorly sited and suffered from inhospitable weather patterns. Alterations in the post-war period include enlarging the seating, enclosing the stadium and reconfiguration of the stands to accommodate football and well as baseball. *Note: In addition to the historical background information provided in Volume I of this document, further discussion can be found in the evaluation completed by Jones & Stokes (Final Historic Property Survey Report, Bayview Traffic Improvements Project, Caltrans District 4, October 2007).* The evaluation is summarized in Section V of this report.

ALICE GRIFFITH PUBLIC HOUSING

In 1937, Congress passed the first United States Housing Act. This act established the Untied States Housing Authority (USHA) as a part of the Department of the Interior. It put the Federal government in the funding role while giving governance of the resulting housing to local housing authorities. San Francisco was one of the first cities to apply for the Federal program, establishing the San Francisco Housing Authority (SFHA) in 1938. By 1940, Holly Courts had opened, becoming the first public housing project completed west of the Rocky Mountains under this system.

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The USHA was initially authorized for a period of three years but was not renewed. Instead, by 1939, the government began to shift its focus from providing public housing to building defense-related housing in preparation for entering World War II. As part of this shift, all housing construction was stopped to conserve construction materials for the war effort. Special provisions were made to those housing projects in strategic locations near defense bases and industrial zones.

An ideal location because if its proximity to the Shipyard and general lack of development in the area, the Hunters Point neighborhood of San Francisco was transformed by the war housing boom. The first of the war housing construction projects to open was the Middle Point War Housing complex between Evans Avenue and Innes Avenue in early 1943. In the next six months, five more war housing complexes opened in the area, including the Double Rock War Dwellings, the precursor to today's Alice Griffith Housing Development. By the war's end in July 1945, over 10,000 units of temporary wartime housing had been constructed to serve the Hunters Point Naval Shipyard.

After the war, many war workers began to transfer out of the temporary housing units and into the single-family dwellings that were showing up throughout the district. By this time, many of the temporary housing units were already showing signs of impermanence. However, because housing was in such short supply, the Federal government made provisions in the Housing Act of 1950 to transfer ownership to local housing authorities rather than require their immediate demolition (as originally mandated). The defense worker housing was officially transferred from the Federal government to the SFHA in 1954. In this same year, SFHA received its first challenge over the quality of the housing projects in the Bayview-Hunters Point area. By 1960, four of the original "temporary" housing complexes were still being used, including the Double Rock War Dwellings.

To address the extreme shortage of quality housing in the city, the SFHA's first priority after the war was to complete the remaining six public housing projects designed before the war. This included Ping Yuen in Chinatown, North Beach Place in North Beach, and

Bernal Dwellings in the Mission. The second priority was to deal with the problem of the temporary war dwellings in the Hunters Point area. The first units to be replaced were part of the Navy Point War Dormitories at Kirkwood Avenue and Earl Street, in 1953. This new complex was called simply “Hunters Point.” It consisted of 317 apartments in a series of 2- and 3-story apartment buildings. This design became the standard for the area. In 1956, Hunters View and Harbor Slope opened up with 576 units, replacing the Middle Point and Harbor Slope War Dwellings along Innes Avenue. These units were largely constructed on existing foundations remaining from the demolition of the temporary war buildings. The Alice Griffith Garden Homes replaced the Double Rock War Dwellings in 1962.

Hertzka & Knowles and H.C. Baumann Associated Architects designed the Double Rock Low Rent Housing Project in 1953-4 and Douglas Bayliss designed the landscape. Construction of the approximately 250 units began in 1960 and was completed in October 1962. Initially referred to as Double Rock after the earlier temporary war housing development on the site, the project was later renamed after former SFHA board member Alice Griffith. Griffith opposed the SFHA’s restrictive placement known as “neighborhood patterns.” This policy allowed settlement within the housing projects only if the applicant reflected the predominate ethnicity of the neighborhood, or if they were White. In spite of the fact that the majority of the tenants were African-Americans who had difficulty finding housing because of rampant racial discrimination, only one permanent housing project, located in the Western Addition, was open to Blacks. The “neighborhood patterns” policy was the City’s way to segregate housing in practice while condemning the practice in theory. Alice Griffith resigned her post over the matter and became a voice opposing the policy in public debate.

Wayne Solomon Hertzka and William Howard Knowles formed Hertzka & Knowles, the San Francisco-based architecture firm in 1932. Hertzka, a Washington native born in 1907, earned his masters degree in architecture from MIT in Cambridge and became a registered architect in California in 1956. Knowles, born in 1909, completed his undergrad work at UC Berkeley and also earned his masters degree in architecture from MIT in 1932. Together the architects worked on a number of projects including 1 Bush Plaza, Anza Elementary School, the Mission BART stations and the Hotel Empire in San Francisco.

Herman C. Baumann started his architectural practice in San Francisco in 1924. A prolific architect, Baumann designed hundreds of apartment buildings in the Bay Area over his career. He also designed hotels and commercial buildings in San Francisco, Oakland and Sacramento. During WWII, Baumann held a contract with the U.S. Navy Bureau of Yards and Docks, designing a number of buildings at Mare Island and other Naval outposts in the Bay Area. After the war, Baumann designed several multi-family housing projects. He is likely best known for his Art Deco apartment houses such as 1895 Pacific Avenue and 1950 Clay Street in San Francisco and the Bellevue-Staten building in Oakland.

Douglas Bayliss is best known for his work in the “California School” of landscape architecture in which the more structures Beaux-Arts conventions were replaced with an approach that centered around the California climate and lifestyle. Bayliss graduated with a Landscape Architecture degree from the University of California, Berkeley in 1941 and began working with Thomas Church. It was during his tenure in Church’s firm that several government-funded housing projects were designed. Bayliss opened his own firm with wife Maggie Bayliss after the war and his projects over the next two decades included Washington Square in North Beach, San Francisco Civic Center Plaza, IBM Headquarters near San Jose and several BART stations. He is often credited along with Church, Garrett Eckbo and Robert Royston as one of the founders of the “California School” of modernism in Landscape Architecture.

Over the years, little has changed within the Alice Griffith Public Housing site and some residents still remain from its opening in 1962. Some upgrade work was completed in the 1980s, however the buildings appear to be in deteriorating condition. A new community facility has been constructed on the site in recent years.

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HUNTERS POINT SHIP YARD SURVEY AREA

PRE WWII PERIOD (PRE-1941)

At HPS, several pre-World War II buildings remain. They are clear representatives of the commercial importance of the shipyard when it was solely contained within the bounds of the Bethlehem Steel dry docks at Hunters Point. Portions of the dry docks area remain from the 19th Century. These elements have previously been determined eligible for listing on the National Register and as such, are the most important resources within the Project boundaries. However, they are not the only resources that remain from the pre-World War II period. Only one other building is extant related to the community that existed prior to the war years, Building 109; originally a restaurant that served the commercial dry dock community, the building was later used as the shipyard police station.

Existing Property Types from the Pre-1941 Period

The Hunters Point Shipyard closed in 1974. The residential area at the north part of the Shipyard was designated Parcel A as part of Phase 1 of the current Project. Within Parcel A and the adjacent Parcel B were at least two commercial buildings constructed to serve the residents of the area as well as the dry docks employees prior to Navy occupation. These two buildings served as restaurants in the pre-Navy period. The first was called The Venetian Villa (later Dago Mary's), and was located just inside the Phase 1 Hunters Point Shipyard (HPS) boundaries at the northeastern corner of Hudson Avenue and Galvez Avenue. The second was known as the Lincoln Restaurant and used as the Navy's police station after the Navy assumed ownership of the shipyard. Following transfer of Parcel A from City ownership to private hands circa 2005, the entire residential district and some Navy administration buildings were demolished and the land regraded as part of Phase 1 HPS.[8] Dago Mary's was demolished in 2008. The former Lincoln Restaurant, currently known as Building 109, a

[8] Buildings 101 and 110 were built by the Navy during the WWII period and are the only buildings still extant within Parcel A.

Spanish Revival style building built in 1934, is the only commercial building still extant at HPS and is near the northern entrance to Hunters Point Shipyard Phase II Area A.

Dry Docks 2 (1903) and 3 (1918) and Buildings 140 (1918), 204 and 205 (1901), and 207 (c.1930) have been previously determined eligible as contributors to a National Register historic district significant for its association with early commercial drydock operations at Hunters Point (see Figures 28 and 29.) These buildings, in addition to Building 208, a Tool Room constructed prior to the Navy's acquisition of the property and later remodeled, constitute the remainder of the pre-WWII buildings and structures within Hunters Point Shipyard sub-area.[9]

Figure 4. View of the Hunters Point dry docks as seen from Hunters Point Ridge, 1924. Dry Dock 2 is to the right in the image. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

[9] Though previous studies listed construction dates for Buildings 207 and 208 as 1942 and 1943 consecutively, research conducted at the Navy archives at Treasure Island for the purposes of this review indicate that the buildings were actually acquired with the property and remodeled by the Navy in 1942 and 1943.

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Figure 5. View of Dry Dock 2, Photo: NAVSEA, 2004.

WORLD WAR II PERIOD

The World War II period brought the most profound physical changes to the shipyard. The land was significantly increased while Hunters Point Hill was dramatically leveled. Rail lines were laid, warehouses built, and the largest dry dock in the world (at that time) was constructed in record time. Hundreds of ships were repaired and returned to battle and thousands of employees worked around the clock to meet the demands of the Navy and its ships. Most of the built fabric remaining in 2008 dates to this period. The buildings range in size from small weighing stations to large warehouses and multiple level repair facilities. It should also be noted that a large number of buildings at the Shipyard have been demolished since the shipyard was decommissioned in 1976, many in recent years.

Zones of Use

As stated in Volume I: Historic Context of this report, the overall site plan for the Shipyard was a direct product of the World War II expansion. Prior to the war effort, the sparse amount of available land at the site did not necessitate a comprehensive site planning strategy. However, with an increased amount of land made available through the reclamation process, site planning became a necessity and the result was an orderly arrangement of buildings and structures in functional groupings. The first and most important influence was access to the water. Since the primary charge of Hunters Point Shipyard during World War II was the repair and retrofit of ocean-going military vessels, access to the various berths had a large impact on the location of storage, shops and administration buildings. Of secondary concern was the movement of equipment and personnel between buildings. Rail lines traced throughout the Shipyard, following wharfs and extending into warehouses. The sometimes massive scale of equipment and materials required the use of cranes and motorized transportation mechanisms to move objects from ships to repair facilities and back again. The consequence of these influences was a compartmentalized base with specific use zones, reflected largely in the numbering system (see Figure 6). In general, these zones were:

- Administration (100-series)
- Submarine Repair (100-series)
- Ship Repair and Outfitting (200-series)
- Warehousing, Supply and Industrial Support (300- and 400-series)
- Residential and related (500- and 600-series)
- Radiological (700- and 800-series)

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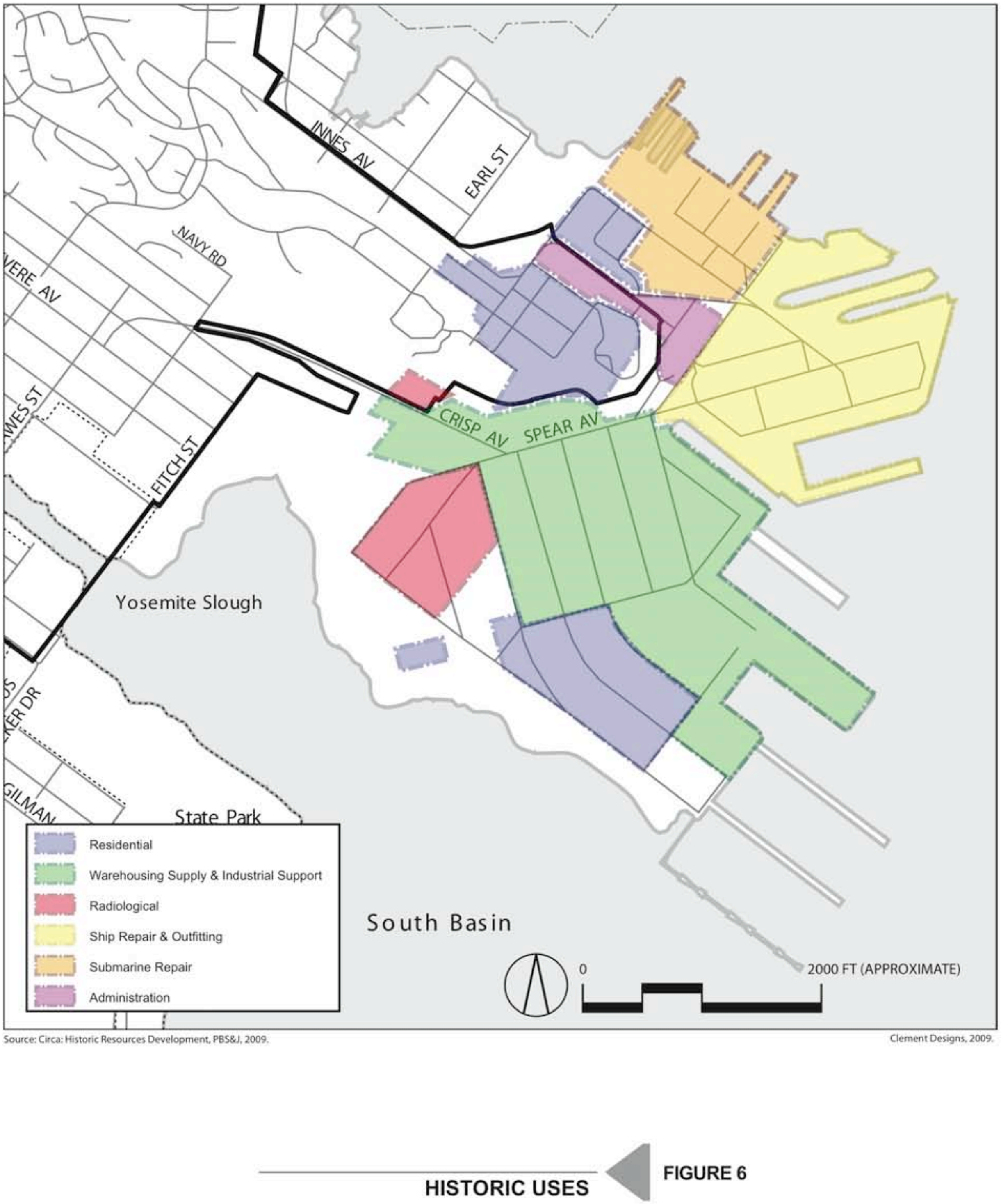

Figure 6. These areas represent general zones of use within Hunters Point Shipyard during World War II. Map courtesy of PBS&J.

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REPRESENTATIVE BUILDING TYPES FROM THE WWII PERIOD

Administrative

Figure 7. Building 101, Main Administration Building, Photo: Circa, 2008.

There are seven World War II-era Administrative buildings remaining at Hunters Point Shipyard. These include: Building 101 (see Figure 7) overlooking the heart of the Shipyard, Building 121 (the Submarine Offices and Apprentice School) in the Submarine Repair area, Buildings 129 and 132 (Submarine Pier offices) on Piers B and C, Building 154 (Area time office #1) in the Ship Repair and Outfitting area, Building 214 (The Accounting and Bond Office) southwest of Dry Dock 2, Building 215 (the Fire Station), and Building 238 (an office building) on the North Pier. All appear to have been built from standardized Bureau of Yards and Docks plans, except for Buildings 214 and 215. These buildings are quite similar to one another in design and materials and may have been designed as part of a larger A&E contract.[10]

The most prominent of these buildings, in terms of siting, is Building 101, the main Administration Building. It appears to be a standardized semi-permanent Bureau of Yards and Docks design, with a series of identical sections pieced together as wings projecting from a long central corridor. It is a wood frame building clad in wood shiplap siding and glazed with one-over-one wood windows. Most of the other administrative buildings also appear to be built around standard plans. Building and 121 closely resembles a World War II-era barracks designs, similar to buildings 103, 104 and 117. Buildings 129 and 132 are identical two-story office buildings on Piers B and C. Building 238 appears to be another office building located on the north pier but is not specifically

[10] Ibid, p. 22.

noted in Navy records. As previously noted, Buildings 214 and 215 are similar in design and research indicates that both are likely variations on standard plans.[11]

Figure 8. Building 110, Marine barracks.
Photo: Circa, 2008.

Residential and Related

As the Navy increased services at Hunters Point Shipyard, a vast increase in housing for enlisted men and their families was needed. This was beyond the thousands of units under construction for civilian shipyard workers. (See Volume I: Historic Context, Chapter VII: Housing, for more discussion on civilian housing construction during World War II). During the Shipyard's peak years of operation, residential and other related facilities for service personnel were located throughout the Shipyard, though chiefly concentrated in the 500 Series Area in the southwest corner of the shipyard and in the former neighborhood on the bluff. Facilities included not only barracks buildings for ships and submarine repair workers, apartment houses, officers quarters and family housing for non-commissioned personnel, but also recreational facilities, latrines, laundry and commissary facilities, a motion picture theater, a chapel, canteens and cafeterias, and a dental clinic.

Most of these buildings have been demolished in recent years because many were utilized by the NRDL as labs or storage facilities after they were no longer needed to service Navy personnel to the extent that they did during wartime. Today, only five barracks buildings remain at the site, most in the 100 series area in or near the Submarine repair Area. A more unique building in this grouping is Building 110, a stucco-clad Art-Deco style barracks building (see Figure 8), that was built from standard Bureau of Yards & Docks plans and housed the Marine detachment.[12] Typical of Navy

[11] Ibid, p. 23.
[12] Perhaps, since the Marine barracks building was more publicly visible than some of the other residential facilities because of its location on a main entry thoroughfare, a more distinctive design was chosen for the building.

Figure 9. Building 117, Submarine barracks. Photo: Circa, 2008.

base layout, the Marine barracks were situated near the entry gate since the Marines served as armed guard for the facility. The other barracks buildings are standard, rectangular-plan buildings (103, 104 and 117) (see Figure 9) that functioned primarily as the Submarine repair workers' barracks. One barracks building does exist in the south waterfront area: Building 500, a two-story, wooden World War II semi--permanent building that served as a Bachelor Officers' Quarters and canteen.

Figure 10. Building 226, Standard plan latrine. Photo: Circa, 2008.

Standard-plan wood frame latrine buildings (see Figure 10) are found throughout the shipyard as are cafeteria facilities like Building 228, the Central Cafeteria, located within the Ship Repair and Outfitting area of the Shipyard. Other remaining buildings include Building 120 in the Submarine Repair Area, constructed as a variation on standard Bureau of Yards and Docks Plans as the Enlisted Men's' Club and Building 505, which housed the Navy Exchange, Gymnasium, a bowling alley and laundry facilities.

Figure 11. Building 236 is typical of the Utility buildings found at the Shipyard. Photo: Circa, 2008.

Utility

A number of reinforced concrete utility buildings remain from the WWII period and are located throughout the Shipyard grounds. Relatively uniform in their utilitarian design, these building house substations, pump houses and switching stations. Generally constructed of reinforced concrete, most of these buildings lack windows and have a single metal access door (see Figure 11.)

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Dry Docks

Figure 12. Dry Dock 4, 2008. This was the largest drydock in the world when it was constructed in 1943. Photo: Circa, 2008.

Four dry docks were constructed at the Shipyard during WWII: Dry Docks 4, 5, 6 and 7. Dry docks, also known as graving docks, are used for the construction, maintenance, and repair of ships, submarines and other watercraft. When a ship is to be repaired, the dry dock is flooded by opening the gate at the mouth of the basin. After the vessel enters the basin, the watertight gate is closed and the dock is pumped dry, bringing the craft to rest on supporting blocks secured to the floor.

Dry Dock 4, constructed in 1943, is a multi-purpose graving dock designed especially to accommodate aircraft carriers (see Figure 12.) This massive dry dock is 1092 feet long, 142 feet wide and 53 feet deep. It was carved into the natural serpentine stone that comprises Hunters Point ridge and finished in concrete. Access steps are built into the sidewalls and the floor of the dock is flat. Crane tracks surround the dry dock, permitting the ships to be accessed from all angles.

Figure 13. The Submarine Repair Area, 1946. Photo used with permission from the San Francisco History Center, San Francisco Public Library (United States Navy Photograph.)

Dry docks 4, 5 and 6, (see Figure 13) the Submarine Dry docks, are located in the Submarine Repair Area of the Shipyard and were designed to fully service underwater craft and smaller surface vessels.[13] Built in

[13] Hunters Point Naval Shipyard Association, untitled report, c.1974, pp. 15-16. Included as an appendix to *Hunters Point Naval Shipyard: A Historical Analysis* by Karl F. Kimbrough, August 1978.

1944, these dry docks are much smaller than Dry Dock 4, measuring about 420' long and between 60' and 75' in width, with a simple "flap gate" design. Originally designed for submarine, the structures were modified to accept destroyers as well.[14]

Warehousing , Supply and Industrial Support

Figure 14. Building 400, a typical warehouse building at Hunters Point Shipyard. Photo: Circa, 2008.

As part of the daily operations, the Shipyard had to be prepared for work on a wide variety of ships, ship components and weaponry as well as supplying repaired vessels for their return to duty. Storage was essential to these operations, as evidenced by the immediate construction of storage facilities when the Navy assumed full command of the site in late 1941. A series of supply storehouses, somewhat varied in design, are located in the south shipyard area, a predictable occurrence in a base dedicated to the repair of ships. Nearly all were built along standard Bureau of Yards and Docks designs, modified on occasions to fit specific requirements. The predominant warehouse type is a rectangular plan, wood warehouse building with a monitor roof. This standard plan was used alone or in groupings of three. Buildings 400, 404, 405, 406 and 407, supply storehouses built in 1943 are the best remaining examples of this building type (see Figure 14.)

Figure 15. Rail spurs are common throughout the Shipyard, especially on the south side. Photo: Circa, 2008.

Railroad tracks entered the Shipyard from the western entrance and ran throughout the shipyard, providing an essential mechanism for the transportation of goods between storehouse, shops and dry dock facilities; much of this extensive network was still extant when the survey process started (see Figure 15.) Tracks run along the north

[14] The following information is taken from Building the Navy's Bases in World War II.

sides of the 400 series listed above and directly into Building 808, a large steel framed and sided warehouse just north of these buildings.

Shops, Shipbuilding and Repair

Figure 16. Building 230, a typical WWII shop building at Hunters Point Shipyard. Photo: Circa, 2008.

Figure 17. Building 123, a typical monitor roofed shop. Photo: Circa, 2008.

Figure 18. Building 241, a two-story shop with a shallow gable roof. Photo: Circa, 2008.

Aside from the supply storehouses, the shops buildings are the other most common building type at the Shipyard. Like the warehouses, nearly all were built along standard Bureau of Yards and Docks designs and modified to fit specific functional requirements. The shops are generally large buildings, some being very substantial in footprint as well as height. Functionally, the buildings were used for a wide variety of purposes, although they may be roughly classified into industrial support and processing uses.

Most of the buildings are wood or steel framed and clad in a combination of metal, wood or corrugated transite panels. A secondary siding of asbestos shingles has been applied over the original wood siding of many buildings. The industrial shops ranged in size from smaller gable-roofed buildings (see Figure 16) to massive monitor roofed shops (see Figure 17), to one- and two-story full height buildings with a shallow gable roof and shed wings (see Figure 18.)

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Figure 19. Building 351, completed in 1945 at the close of World War II. Photo: Circa, 2008.

There are a few examples of reinforced concrete shop buildings, though concrete was a scarce construction material during the war and was use sparingly. It was generally used when the building was to be used for the handling of flammable or energetic materials or because the building was scheduled for permanent status. Building 351 is a large reinforced concrete shop building, constructed as the Optical Shop in 1945 but never used for that purpose (see Figure 19.) It was later used as an electronics shop, NRDL Annex E and for general research laboratories.

Figure 20. Building 231, constructed by the Navy in 1942 as the first major shop at the Shipyard. Photo: Circa, 2008.

Possibly most notable are the three large curtain wall shop buildings, Buildings 253, 411 and 231 (see Post-WWII section below for discussion of Building 253 and 411). Building 231 (see Figure 20,) the Inside Machine Shop, was the first major shop building constructed by the Navy in 1942. Steel framed and clad in corrugated iron siding and corrugated safety glass, the rectangular plan building has a sawtooth roof and is glazed with steel industrial sash windows.

WWII Period Summary

All of this construction was centered on the stated mission of Hunters Point Shipyard:

> "For all classes of vessels: interim docking, shaft and propeller repairs, repairs of major underwater damage; for carriers: interim overhaul of about three to four weeks comparable to overhaul by repair vessels afloat."[15]

In general, that is what occurred. However, sometimes Hunters Point Shipyard was used to load and outfit ships prior to embarkation. This was the case on July 15, 1945, while the USS Indianapolis was docked at Hunters Point awaiting orders. On this day, components of the atomic bomb "Little Boy" were loaded aboard the Indianapolis for transport to the South Pacific. It was reported to have contained half of the available uranium in the United States, valued at over $300 million at the time. The ship left Hunters Pont at 6:30 AM the next morning but was held in San Francisco, awaiting the results of the first atomic weapons test in New Mexico. The test was a success and the Indianapolis sailed out of the Golden Gate at 8:30 AM.[16] On August 6, 1945, the bomber Enola Gay dropped "Little Boy" on Hiroshima, essentially ending World War II.

POST WWII PERIOD

Hunters Point Shipyard continued to function as a Navy repair facility in the post-war period. It did not, however, continue to receive the same level of attention from the Navy. Other, newer shipyards were developed in Southern California during the 1950s and 1960s. By 1974, HPS had become obsolete.

In the post-WWII period the Shipyard became home to the Navy's Radiological Defense Laboratory, NRDL. NRDL came to dominate much of the space on the shipyard, at one time occupying over three-dozen different buildings. In 1955, these operations were

[15] Ibid, p. 15.
[16] NAVSEA, Hunters Point Shipyard: Final Historical Radiological Assessment: History of the use of General Radioactive Materials, 1939-2003. 2004, p. 6-4.

Figure 21. Building 367 is constructed of two Quonset huts placed end-to-end. This building type was used for housing along the south shore of Hunters Point during World War II. Photo: Circa, 2008.

partially consolidated in the newly constructed Building 815. The research and scientific advancements that occurred as a result of experimentation within Building 815 had a direct impact on development of practical uses for nuclear materials as well as protective measures and public policy regarding exposure and handling of such materials. NRDL was a unique and highly influential enterprise that brought a new level of prominence to Hunters Point Shipyard.[17]

REPRESENTATIVE PROPERTIES FROM THE POST - WWII PERIOD

Though the bulk of the buildings and structures remaining at Hunters Point Shipyard date to the WWII period, a number of buildings, constructed to supplement ongoing Naval ship repair activities, remain from the post-war period.

Administration and Support

Some expansion of administrative and other worker support facilities occurred in the post-war period, mostly concentrated within the Warehousing, Supply and Industrial Support Area in the south Shipyard. Buildings 367 and 424, small administrative

[17] Building 815 is not located within the survey area.

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buildings, served shipyard workers as Work Control center #3 and Area Time Office #4, respectively. Comprised of two Quonset huts, Work Control Center #3 sits along the southern edge of Dry Dock 4 (see Figure 21.) Over 130 Quonset huts, also known as Homoja Homes, were once located in the residential (500 series) area of the south Shipyard. Of this once common building type at the shipyard, Building 367 is one of only two Quonsets remaining at the site. It is possible that the Navy relocated two Quonsets to create Building 367 after the WWII demand for worker housing had subsided.

Figure 22. Building 709, the Navy Exchange Gas Station, built in 1952. Photo: Circa, 2008.

Additional employee support facilities were also constructed during this period including Buildings 159, 710 and 370, temporary wood frame latrines. Building 709, the Navy Exchange Gas Station, is a unique service station building constructed in 1952 with Art Deco design features unusual for the date of construction (see Figure 22.)

Figure 23. Building 521. One of several utility buildings. It was constructed in 1948. Photo: Circa, 2008

Utility services at the Shipyard were also improved during the post-war period, most notably with the construction of Building 521, a reinforced concrete power plant in the south shipyard area (see Figure 23.) Built by Barnes Construction Company in 1948, the building is a prominent structure and one of the last standing in this formerly residential part of the shipyard. Other utility buildings completed during this period include a one-story brick salt water pump house (Building 523) near the South Slip and a concrete sewage pump station (Building 819) located just north of the Crisp Road and Spear Avenue intersection.

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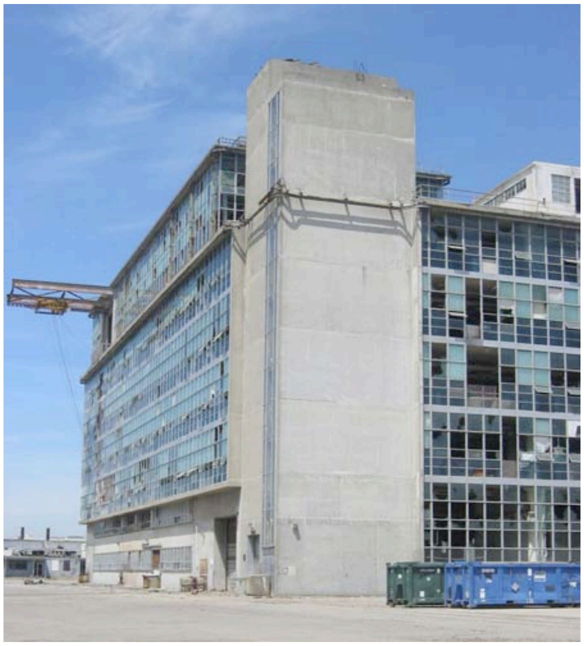

Figure 24. Building 253. The Optical, Ordnance and Electronics Building was built in 1947. Its green glass façade can still be seen from Highway 101. Photo: Circa, 2008.

Ship Repair and Outfitting

Several shipbuilding and repair-related buildings were constructed at the shipyard after 1945. These generally fall into two categories: large specialized shop buildings and smaller, pre-fabricated support buildings.

Buildings 253 and 411 are the most notable post-WWII industrial buildings at the shipyard, both visually and architecturally. They were planned, and in the case of Building 253, under construction during wartime but not completed until 1947 and hail from a long-standing Navy practice of designing large shops using the curtain wall system. The Navy's use of this form dates to the years just before World War I, when Albert Kahn, a pioneer in the field of American factory design, developed a curtain wall shop building for the Navy shipyard in Philadelphia. The Bureau of Yards and Docks quickly recognized the utility of the form for the metalworking, assembly, and other aspects of mass production that required large clear spans and ample natural light. The Bureau of Yards and Docks built curtain wall shops buildings at Mare Island, Terminal Island, Hunters Point, Puget Sound and other Naval shipyards throughout the country from World War I through the end of World War II.

Building 253, the Optical, Ordnance and Electronics Building, is a six-story, concrete framed, glass curtain wall building located in the Ship Repair and Outfitting area of the Shipyard (see Figure 24.) Designed by the architecture firm of Ernest J. Kump Co. and Mark Falk, structural engineer, the building cost over $2,000,000 to build. More than 80 percent of the structure's walls and roof are comprised of glass providing abundant natural light to the building interior. A large overhead crane attaches to the south side of the building and was used for external lifting of equipment. A periscope tower extends

Figure 25. Building 411 has been partially attributed to Albert Kahn & Associates Architects and Engineers, Inc. Photo: Circa, 2008.

vertically from the roof and was part of the sixth floor Optical Shop where rangefinders from naval ships were repaired and submarine periscopes calibrated by sighting on known points throughout the Bay Area.

Building 411 is a steel-framed curtain wall building located in the Warehousing, Supply and Industrial Support Area in the south Shipyard (see Figure 25.) According to an earlier evaluation of the building, it was designed in part by Albert Kahn and exhibits several common features of his industrial buildings including a saw tooth roof, bands of steel industrial sash windows and massive glazed industrial doors. The building housed the Shipfitters and Boilermakers Shop and Ship Repair shop as well as a civilian cafeteria, mold loft, radiography shop and storage areas. The plate yard was located directly north and assembly yard directly south of the building.

The second grouping of industrial buildings extant from the post-war period, and the most common building type, is the metal-sided Butler (or Butler-type) building. All of the Butler Buildings at Hunters Point date to the immediate post-war era (1947-1953) and include Buildings 156, 271, 274, 275, 323, 324, 368, 369, 415/416, 525, 526, 530 and 704. Butler Buildings are of varying sizes and are sometimes paired. This prefabricated, standard building was used on military bases throughout the nation in the immediate post-war era, when construction budgets were quite limited and were utilized for various industrial support activities and supply storage.

Radiological Laboratories

The NRDL primarily occupied buildings in the 800 and 700-series areas of the Shipyard, though portions of other buildings were utilized for NRDL storage, administrative offices and other purposes throughout the course of their work at Hunters Point. Many buildings in the 500-series area were used for radioactive waste storage, personnel decontamination, research and offices related to NRDL activities. The center for NRDL research, Building 815, also known as the Radiological Laboratory or RADLAB is still extant but located outside of the study area (see Figure 27). Buildings such as Building 820, the Navy Radiation Laboratory and Building 830, a Navy Biological Laboratory, as well as most of the 500 series buildings have been demolished in recent years. Extant NRDL related buildings include Buildings 707 and 708, NRDL animal research facilities and study colonies, and Building 366, which housed the NRDL Electronics Laboratory.[18]

Other

Warehousing and Supply

Building 813, built in 1947, is the only reinforced concrete warehouse built during the postwar period and stands on Parcel A, just north of the Warehousing, Supply and Industrial Support Area. This four-story warehouse is glazed with bands of industrial steel sash windows and functioned as a supply storehouse.

450-Ton Crane

Figure 26. 450-ton crane. Photo: Circa, 2008.

One of the more impressive structures built just after the WWII-era was a large bridge crane, installed on the 405-foot-wide Gun Mole Pier at the south waterfront area (see Figure 26). The bridge crane is constructed of riveted and welded braces and plates and measures 730 feet in length, rising 182 feet above the water. The fixed cantilevered arms at each end project 162.5 feet over the water on either side of the pier. The support towers are 35 feet by 50 feet at the base and are 320 feet apart across the pier. Two trolley cranes were self-contained units with a cab

[18] The area around Building 707 was known as the "707 Triangle." It was formed by the intersections of I Street, J Street and Manseu Street. It was used as a staging area for radiologically contaminated waste prior to its disposal at sea.

for the operator and cable extensions to lift and move large objects. The trolley cranes were removed in about 1970.[19]

Other buildings constructed in the post-war period include series of later pre-fabricated, metal-clad buildings, built near the base of the 450-ton bridge crane in the 1960s (Buildings 377, 379 and 380).

Figure 27. Building 815 was constructed in 1955 to consolidate laboratory and office facilities for NRDL. The building has historically been referred to as RADLAB. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

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[19] Bonnie Baumburg, Urban Programmers, National Register of Historic Places Nomination: 450-ton Bridge Crane, Hunters Point Shipyard, 1988. As cited in JRP Historical Resources Consulting Services, Historic Context and Inventory Evaluation of Buildings and Structures: Hunters Point Shipyard, September 1997. The crane is not currently listed on the NRHP.

IV. EVALUATIVE FRAMEWORK

Cultural resources are defined as buildings, sites, structures, or objects, each of which may have historical, architectural, archaeological, cultural, or scientific importance. Numerous laws, regulations, and statutes, on both the federal and state levels, seek to protect and target the management of cultural resources. Depending upon a variety of preconditions such as the inclusion of federal monies or significant effects on wetlands, federal or state law may be the primary governing code. These laws include the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), and the California Environmental Quality Act (CEQA). For the purposes of the environmental documentation for the project, cultural resources are considered under Section 106 of the NHPA and CEQA.

SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT

Section 106 of the NHPA requires federal agencies and those they fund or have approval authority over to consider the effects of their actions on properties that may be eligible for listing or are listed in the NRHP. To determine whether an undertaking could affect NRHP-eligible properties, cultural resources (including archaeological, historical, and architectural properties) must be inventoried and evaluated for listing in the NRHP. Although compliance with Section 106 is the responsibility of the lead federal agency, others can undertake the work necessary to comply with Section 106. The Section 106 process entails the six primary steps listed below[20]:

- Initiate consultation and public involvement.
- Identify and evaluate historic properties.
- Assess effects of the project on historic properties.
- Consult with the SHPO regarding adverse effects on historic properties, resulting in a memorandum of agreement (MOA).

[20] Not all steps are necessary for all projects. If no historic properties are identified, no additional steps are taken. If the project will not have an adverse effect on historic properties, no MOA is necessary.

- Agency official (from USACE) submits the MOA to the Advisory Council on Historic Preservation (ACHP).
- Proceed in accordance with the MOA.

NATIONAL REGISTER OF HISTORIC PLACES (NRHP)

The National Register is the nation's master inventory of known historic resources. It is administered by the National Park Service (NPS) in conjunction with SHPO. The National Register includes listings of buildings, structures, sites, objects, and districts that possess historic, architectural, engineering, archaeological, or cultural significance at the national, state, or local level. The National Register criteria and associated definitions are outlined in National Register Bulletin Number 15: How to Apply the National Register Criteria for Evaluation. The following is a summary of Bulletin 15:

Generally, resources (structures, sites, buildings, districts and objects) over 50 years of age can be listed in the National Register provided that they meet the evaluative criteria described below. Resources can be listed individually in the National Register or as contributors to an historic district.[21] The National Register criteria are as follows:

A. Resources that are associated with events that have made a significant contribution to the broad patterns of history;

B. Resources that are associated with the lives of persons significant in our past;

C. Resources that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

[21] A "contributor" is a building, site, structure, or object that adds to the historic associations or historic architectural qualities for which a property is significant. The contributor was present during the period of significance, relates to the documented significance of the property, and possesses historic integrity or provides important information about a period; or the contributor independently meets National Register criteria. A "non-contributor" does not add to the historic associations or historic architectural qualities as it was not present during the period of significance; it has experienced alterations, disturbances, additions, or other changes; or it does not independently meet the National Register criteria.

D. Resources that have yielded or may likely yield information important in prehistory or history.

Certain resources are not usually considered for listing in the National Register. These properties can be eligible for listing, however, if they meet special requirements, called Criteria Considerations (A-G), in addition to meeting the regular requirements (that is, being eligible under one or more of the four significance criteria and possessing historic integrity). Generally, such properties will qualify for the National Register if they fall within the following seven criteria considerations:

A. A religious property deriving primary significance from architectural or artistic distinction or historical importance;

B. A building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event;

C. A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his or her productive life;

D. A cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events;

E. A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived;

F. A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or

G. A property achieving significance within the past 50 years if it is of exceptional importance.

When nominating a resource to the NRHP, one must evaluate and clearly state the significance of that resource to American history, architecture, archaeology, engineering, or culture. A resource may be considered individually eligible for listing in the NRHP if it meets one or more of the above listed criteria for significance and it possesses historic integrity. Historic properties must retain sufficient historic integrity to convey their significance.

The National Register recognizes seven aspects or qualities that define historic integrity:

- **Location**. The place where the historic property was constructed or the place where the historic event occurred.
- **Design**. The combination of elements that create the form, plan, space, structure, and style of a property.
- **Setting**. The physical environment of a historic property.
- **Materials**. The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- **Workmanship**. The physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- **Feeling**. A property's expression of the aesthetic or historic sense of a particular period of time.
- **Association**. The direct link between an important historic event or person and a historic property.

To retain historic integrity, a resource should possess several of the above-mentioned aspects. The retention of specific aspects of integrity is essential for a resource to convey its significance. Comparisons with similar properties should also be considered when evaluating integrity as it may be important in deciding what physical features are essential to reflect the significance of a historic context.

THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

The California Environmental Quality Act (CEQA) provides the legal framework by which historical resources are identified and given consideration during the planning process. The law was adopted in 1970 and incorporated in the Public Resources Code §§21000-21177. CEQA's basic functions are to:

- inform governmental decision makers and the public about the potential significant environmental effects of proposed activities;
- identify ways to reduce or avoid adverse impacts;
- offer alternatives or mitigation measures when feasible; and
- disclose to the public why a project was approved if significant environmental effects are involved.

CEQA applies to projects undertaken, funded or requiring an issuance of a permit by a public agency. The analysis of a project required by CEQA usually takes the form of an Environmental Impact Report (EIR), Environmental Impact Statement (EIS), Negative Declaration (ND), or Environmental Assessment (EA).[22]

CALIFORNIA REGISTER OF HISTORICAL RESOURCES (CRHR)

The CRHR is a guide to cultural resources that must be considered when a government agency undertakes a discretionary action subject CEQA. The CRHR helps government agencies identify and evaluate California's historic resources, and indicates which properties are to be protected, to the extent prudent and feasible, from substantial adverse change.[23] Any resource listed in, or eligible for listing in, the CRHR is to be considered during the CEQA process.

1. A cultural resource is evaluated under four CRHR criteria to determine its historical significance. A resource must be significant in accordance with the one or more of the following criteria (as defined in §15064.5(a)(3):

2. Is associated with events that have made a significant contribution to the broad pattern of California's history and cultural heritage;

3. Is associated with the lives of persons important in our past;

[22] http://www.aqmd.gov/ceqa/
[23] PRC §5024.1(a)

4. Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

5. Has yielded, or may be likely to yield, information important in prehistory or history.

In addition to meeting one or more of the above criteria, the CRHR requires that sufficient time must have passed to allow a "scholarly perspective on the events or individuals associated with the resource." Fifty years is used as a general estimate of the time needed to understand the historical importance of a resource.[24] The OHP recommends documenting, and taking into consideration in the planning process, any cultural resource that is 45 years or older.[25] As such, this report evaluates all resources 45 years or older for the purposes of CEQA.

CRHR criteria are similar to National Register criteria, and are tied to CEQA, as any resource that meets the above criteria, and retains a sufficient level of historic integrity, is considered an historical resource under CEQA. Integrity is the authenticity of an historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. Historical resources eligible for listing in the California Register must meet one of the criteria of significance described above and retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. It is possible that historical resources may not retain sufficient integrity to meet the criteria for listing in the National Register, but they may still be eligible for listing in the California Register.[26]

Resources that are significant, meet the age guidelines, and possess integrity will generally be considered eligible for listing in the CRHR.

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[24] CCR 14(11.5) §4852 (d)(2).
[25] California Office of Historic Preservation, 1995, p.2. Instructions for Recording Historical Resources. Office of Historic Preservation, Sacramento.
[26] California Office of Historic Preservation, 2006, p.2. California Register and National Register: A Comparison. Technical Assistance Series No. 6. California Department of Parks and Recreation, Sacramento. Assistance Series No. 6. California Department of Parks and Recreation, Sacramento.

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HISTORIC DISTRICTS

According to National Register Bulletin 15 (NRB15), a historic district "possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development." Bulletin 15 continues:

CONCENTRATION, LINKAGE, & CONTINUITY OF FEATURES

> "A district derives its importance from being a unified entity, even though it is often composed of a wide variety of resources. The identity of a district results from the interrelationship of its resources, which can convey a visual sense of the overall historic environment or be an arrangement of historically or functionally related properties. For example, a district can reflect one principal activity, such as a mill or a ranch, or it can encompass several interrelated activities, such as an area that includes industrial, residential, or commercial buildings, sites, structures, or objects. A district can also be a grouping of archeological sites related primarily by their common components; these types of districts often will not visually represent a specific historic environment.

SIGNIFICANCE

> "A district must be significant, as well as being an identifiable entity. It must be important for historical, architectural, archeological, engineering, or cultural values. Therefore, districts that are significant will usually meet the last portion of Criterion C plus Criterion A, Criterion B, other portions of Criterion C, or Criterion D.

TYPES OF FEATURES

> "A district can comprise both features that lack individual distinction and individually distinctive features that serve as focal points. It may even be considered eligible if all of the components lack individual distinction,

provided that the grouping achieves significance as a whole within its historic context. In either case, the majority of the components that add to the district's historic character, even if they are individually undistinguished, must possess integrity, as must the district as a whole...A district can contain buildings, structures, sites, objects, or open spaces that do not contribute to the significance of the district. The number of noncontributing properties a district can contain yet still convey its sense of time and place and historical development depends on how these properties affect the district's integrity.

GEOGRAPHICAL BOUNDARIES

A district must be a definable geographic area that can be distinguished from surrounding properties by changes such as density, scale, type, age, style of sites, buildings, structures, and objects, or by documented differences in patterns of historic development or associations. It is seldom defined, however, by the limits of current parcels of ownership, management, or planning boundaries. The boundaries must be based upon a shared relationship among the properties constituting the district.

DISCONTIGUOUS DISTRICTS

A district is usually a single geographic area of contiguous historic properties; however, a district can also be composed of two or more definable significant areas separated by non-significant areas. A discontiguous district is most appropriate where:

- Elements are spatially discrete;
- Space between the elements is not related to the significance of the district; and
- Visual continuity is not a factor in the significance."[27]

[27] U.S. Department of the Interior, National Park Service. National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation, Section IV. Online at : http://www.nps.gov/nr/publications/bulletins/nrb15/nrb15_4.htm#district (Accessed: 7.10.2009).

SAN FRANCISCO LANDMARKS AND HISTORIC DISTRICTS

According to the San Francisco Planning Department:

> "The City of San Francisco maintains a list of locally designated City Landmarks and Historic Districts, similar to the National Register of Historic Places but at the local level. Landmarks can be buildings, sites, or landscape features. Districts are defined generally as an area of multiple historic resources that are contextually united. The regulations governing Landmarks, as well as the list of individual Landmarks and descriptions of each Historic District, are found in Article 10 of the Planning Code."[28]

According to San Francisco Preservation Bulletin #5, the San Francisco Landmarks Advisory Board and the Planning Commission use the National Register Criteria for evaluating potential historic properties.

HISTORICAL RESOURCE STATUS CODES

Properties included in the survey were assigned California Historic Resource Status Codes. Status codes reflect the eligibility of a resource at a specific point in time (the time the evaluation was performed) and therefore do not necessarily reflect the eligibility of a resource at a later point in time. If a resource is altered and changed in the future, it may no longer be eligible for the same historic resource designation.

New California Historical Resource Status Codes were instituted by the California State Office of Historic Preservation effective August 2003. The updated codes were used for this study. All applicable codes were assigned in order to provide as much information as possible for local planning officials.

[28] San Francisco Planning Department website, Historic Preservation: http://www.sfgov.org/site/planning_index.asp?id=77300#landmarks (accessed 5.14.2009).

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V. SURVEY RESULTS

INDIA BASIN SURVEY AREA

DESCRIPTION

According to the Project Description, the India Basin Shoreline Plan area, also known as Bayview Hunters Point Redevelopment Area C, encompasses:

> "…approximately 76 acres, including approximately 59.5 acres that are privately owned, 7.2 acres that are publically owned, and about 9.3 acres in public right of way…Existing land uses include residential, industrial, unimproved public shoreline open space, India Basin Shoreline Park, and vacant land. Residential uses, with some commercial uses, generally front on Innes Avenue. Industrial uses are interspersed among residential uses near the shoreline, including a boatyard on India Basin east of Innes Avenue. Activities at the boatyard are limited by tidal flows and shallow water depth. The former PG&E Hunters Point Power Plant, on a 35-acre site near Jennings Street and Hunters Point Boulevard, has been dismantled. The adjacent existing PG&E switching station is operational. A former PG&E fuel tank site is directly across Hunters Point Boulevard from the PG&E power plant site. Heron's Head Park is immediately north of the area, with industrial uses and Port of San Francisco maritime uses further north.

> "There are many vacant and underused parcels in India Basin. One of the largest vacant properties is a 13.5-acre privately owned parcel fronting the Bay northeast of Innes Avenue and bisected by Arelious Walker Drive, just north of the HPS. This site was previously referred to as the "Ferrari Site" and more recently as the "India Basin Flats." The shoreline band adjacent

to India Basin Flats site is open space owned by the San Francisco Recreation and Park Department."[29]

PREVIOUS SURVEY FINDINGS

India Basin neighborhood

Kelley & VerPlanck Historical Resources Consulting recently completed a historical resources survey of a large portion of the India Basin neighborhood for the Bayview Historical Society. The complete historical background and findings of this survey are documented in the report titled *India Basin Survey, San Francisco, California (Final Report, 1 May 2008)*.[30] The findings of this survey are summarized as follows.

Kelley & VerPlanck (K&VP) surveyed a roughly six-block area of the India Basin neighborhood including 113 single-family, industrial, maritime, and vacant properties. The boundaries of the India Basin survey area include the San Francisco Housing Authority's (SFHA) Westbrook and Hunters Point housing projects to the west and south, Earl Street to the east, and Hudson Avenue to the north. It also includes portions of two partially submerged blocks between Hudson and Galvez Avenues. (See survey area map with parcel ID numbers below).

Out of the 113 properties surveyed, K&VP identified four properties that appear to be eligible for listing on the California Register of Historical Resources: 702 Earl Street (APN: 4644/001 & 011); 900 Innes Avenue (APN: 4646/003); 911 Innes Avenue (APN: 4653/019); and 967 Innes Avenue (APN: 4653/012A). In early 2008, the Shipwright's cottage at 900 Innes Avenue became San Francisco Landmark #250. The former Albion Brewery building at 881 Innes Avenue (APN 4654/013) was found to appear eligible for listing on the National Register of Historic Places. The India Basin survey also identified a potential historic district, the India Basin Boatyards. According to the Department of Parks and Recreation District Record form for the proposed district:

[29] PBS&J for SFRA, Bayview Waterfront Project, Administrative Draft EIR – June 2009, p. II-12.
[30] Kelly and VerPlanck, Historical Resources Consulting. *India Basin Survey*, *Final Report.* Prepared for the Bayview Historical Society (1 May 2008).

> "The India Basin boat yards are located on the southern side of India Cove in the India Basin neighborhood of San Francisco. The proposed district is comprised of eight parcels within an area bounded roughly by Hunters Point Boulevard, Innes Avenue, Fitch Street and Galvez Avenue. The core of the proposed district centers on the intersection of Hudson Avenue and Griffith Street, neither of which is an officially opened street according to the Department of Public Works. The eight parcels are identified by their APN (Assessor Parcel Number): 4629A/010, 4630/002 and 006, 4645/010, 010A, and 011; and 4646/001 and 002. Although the ownership of these parcels is divided between several different owners and two boat yards have occupied the area since the 1960s, the entire survey area historically operated as a single yard (Anderson & Cristofani) before ca. 1965 and will therefore be described and evaluated as a single continuous property. The proposed district slopes gently downhill from near Innes Avenue to India Cove and extends into open water. Most of the land was historically either submerged tidelands or tidal flats that have since been filled. Remnants of piers and wood pilings extend into the shallow waters of India Cove, an area still occupied by submerged water lots and unopened 'paper' streets."[31]

Kelley & VerPlanck found that "the boat yards of India Basin appear eligible for listing in the California Register under Criteria 1 (Events) and 3 (Design/Construction)…as the last remaining historic boat yard at India Basin, the center of the bay scow building and repairing industry from the early 1870s to the mid-1930s."[32]

Pacific Gas & Electric (PG&E) Plant – Hunters Point

Blocks 4580, 4604A, 4603A and a portion of Block 4602A (Parcel ID# 1, 8, 7 and 6) are owned by PG&E and are the site of the former PG&E Hunters Point Power Plant, a

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[31] Kelly and VerPlanck, Historical Resources Consulting. *India Basin Survey*, *Final Report.* Prepared for the Bayview Historical Society (1 May 2008), Appendix – District Record Form.
[32] Ibid.

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35-acre site near Jennings Street and Hunters Point Boulevard that has been dismantled. The existing PG&E switching station is operational. A former PG&E fuel tank site is directly across Hunters Point Boulevard from the PG&E power plant site (Parcel ID # 7).

San Francisco Planning Department staff determined that the PG&E power plant building, constructed in 1929, was not a historic resource in a memorandum dated October 26, 2006. The planning department finding supported an earlier evaluation completed in September 2006 by Roland Nawi Associates and the building was demolished in 2008.[33] No other historic resources are present on the former PG&E Hunters Point Power Plant site (Parcel ID# 1, 8, 7 and 6) (see Figure 28.)

CIRCA SURVEY RESULTS

The remaining parcels within the India Basin survey area are comprised of unimproved public shoreline open space, India Basin Shoreline Park, and vacant land. No buildings or structures over 45 years old were found. This includes the following parcels, as identified in the survey map above by ID numbers: 2-5, 9-16, 17-35, 37-40, 43-45, 47, 49, 50-52. As such, no evaluation of historic resources is necessary. A survey matrix with property information and survey ID numbers keyed to the map below is located in Appendix C of this report.

[33] See: Planning Department, *Historic Resources Evaluation Response Memorandum for 1000 Evans Avenue*, October 26, 2006. Also see: Roland Nawi Associates: Preservation Consultants, PG&E Hunters Point Station P Evaluation of Eligibility, September 2006. A copy of each document is available for public review by appointment at the Planning Department as part of Case File No. 2006.1297E.

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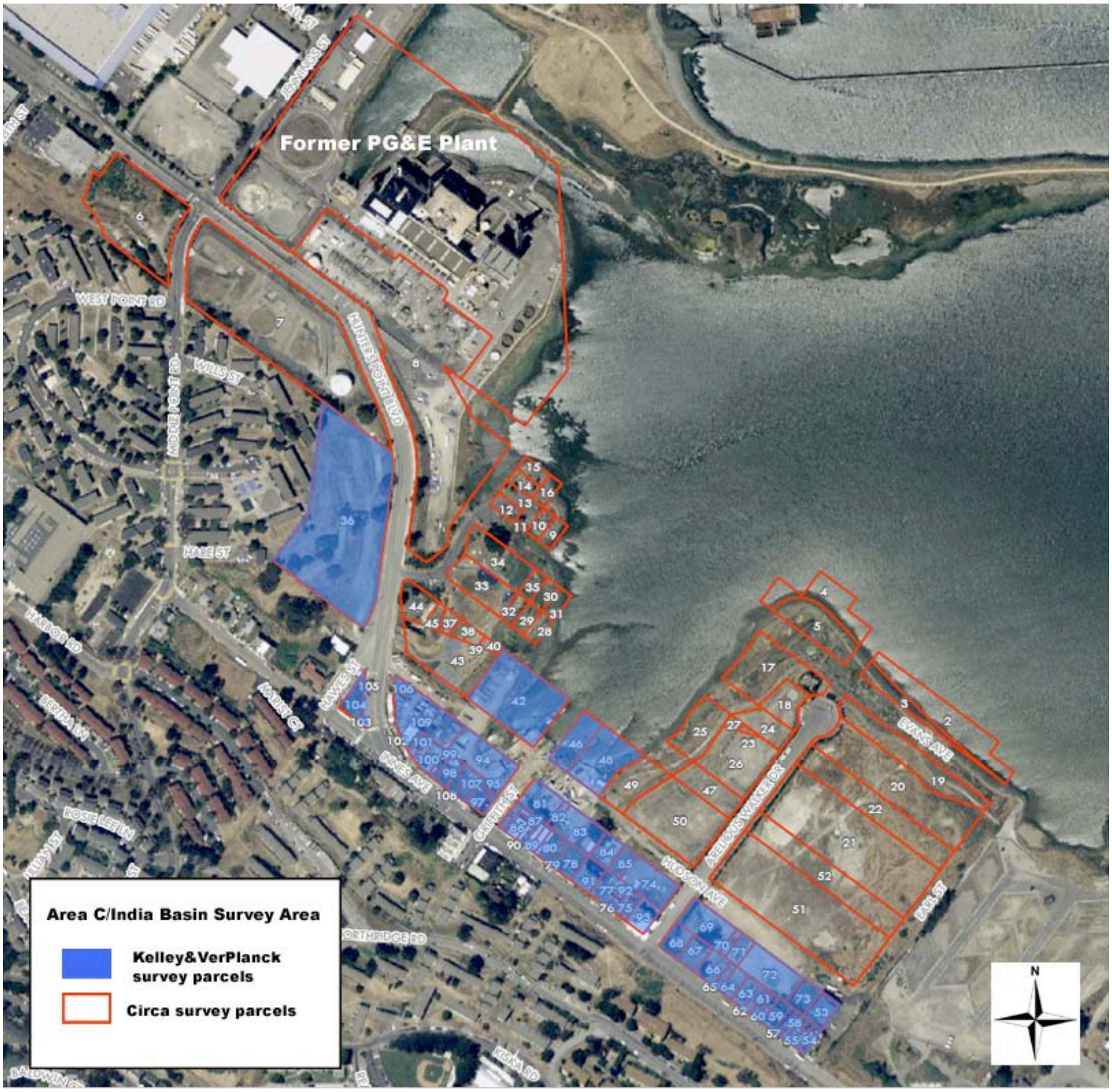

Figure 28. India Basin survey area showing lot lines and area boundaries. Base map courtesy of PBS&J.

CANDLESTICK POINT SURVEY AREA

DESCRIPTION

The Candlestick Point survey area encompasses most of the Candlestick Point part of the BVHP Plan ("Area B"), including the Candlestick Park sports stadium (formerly Monster Park), the Alice Griffith Public Housing site and Candlestick Point State Recreation Area (See survey area map with parcel ID numbers below). According to the Project Description:

"The Candlestick Point area is approximately 267 acres, including the Alice Griffith public housing site. Current land uses in the Candlestick Point area include Candlestick Park stadium, owned by the City and County and leased by the San Francisco 49ers National Football League team, and associated parking lots and access roadways. The stadium and parking lot areas are under the jurisdiction of the San Francisco Recreation and Park Department. The area includes several privately owned parcels near Gilman Avenue and Arelious Walker Drive, north of the stadium. That area is primarily vacant and used for stadium parking. A recreational vehicle park occupies a portion of the site on Gilman Avenue. The Candlestick Point area also includes the Alice Griffith public housing site, which is bounded by Gilman Avenue on its southwest, Hawes Street on the northwest, Carroll Avenue on the northeast and Arelious Walker Drive on the southeast."[34]

Please see Figure 29 for a visual overview of the Candlestick Point survey area. A survey matrix with property information and survey ID numbers keyed to the map below is located in Appendix C of this report.

[34] PBS&J for SFRA, Bayview Waterfront Project, Administrative Draft EIR – June 2009, p. II-11. (Confirm proper citation for final).

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Figure 29. Candlestick Point survey area showing lot lines and area boundaries. Base map courtesy of PBS&J.

PREVIOUS SURVEY FINDINGS

Candlestick Park

In May 2007, Architectural Historian Kathryn Hayley of Jones & Stokes completed a review of Monster Park (APN: 5000 001 30), a.k.a. Candlestick Park, for its eligibility for listing in the National Register of Historic Places (NRHP) as part of the Bayview Transportation Improvements Project.[35] This evaluation determined that Monster Park, which was constructed in 1960, did not meet the criteria that would qualify it as exceptional as a property that is less than 50 years of age. The conclusions are quoted below:

> "Although Candlestick/Monster Park is a well-known building in San Francisco, California, it does not appear to meet the threshold of NRHP exceptional significance for buildings less than 50 years old (Criterion G)…Although a number of culturally important events have occurred at Candlestick Park, in comparison to [other properties that have met this criterion such as the Whitney Museum of American Art in New York City], the building, one of many sports stadiums located in the United States, does not appear to embody qualities and characteristics (outstanding cultural, engineering or architectural significance) that would allow it to meet the 'exceptional significance' threshold, and therefore requires no further formal consideration.
>
> "In addition, Monster Park has been extensively altered since its initial construction in 1960, including ongoing maintenance and upgrades, the extensive expansion and enclosure of the structure in 1970, and the recent conversion of the park to a football-only facility. Because of these

[35] For full evaluation see: Memorandum, Kathryn Hayley to Meg Scantlebury, Re: Bayview Transportation Improvements Project – Evaluation Exemption for Monster Park (APN 5000 001 30) as per Attachment 4 of the Programmatic Agreement (15 May 2007). Memorandum in Appendix B of the Final Historic Property Survey Report, Bayview Traffic Improvements Project, Caltrans District 4, San Francisco, CA (October 2007), 1-13.

> changes, Monster Park does not appear to meet the high level of integrity necessary for the property to be considered exceptionally significant under NRHP Criterion G.[36]

The report concludes with the recommendation that the property be reevaluated for NRHP eligibility when it reaches the 50-year mark (in 2010). The property has not been evaluated for California Register eligibility and has not been previously included or listed in any local survey of historic properties.

Alice Griffith Public Housing

No previous studies have evaluated Alice Griffith Public Housing for eligibility for the National, State or local registers.

CIRCA SURVEY RESULTS

All parcels along the south side of the survey area (ID# 155, 134-143, 145-147, 150-154) and the large parcel that forms the eastern boundary (ID# 112) are State and privately owned property occupied by Candlestick Point State Recreation Area. The park is minimally developed with vehicle and pedestrian access paths. No buildings or structures over 45 years old are present.

The two parcels along the west side of Jamestown Avenue are vacant parcels that border the eastern side of Bayview Park. The south parcel (ID# 144) is owned by the City's Recreation and Park Department and the north parcel (ID# 148) is privately owned. No buildings or structures over 45 years old are present.

The four blocks bounded by Egbert Avenue (NE), Donahue Street (SE), Gilman Avenue (SW) and Arelious Walker Drive (NW) are occupied by vacant land used for parking lots and the Candlestick RV Park. The Candlestick RV Park property (parcel ID # 116-127, 129-130) is comprised of a paved parking area for RV parking and a modern building that faces Gilman Avenue. A sheltered storage area is located along the Egbert Avenue border. Just northwest of the RV Park are three vacant parcels (ID# 131-133) that

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[36] Ibid, 9-10.

appear to be used for event parking. Two additional vacant parcels (ID# 114-115) and one largely open parcel (ID# 113) containing three modern storage buildings are located just northeast of this parking area. Across Aurelious Walker Drive, an additional parcel (ID# 111) is cleared and used for event parking. No buildings or structures over 45 years old are present.

The remaining parcels comprise Candlestick Park (ID# 149) and Alice Griffith Public Housing (ID# 110).

Candlestick Park

It was beyond the scope of this project to conduct any additional review of the Candlestick Park stadium, however, Circa recommends that the property be reevaluated for eligibility for listing on the National Register of Historic Places once it meets the 50-year mark in 2010. Additionally, since the California Office of Historic Preservation recommends recordation of buildings 45 years old or older, Circa recommends the building be evaluated for the California Register of Historical Resources and for local listing as a San Francisco Landmark

Alice Griffith Public Housing

At the time of this evaluation the property is 47 years old. In general, in order to qualify for listing on the National or California Registers, a property must be 50 years old, meet one of the four criteria for significance and retain integrity. Unless the property demonstrates exceptional significance, a property less than 50 years old is not eligible for listing. However, the California Office of Historic Preservation recommends the recordation of properties 45 years or older, recognizing that there is commonly a five year lag between resource identification and the date that planning decisions are made. As such, an evaluation has been provided below.

Description

The Alice Griffith Housing Development sits on a single large parcel in the Bayview-Hunters Point neighborhood of San Francisco. Set on a rise overlooking Monster Park to the south, the development is generally bound by Carroll Avenue (north), Arelious Walker Drive (east), Gilman Avenue (south) and Hawes Street (west). A guard kiosk secures the property's Fitzgerald Avenue entrance at Cameron Way. The housing stock consists of 33 apartment buildings, constructed from standardized plans using five slightly different building types. The six (6) Type A buildings and eight (8) Type B buildings contain six (6) apartments each, the four (4) Type C buildings and seven (7) Type E buildings have ten (10) apartments per building, and the eight (8) Type D buildings each contain seven (7) apartments. The buildings line a simple circulation network of streets including Double Rock Street, a cul-de-sac named after the geologic formation visible at low tide nearby. (This is also the name of the war housing development that occupied this site during WWII – see *Bayview Waterfront Plan Historic Resources Evaluation, Volume I: Historic Context Statement*).

Rectangular in plan, the concrete buildings are topped by a side-facing, gravel covered gable roof and exterior walls are clad primarily in stucco with board and batten panels surrounding the second-story windows. The number of windows per building varies by building type, though the metal sash windows are consistent throughout. These are three-lite vertical windows with central awning sash at the ground level and two-lite windows at the upper level with fixed transom and lower awning sash. Each building has a concrete front walk and entry step and a rear, shared rectangular concrete patio with concrete planters and clotheslines. Simple flat roofs project over both the front and rear entry porches. A community garden and basketball court are located along the east side of the development, and the modern Alice Griffith Opportunity Center building is located at the southeast corner, adjacent to the development's Griffith Street entrance. The housing development was completed in 1962 and rehabilitated in 1980. Common alterations include installation of metal screen doors and window bars at the first floor windows. Some window and door openings have been covered with plywood panels. Though most of the original concrete planters are still extant, the original plantings have not been maintained. The property appears to be in good to fair condition.

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Evaluation

Under Criterion A/1, archival research yielded no information indicating that Alice Griffith Housing complex is strongly associated with an event or pattern of events important to local or regional history, or to the cultural heritage of California or the United States. The development was one of a number of housing developments constructed as part of the San Francisco Housing Authority's (SFHA) post WWII campaign to replace temporary war housing and address the need for public housing in the city. Though associated with this pattern of events, "mere association with historic events or trends is not enough to qualify under this criterion, and the property's specific association must be considered important as well". Since the property is not notably associated with the SFHA's building campaign or public housing in San Francisco, the development does not appear to be eligible for listing on the NRHP/CRHR under Criterion A/1.

The subject property also does not appear to be eligible under Criterion B/2 for association with persons significant in local, state or national history. Although later named for former SFHA board member Alice Griffith, the housing equality advocate died in 1959 and therefore has no direct involvement with the housing development. The property is not directly associated with Griffith's productive life and is therefore not eligible for listing on the NRHP/CRHR under Criterion B/2.

The subject property does not notably embody the distinctive characteristics of a type, period, region or method of construction, or represent the work of a master or possess high artistic values. While representative of its period, the overall architectural design displays no exceptional design characteristics. Further, though the property was designed by notable architects (Hertzka & Knowles and H.C. Baumann Associated Architects) and a well-known landscape architect (Douglas Bayliss), it is not particularly illustrative of any one of their characteristic design styles. A property is not eligible as the work of a master simply because it was designed by a prominent architect. Therefore, the subject property does not appear to be eligible for listing on the NRHP/CRHR under Criterion C/3.

Archival research provided no indication that the property has the potential to yield information important to prehistory or history, therefore the property does not appear to be eligible for the NRHP/CRHR under Criterion D/4.

Additionally, for the reasons noted above, the Alice Griffith Housing site does not appear to be eligible for local listing as a San Francisco Landmark or historic district.

HUNTERS POINT SHIP YARD SURVEY AREA

The Hunters Point Shipyard is comprised of approximately 420 acres of dry land and contains many buildings and structures associated with ship repair including, berths, piers, dry docks, warehouses, industrial shops, administrative buildings, and other structures, largely from the World War II and immediate post-war eras. Several former Navy buildings are currently leased and occupied as artist studios. The Hunters Point Shipyard survey area primarily consists of Navy Parcels B, C, D and E; most of the residential, commercial and administrative buildings on Parcel A were demolished in 2006-2007. Parcel F is comprised of approximately 440 acres of submerged lands in the San Francisco Bay surrounding the central portion of HPS to the north, east, and south.[37] Figure 30 below illustrates the existing Navy parcels and survey boundaries. The entire Hunters Point Shipyard survey area is currently under the jurisdiction of the U.S. Navy.[38]

PREVIOUS EVALUATIONS

Two prior historic resource evaluation reports for HPS have been completed since it was decommissioned in the 1970s. Bonnie L. Baumberg, of Urban Programmers in San Jose, prepared an historic context and evaluation document for the Navy in 1988. The report, entitled, *Historical Overview of Hunters Point Annex, Treasure Island Naval Base and Descriptions of Properties that Appear to Qualify for Listing in the National Register of Historic Places*, included a historical overview and evaluation forms (DPR 523 forms)

[37] Portions of Parcel F in HPS Phase II are proposed for water-related uses.
[38] PBS&J for SFRA, Bayview Waterfront Project, Administrative Draft EIR – June 2009, p. II-11 – II-12.

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SOURCE: PBS&J; CIRCA Historic Properties Development, 2009.

Clement Designs, 2009

HUNTERS POINT SHIPYARD HISTORIC SURVEY AREA

FIGURE 30

Figure 30. Map of the Hunters Point Shipyard survey boundaries. Map courtesy of PBS&J.

for buildings and structures that appeared to qualify for listing in the National Register. That report found that the following four properties were eligible for listing on the NRHP:

1. Dry Dock #4
2. Building 253, the Ordinance and Optical Building
3. 450-Ton Bridge Crane
4. The “Hunters Point Commercial Dry Docks Historic District,” which included Dry Dock No. 2; Dry Dock No. 3; remnants of Dry Dock No. 1, Pumphouse No. 2 (Building 205); Pumphouse No. 3 (Building 140); a Paint and Tool building (Building 207); a gatehouse (building 204); and the seawall and wharves in the area. Two non-contributing elements were included within the boundaries of this district: a Tool Room (Building 208) and a Shop Building (Building 141).

The report further concluded that no other buildings or structures at HPS qualified for listing on the NRHP.

In a June 1993 response letter to Louis S. Wall of the Naval Facilities Engineering Command in San Bruno, California, Steade R. Craigo, Deputy State Historic Preservation Officer, concurred with the above historic resources survey findings that Dry Docks 2, 3 and 4; Pumphouses No. 2 (Building 205) and 3 (Building 140) and their respective pumping machinery; gatehouse Building 204; wharves; the site of the western tip of Dry Dock No.1; Paint and Tool building (Building 207); and Building 253 were eligible for inclusion on the NRHP as members of a historic district. The letter states that:

> “Each of these resources are significant reminders of the historic function of Hunters Point during its period of significance as both a private and military shipbuilding and dry dock facility. Dry Docks No. 2 and 3 and their respective structures have been suggested as a potential district apart from Dry Dock 4 and Building 253. This is because of the association of

> Dry Docks 2 and 3 with the commercial dry docking enterprises that arose [in that area] in 1866 (when Dry Dock No.1 was constructed) to 1940. This seems appropriate since Dry Dock No.4 and Building # 253 are more closely associated with [the World War II-era function of Hunters Point under the command of the U. S. Navy]."[39]

The letter also upheld the findings that Buildings 208 and 141 were not eligible for listing on the NRHP.

In September 1997, JRP Historical Consulting Services completed an updated report entitled, *Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard, San Francisco, California* for the Naval Facilities Engineering command in San Bruno, California. This report provided the following conclusion regarding properties previously found eligible for the NRHP.

1. Dry Dock #4: Dry Dock # 4 "appears to qualify for listing in the National Register [because] it was and is one of the largest structures of its type on the West Coast and made a significant contribution to the American war effort during World War II. It also retains a high degree of integrity." The California State Historic Preservation Officer (SHPO) concurred with this finding of eligibility.[40]

2. Building 253: "does not meet the criteria for listing in the National Register because it is not significant and because of modifications to it since 1988, attributable chiefly to vandalism and neglect." [The building was also not found to retain a level of significance or integrity that would make it eligible for listing on the NRHP].[41]

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[39] Letter to Louis S. Wall of the Naval Facilities Engineering Command in San Bruno, California, from Steade R. Craigo, Deputy State Historic Preservation Officer, Re: Lease of Parcel A at the Naval Station Treasure Island Hunters Point Annex to the City of San Francisco, 16 June 1993.

[40] JRP Historical Consulting Services, *Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard, San Francisco, California. (*Completed for the Naval Facilities Engineering command in San Bruno, California, 1997), 3.

[41] Ibid, 4.

3. The 450-Ton Bridge Crane: "does not meet the criteria for listing on the National Register. The [SHPO] has agreed that the property does not meet the eligibility criteria for listing in the National Register because it lacks integrity." The traveling cranes were removed c.1970 and the basic bridge structure is all that remains of the original 1948 crane. In a 1993 letter to the Navy, acting SHPO Steade Craigo concurred that the structure had lost integrity and therefore did not qualify for listing in the National Register.[42]

4. The "Hunters Point Commercial Dry Docks Historic District": was found to appear eligible for listing in the NRHP with some revisions to the number of contributing buildings. JRP found that the following buildings contributed to the district: Dry Dock No. 2; Dry Dock No. 3; remnants of Dry Dock No. 1, Pump House No. 2 (Building 205); Pump House No. 3 (Building 140); a Paint and Tool building (Building 207); a gatehouse (Building 204). The seawall and wharves were found to no longer retain integrity and therefore no longer qualified as contributors to the district. It was further concluded that the remnants of Dry Dock 1 may or may not exist in the area, a fact that can only be proven by archaeological investigation, and therefore the location should be treated as an archaeologically sensitive area and potential contributing element of the historic district.

In a May 1998 letter to the Navy, the SHPO concurred with the Navy's findings that the Dry Dock 4 and the Commercial Dry Dock Historic District, which included as contributing structures Dry Dock 2, Dry Dock 3 and Buildings 140, 204, 205 and 207 appeared to qualify as eligible for inclusion in the NRHP.[43]

Currently, the following resources are listed in the Office of Historic Preservation Directory of Properties in the Historic Property Data File with the California Historical Resource Status Code of 2S2 – Individual property determined eligible for the NR by a consensus through Section 106 process and are currently listed on the CRHR:

[42] Ibid, 4. Also: Letter from Steade Craigo, Acting SHPO to Louis S. Wall, U.S. Navy, 1 April, 1993.
[43] Louis S. Wall, Department of the Navy to Lee Keatinge, Advisory Council on Historic Preservation, October, 15 1998. Findings of May 29, 1998 letter from SHPO to Navy are stated in this letter.

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- Dry Docks No. 2 and No. 3 and associated wharves and seawalls;
- Pump Houses No. 2 and No. 3 (Buildings 205 and 140);
- the (potentially extant) western portion of Dry Dock 1 and;
- the Gatehouse (Building 204).

No other buildings at the Hunters Point Shipyard have been found to be eligible for listing on the NRHP. In these previous studies, however, none of the buildings at HPS have previously been evaluated for listing on the California Register of Historical Resources or for local listing.

CIRCA FINDINGS: RESOURCES PREVIOUSLY FOUND ELIGIBLE FOR NRHP

Note: See Appendix B for DPR forms and Appendix D for a survey matrix with property-specific information and CA Status codes.

Dry Dock 4

Circa concurs with the SHPO finding that Dry Dock 4 appears to qualify for individual listing in the National Register "[because] it was and is one of the largest structures of its type on the West Coast and made a significant contribution to the American war effort during World War II. It also retains a high degree of integrity." Buildings, structures and objects that have been officially determined eligible for listing on the NRHP are automatically considered eligible for listing on the California Register. As such, Dry Dock 4 qualifies as a historic resource for the purposes of CEQA.

Building 253

Circa has found that Building 253, the Optical & Ordnance Building, appears eligible as a contributor to a potential CRHR historic district. See discussion of Hunters Point Commercial Dry Dock and Shipyard Historic District below.

450-Ton Bridge Crane

Circa concurs with the SHPO finding that this crane structure does not meet the criteria for listing on the National Register because it lacks integrity. The traveling cranes were removed c.1970 and the basic bridge structure is all that remains of the original 1948 crane. Additionally, the bridge crane does not appear to have been significantly associated with people or events important to California or local history, and therefore does not appear to be eligible for listing on the CRHR (under Criteria 1 or 2) or for local listing. Because of later alterations, the bridge crane structure does not appear to qualify for listing on the CRHR (Criterion 3) or for local listing as a significant example of a type, period, or method of construction or a representative of a significant technological advance in engineering. As such, the bridge crane does not appear to qualify as a historic resource for the purposes of CEQA. However, the structure has been a prominent point of visual interest along the waterfront since it was constructed and as such may warrant special consideration in the local planning process.

Hunters Point Commercial Dry Dock and Shipyard Historic District

Overview

Hunters Point Shipyard (Shipyard) occupies the eastern end of Hunters Point Hill. What was originally a narrow, steeply sloped finger of bedrock extending into San Francisco Bay has been transformed over the years into a flat expanse of reclaimed land. Part of the reclamation was accomplished through the leveling of portions of the original landform. Today, the Shipyard covers approximately 936 acres, of which approximately 493 acres are dry land and approximately 443 acres are under water.[44] By the time the Navy closed the Shipyard in 1974, the Shipyard contained over 337 industrial buildings, 57 housing and non-industrial buildings, 24,000 linear feet of pier, wall and wharf space, 21 repair berths, 10 additional deep water berths, 6 dry docks and a 225-ton crane (modified from the former 450-ton crane.)[45] As of July 2009, only 137 buildings and structures remain extant on the shipyard property, including only five residential buildings and roughly 15 non-industrial buildings. The piers, seawalls, berths and wharves appear to be generally extant though portions have deteriorated significantly

[44] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Reuse FEIR,* certified February 8, 2000, File No.1994.061E, pp. ES-1.
[45] City and County of San Francisco, Planning Department, *Hunters Point Shipyard Study Options for Future Use*, June 1974, p. 2-12.

due to neglect and exposure. The former 450-ton crane appears to be the last remaining large crane structure on the nearly 500 acres of available land.

The Shipyard has traditionally played a primary role in the development and definition of the Bayview and Hunters Point neighborhoods. In its early days as a private dry dock, it was the largest single commercial entity in the Project vicinity as well as the largest and most modern dry dock on the Pacific Coast.[46] This early enterprise represented a new era in maritime history, spanning from large wooden shipping craft to new steel-hulled vessels. After Navy acquisition in 1939, it brought national attention to the district and eventually resulted in the complete transformation of the economy and demographics of the area.

Naval interest in Hunters Point corresponded to a dramatic expansion in the size and importance of the United States Navy, as well as a general increase in the military's presence on the West Coast. Continued Pacific military campaigns (Philippine War, World War I, World War II) only emphasized the importance of West Coast military facilities. As part of this, the Navy became affiliated with the Hunters Point dry docks during this period, first as a client of the privately held shipyard then as owner of the shipyard. The continued expansion and successful operation of Naval campaigns in the Pacific Ocean was dependent on the availability of the facility's ship-servicing capacity. In 1939, when the Navy purchased Hunters Point, the facility became only the third Naval shipyard on the West Coast and the only one south of Puget Sound capable of handing modern military ships.[47] It retained this status until well after World War II when the Navy changed its policies to rely on private shipyards instead of maintaining its own facilities.

As important as Hunters Point was to the World War II Naval campaigns, it gained significance in its own right in the post-war period through its role as home to the Naval Radiological Defense Laboratory (NRDL). This facility was borne out of necessity in the

[46] "San Francisco Dry Dock: Its Location, Dimensions, Machinery, Etc.," *Daily Alta California*, April 16, 1867.
[47] Twelfth Naval District, Physical Properties Facilities and Services: Naval Activities and Principal Offices, June 1948.

latter war years and grew into a major research facility dedicated to studying the physiological impacts of radiological exposure as well as the detection of and protection from such nuclear hazards. This facility was established at Hunters Point Shipyard because of its many geographic, political and logistical advantages, and operated there from 1944 to 1969. It was one of the only facilities of its kind in the United States in either private or military control, was recognized as a leading research facility on a national scale and played a major role in every U.S. nuclear weapons test during its 25-year history.

Together, these areas of importance are reflected in the built environment. There are a small number of buildings that pre-date the Navy and comprise an already identified potential historic district near Dry Docks 2 and 3. The rest of the Shipyard building stock was historically almost evenly split between World War II era construction and post-war era construction, although recent demolitions have left more World War II structures at the expense of the post-war buildings. While not as impressive architecturally as the earlier dry dock buildings, these later military buildings and structures carried out operations critical to the United States' success during World War II. After the War, the shipyard continued to contribute to the success of military campaigns both as a shipyard as home to the Naval Radiological Defense Laboratory (NRDL, RADLAB).

District Description

The proposed Hunters Point Commercial Dry Dock and Naval Shipyard California Register Historic District is comprised of a collection of buildings, structures and objects associated with the area's transition from early commercial dry dock operation through its period of Radiological research. Hunters Point Shipyard began as the California Dry Dock Company in 1867-1868 when the first dry dock (Dry Dock #1) was cut from solid rock at the northeastern tip of Hunters Point. The dry dock facilities expanded in 1901-1903, when the newly formed San Francisco Dry Dock Company completed Buildings 204 (Gate and Pump House), 205 (Dry Dock No. 2 Pump House) and Dry Dock 2.[48] At the time it was the most modern dry dock on San Francisco Bay. Dry Dock 3 replaced

[48] Building 141, previously identified as a contributor to the potential NR district, has been demolished.

Dry Dock 1 in 1918, in response to an increase in Naval contracts.[49] Building 140 (Dry Dock No. 3 Pump House, 1918) was constructed in conjunction with this phase of development. Buildings 207 (Latrine building) and 208 (Shop Service, Tool Room and Canteen Building) were acquired with the property when the Navy took over in 1939 and were likely built c.1930. Navy records indicate that these two buildings were remodeled in 1942 and may have been moved to their current locations at that time. In 1939, in preparation for WWII, the Navy purchased the dry docks and adjacent support buildings. They then began the first direct government improvements (Building 231, 1942-1945) to expand the existing facilities. When the United States entered WWII in 1941, the Navy dramatically increased construction at Hunters Point to create a high tech shipyard capable of assisting with the maintenance and repair of the Pacific fleet.

The Historic District encompasses a range of buildings from each of the three primary periods of significance for Hunters Point Shipyard: early dry docks, Navy use during WWII, and radiological research in the WWII and post-WWII periods. This is represented by the early dry dock facilities (the previously identified Hunters Point Commercial Dry Dock District), the first building built by the Navy in preparation for WWII (Building 231, completed 1942), buildings important to the functioning of a high-tech mid-century Naval facility (the Optical, Electronics and Ordnance Building (Building 253, completed 1947), the original Shipfitters Shop (Building 211, completed 1942), and an air raid shelter (Building 224, completed 1944), later used for NRDL purposes. Buildings 224 and 253 were also utilized for radiological work at Hunters Point Shipyard in the post-war period. In addition, the chosen boundaries include relevant site features such as rail spurs, crane ways, light standards, bollards, dry dock pumping equipment and other built-ins, fencing and wharves. The remaining buildings (Buildings 214, 218 and 219) within the boundaries of the proposed historic district did not rise to a level of associative or architectural significance to qualify for inclusion.

[49] Dry Dock 3 was partially funded by the Navy to support the ever-increasing size of Naval vessels. This was done as a stop-gap measure while the Navy studied locations in the vicinity upon which to construct their own ship repair facilities.

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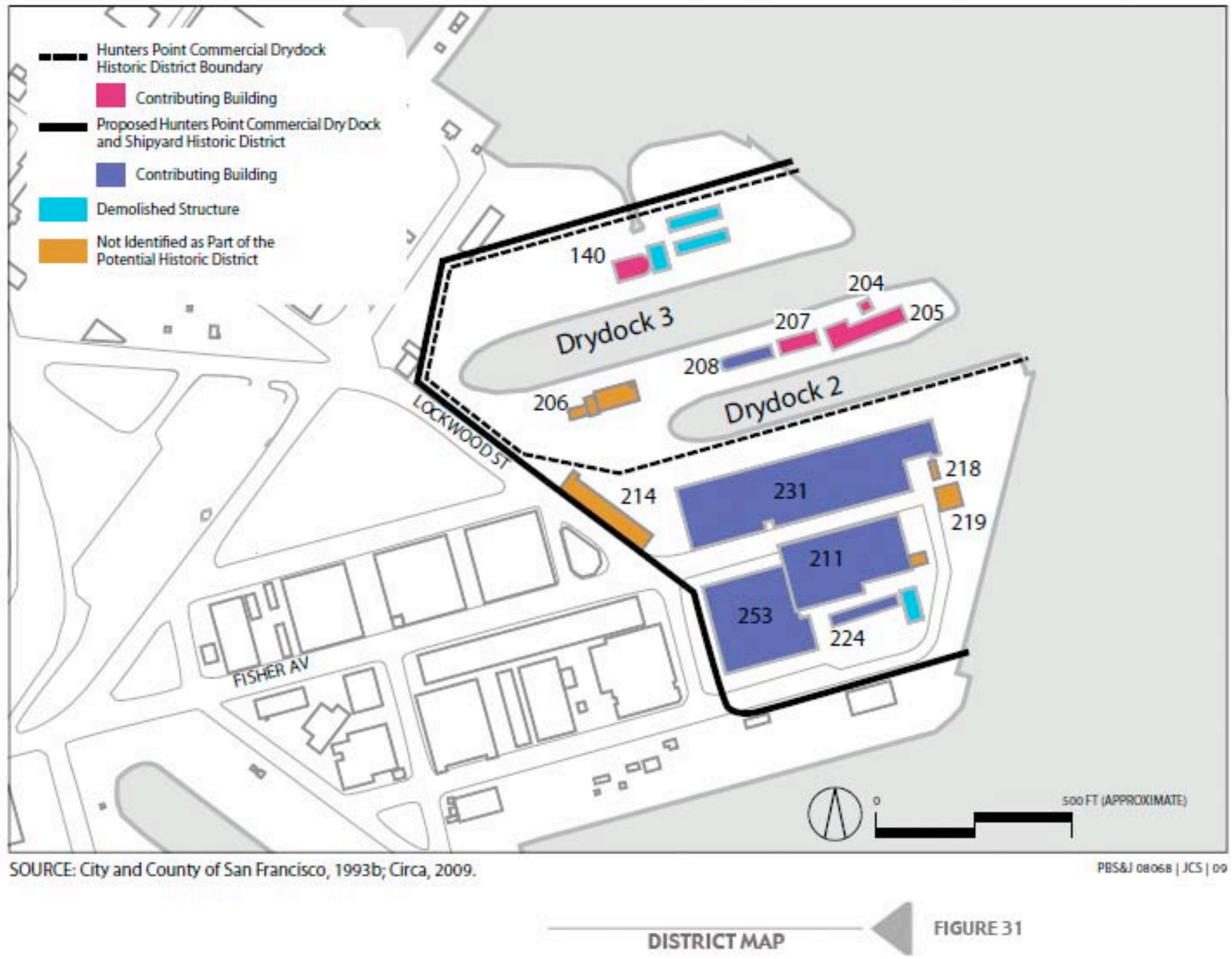

Figure 31. Map of the Hunters Point Shipyard Historic District boundaries. Map courtesy of PBS&J.

Boundary Justification

The proposed district is a potentially California Register-eligible district that circumscribes a previously identified, potentially eligible National Register Historic District (The Hunters Point Commercial Dry Docks Historic District). The boundaries of the new proposed California Register district encompass contributing buildings and structures determined in previous evaluations to be eligible for the National Register of Historic Places (Dry Dock 2, Dry Dock 3, Buildings 140, 204, 205, and 207) as a historic district under Criteria A and C. This eligibility was confirmed by the California State Historic Preservation Office (SHPO) and is therefore automatically considered as an eligible district for the California Register.

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This evaluation proposes to extend the existing National/California Register eligible district boundaries to include contributing buildings and site features constructed by the Navy in both the WWII and post-WWII periods that are significant under Criterion 1 and 3, therefore creating a larger California Register eligible historic district comprised of both NRHP eligible and CRHR eligible resources. The potential CRHR-eligible district possesses a significant concentration of buildings, structures and objects that together convey a visual sense of the overall historic environment that existed at the shipyard throughout the period of significance and includes representative buildings from all phases of development.

Period of Significance

The Period of Significance for the proposed expanded district is from 1903, the date of completion of the oldest extant buildings and structures at the Shipyard (Dry Dock 2, Buildings 204 and 205), through 1969, the year NRDL was decommissioned. Throughout this period, the proposed Hunters Point Commercial Dry Dock and Shipyard Historic District represents early commercial dry docking activities, state-of-the-art ship repair facilities and activities associated with a major national research institution (NRDL).

Evaluation

The Hunters Point Shipyard has a long history that began during a period of transition between wood-hulled sailing vessels and steel-hulled motor-driven vessels and ended with modern military warcraft. It serviced private ships during the height of water shipping on San Francisco Bay as well as military ships during four major wars/conflicts (Philippine-American War, World War I, World War II and the Korean Conflict.) During this time, it also served as a major radiological research facility that was unique within the United States military. This evaluation includes buildings that individually represent these various areas of significance and collectively demonstrate the broad spectrum of historical development at the Shipyard.

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The first building built by the Navy in preparation for WWII was Building 231 (1942-1945), the Inside Machine Shop. Constructed by the San Francisco-based firm of Barrett & Hilp and situated adjacent to Dry Dock 2, the curtain-wall building was for a brief period the only major functional shop at the Shipyard as the United States headed into WWII. Building 211 was also one of the first erected by the Navy. Constructed in 1942 by Barrett & Hilp, the building was the original Shipfitters Shop and is a good representation of the typical semi-permanent, monitor-roof shop building constructed throughout the Shipyard during the WWII era. Building 224, a concrete air raid/bomb shelter building built in 1944, and later used as an annex for the Naval Radiological Defense Laboratory (NRDL, RADLAB), is a unique representative of its type at the Shipyard. The only building within the proposed district completed after WWII is the Optical, Electronics and Ordnance Building (Building 253) finished in 1947 and attached to the west elevation of Building 211. This concrete frame curtain wall building, designed for the Navy by local architect Ernest J. Kump, was a highly specific repair and research facility. Related site features associated with the district include light standards, rail spurs, crane tracks, dry dock perimeter fencing, bollards and cleats.

According to the California Office of Historic Preservation, historic districts "consist of a significant concentration or continuity of associated historical resources. [They] may be recognized and documented at the time a survey is conducted, or they may become apparent only after several survey efforts reveal the historical relationships among the individually recorded resources in a given geographic region." National Register Bulletin No. 15, *How* to *Apply the National Register Criteria for Evaluation,* states that, "A district derives its importance from being a unified entity, even though it is often composed of a wide variety of resources. The identity of a district results from the interrelationship of its resources, which can convey a visual sense of the overall historic environment or be an arrangement of historically or functionally related properties."

The potential historic district encompasses a cross section of buildings, structures and objects, varying in age and function from the early commercial dry dock operations (1903), through the Shipyard's function as a high tech naval ship repair and decontamination facility in WWII, and as a ship repair and radiological research facility in the post WWII-period (1946-1969). The industrial buildings (140, 204, 205, 207, 208, 211, 231, 224 and 253), Dry Docks (#2 and #3), and other related site features represent a microcosm of the historical development and context of the Hunters Point Shipyard. The potential district contains previously determined National Register eligible buildings (automatically listed as a district on the California Register) as well as recommended contributors to a new expanded California Register Historic District. Though the condition of the buildings ranges from good to fair, the potential district as a whole retains a high degree of integrity of location, design, setting, workmanship, materials, association and feeling.

A district can comprise both features that lack individual distinction and individually distinctive features that serve as focal points. While buildings 207, 208, 231, 211, 224 and 253 may not be individually eligible for listing on the California Register, when combined with the historic dry docks and associated buildings, the district is a physical representation of the broad history of the Hunters Point Shipyard.

Note: no buildings remain from the earliest dry dock operations within the proposed historic district boundaries. Remnants of Dry Dock 1 (1868), which was replaced by Dry Dock 3 in 1918, may or may not exist in the area with sufficient potential to yield information that make the property eligible for the National Register. That point can only be proven through subsurface investigation. Until existence of the remnants of Dry Dock 1 has been demonstrated, its location should be treated as an archaeologically sensitive area and as a potential contributing element of the district.

CIRCA FINDINGS: RESOURCES PREVIOUSLY FOUND INELIGIBLE FOR NRHP

As part of the evaluation process, Circa completed additional research and analysis on a number of the more architecturally and/or functionally notable buildings from the Pre-WWII, WWII and Post WWII eras that retained a relatively good degree of integrity in order to determine if they displayed a level of significance that would make them individually eligible for listing on the NRHP, the CRHR or for local listing. These buildings and our evaluations are discussed below.

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Note: Please see DPR Primary A forms in Appendix B for photographs and physical descriptions of the following buildings. Those buildings that lacked integrity and those that are not yet 45 years old were not recorded but are noted in the matrix of shipyard buildings found in Appendix D.

Pre-WWII Buildings[50]

Building 109

Building 109 is a one-story, Spanish Revival style building constructed on Robinson Street in 1934. Triangular in plan and set into the hillside, the building is topped by a flat roof with Spanish-tiled parapets along the primary (south) elevation. The building was originally a restaurant that the Navy later adapted for use as a police station during World War II. Building 109 does not appear to qualify for listing in the NRHP, the CRHR or for local listing because it is not strongly associated with a significant historic event or person. Though the building is the only Spanish Revival style building at the shipyard, it is not a rare or distinctive example of the style. Additionally, original architectural elements appear to have been removed and some window openings have been infilled, alterations that have resulted in a diminished degree of historic integrity. As such, the building does not appear to be individually eligible for listing on the NRHP, CRHR or local register.

WWII-era Buildings[51]

Building 101 – Main Administration Building

This two-story Main Administration Building, built in 1943, sits on a rise overlooking the shipyard's heavy industrial center (200 series buildings). The compound plan building is organized around a central core that runs east to west, with five cross wings that extend across the core from north to south, creating courtyards on either side. Fenestration

[50] Except for Building 109, all other remaining Pre-WWII buildings are contributors to the Hunters Point Commercial Dry Dock and Shipyard Historic District.
[51] For buildings 224, 231 and 211 see District evaluation above. For Dry Dock 4 see evaluation discussion above.

consists primarily of paired, one-over-one wood windows and wood shiplap siding clads the exterior wall surfaces.

The building has had few major exterior alterations but records indicate that upgrade work (new roof, exterior paint, electrical and plumbing upgrades, minor interior upgrades) was completed in 1972-1973. Building 101 was the Main Administration Building for the Hunters Point shipyard providing general administrative oversight for daily operations the base. However, Hunters Point was an annex to the Mare Island Shipyard, which was the primary administrative headquarters for the Navy in the Bay Area during WWII.

Though somewhat architecturally interesting when compared to the other administrative buildings at the shipyard, Building 101 itself does not appear to have made a significant contribution to the ship repair function at Hunters Point during or after the WWII-era. Though it was the on site headquarters for the shipyard, most operations functions were directed from Mare Island. Research does not indicate that it was directly associated with any specific events notably important in the war effort or to post-war radiological research (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction (Criterion C/3). Built from a standardized plan, the building is similar to hundreds of other semi-permanent buildings built on Navy bases throughout the United States. Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Building 110 Marine Barracks

Building 110 faces Robinson Drive, just west of Building 101. Its design is evocative of the Art-Deco style, although the construction date of 1943 places the building at the latter end of that stylistic period. Rectangular in plan and topped by a flat roof, the building is constructed of reinforced concrete. Contractors Barrett & Hilp built this standard mess hall/barracks building using Bureau of Yards & Docks Drawings #184765. Minor upgrade work was completed in the galley and shower areas of the building in 1951.

Though architecturally distinctive when compared to the other barracks buildings at the shipyard, Building 110 itself does not appear to have made a significant contribution to the ship repair function at Hunters Point during or after the WWII-era (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction (Criterion C/3). Built from a standardized Bureau of Yards & Docks plan, the building is similar to hundreds of other semi-permanent buildings built on Navy bases throughout the United States. Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Building 134 Outside Machine Shop

Building 134, the Outside Machine and Diesel Engine & Gun Overhaul Shop is a two-story reinforced concrete building located at the southern end of the submarine repair area of the shipyard. Likely built using a standard plan, Walter L. Huber and Edward K. Knapik were the consulting civil engineers for this building. Though functionally related to the ship repair function of the shipyard, Building 134 itself does not appear to have made an individually significant contribution to the ship repair function at Hunters Point during or after the WWII-era (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction. Though Walter L. Huber was a noted local engineer, the building was likely built using standard plans and does not represent the work of a master or possess high artistic value. (Criterion C/3). Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Building 214 Administration Building

Building 214, originally two separate buildings housing an administration building and a cafeteria, later functioned as an accounting office and a credit union. This two-story building was adapted from standard Bureau of Yards and Docks plans and is similar in design to Building 215, the fire station. Plan drawings in the Navy's archives indicate that Barrett & Hilp (contractors) designed a central addition to connect the existing

Administration and existing cafeteria buildings in 1942. Various interior alterations were also made at that time.[52]

Building 214 itself does not appear to have made a significant contribution to the ship repair function at Hunters Point during or after the WWII-era (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction (Criterion C/3). Built from a standardized Bureau of Yards & Docks plan, the building is similar to other semi-permanent buildings built on Navy bases throughout the United States during the WWII-era. Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Building 215 HPSY Fire Station

Building 215 was constructed in 1942 to serve as the fire station for the base, a function that continues to this day. The second story addition was added shortly after construction and the building appears to be in good condition.

Building 215 itself does not appear to have made a significant contribution to the ship repair function at Hunters Point during or after the WWII-era (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction (Criterion C/3). Built from a standardized Bureau of Yards & Docks plan, the building is similar to other semi-permanent buildings built on Navy bases throughout the United States during the WWII-era. Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Building 351/351A Electronics Shop

Building 351 is a reinforced concrete industrial building constructed in 1945 and enlarged, with the addition of Building 351A, in 1960. Building 351 is a three-story, rectangular plan building with a flat roof and a tall freight elevator tower at the northwest

[52] See Drawing nos.110457-110461 on microfiche at Treasure Island Navy BRAC office.

corner. Bands of concrete spandrels and continuous steel sash glazing stretch around the second and third stories of the north, west (front) and south elevations. The corner tower is given a vertical emphasis with the use of both projecting and incised decorative vertical bands and two, tall window openings with multi-pane steel sash windows. The vertical emphasis of the tower, enhanced by the raised, fluted vertical bands on either side of the tower, lend a slightly Art Deco feel to the building.

Structural engineer W.P. Day, a structural engineer from San Francisco who was primarily involved in bridge design during much of the 20th century, designed building 351. This building was originally planned to serve as the Ordnance and Optical Shops (prior to the construction of Building 253), but was never used for this purpose due to inadequacies in design resulting from miscommunication among Navy personnel.[53] Records indicate that the building was used primarily as the Electronics Shop after the war and as NRDL Annex E from the late 1940s to the early 1950s.

Though somewhat architecturally distinctive when compared to the other shops buildings at the shipyard, Building 351/351A itself does not appear to have made a significant contribution to the ship repair function at Hunters Point during or after the WWII-era (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction (Criterion C/3). The building also does not appear to be a significant example of engineering design by W. P. Day, who was known primarily for his work in bridge design. Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Buildings 400, 404, 405, 406 and 407 – Supply Storehouses

Buildings 400, 404, 405, 406 and 407 are identical "Supply Storehouses," built in two rows, facing one another on "H" Street in the southern industrial area of the shipyard. All are rectangular and comprised of three identical sections with slight variations. Each

[53] JRP, DPR series form for Building 351/351A, p. 3 of 4.

section is a one-story, wood frame storehouse with monitor, sided in wood shiplap siding. Sliding industrial doors constructed with diagonal wood boards are located beneath each monitor, at either end of each building. Concrete and wood loading platforms attach to the buildings' north elevations, between the building and the adjacent rail spur.

Buildings 400, 404, 405, 406 and 407 do not appear to have made a significant contribution to the ship repair function at Hunters Point during or after the WWII-era (Criterion A/1). The buildings were not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and are not a distinguished example of their type, period or method of construction (Criterion C/3). Likely built from standardized Bureau of Yards & Docks plans, these supply storehouses are similar to other semi-permanent buildings built on Navy bases throughout the United States during the WWII-era. Therefore, the buildings do not appear to qualify for individual listing on the National, California or local registers.

<u>Building 505 Navy Exchange/Gymnasium</u>

Building 505, the Navy Exchange and Gymnasium, is located in the southern shipyard area. Generally U-shaped in plan, the wood frame building was originally clad in wood shiplap boards but is now covered with asbestos shingles. The various roof projections are topped with flat and shallow gabled roofs and the building is punctuated with vertical bands of awning type windows, many covered by plywood boards. Tennis courts, a basketball court and an archery field are located adjacent to the building at the north.

Navy records indicate that the building was reroofed in 1960 and exterior trim painted in 1970. Minor interior modifications were made in 1972 and 1973 including plumbing, electrical and general equipment upgrades. Navy records also indicate that Timothy Pflueger designed the barbershop and chaplain’s office portions of this otherwise standard plan building. These additions are located on the rear of the building and are architecturally compatible with the rest of the building.

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Though somewhat unique as one of the remaining personnel and social services buildings extant at the shipyard, Building 505 itself does not appear to have made a significant contribution to the ship repair function at Hunters Point during or after the WWII-era (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction (Criterion C/3). The involvement of notable architects and engineers in the design of military buildings during wartime was not uncommon and the portions of Building 505 designed by the firm of Timothy Pflueger are not distinguished examples of his work. Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Building 809 Storehouse

Building 809 is a square plan, wood frame building with monitor roof and wood shiplap siding. Large, central, sliding industrial doors are located at each end, allowing for a railcar to pass through the length of the Engine House. Two, sliding, diagonal shiplap-clad industrial doors are also located on the north wall, facing the four rail spurs that run parallel to this elevation. A pair of silos, set between two temporary trailers, are set to the east of the building and a bridge crane structure and two ancillary buildings are located near the building's west end.

Though Building 809 appears to be in excellent condition and retains a high degree of integrity, individually it does not appear to have made a significant contribution to the ship repair or NRDL operations at Hunters Point during or after the WWII-era (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction (Criterion C/3). Likely from a standardized Bureau of Yards & Docks plan, the building is similar to hundreds of other semi-permanent buildings built on Navy bases throughout the United States. Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Dry Docks 5, 6, and 7

Built in 1944, the chief function of Dry Docks 5, 6 and 7 was submarine repair, but it was also capable of housing destroyers and other relatively small vessels. Each dry dock is 420 feet by 60 feet, with a gate that is hinged at the bottom that flaps down to allow the vessel to enter. They were dewatered by four 20,000-gallons per minute (gpm) pumps. Two pumps were located at each side of the Bay end of the docks. Dry Docks 5, 6 (and possibly) 7 were used for decontamination of ships from OPERATION CROSSROADS and submarine repair (NAVSEA). Railroad spur lines run the length of each dock projection.

These Dry Docks do not appear to have achieved national, state or local significance for their role in submarine repair during the WWII-era (Criterion A/1) or as distinguished examples of naval engineering (CriterionC/3). The primary responsibility for submarine repair during the war was assigned to Mare Island and the submarine function at Hunters Point, by contrast, was relatively insignificant. As such, Dry docks 5, 6, and 7 do not appear eligible for listing on the NRHP, CRHR or for local listing.

Remaining Buildings

See tables on pages 91-92 below for findings evaluation for remaining WWII-era buildings.

Post WWII-era Buildings[54]

Building 411 Shipfitters, Welders & Boilermakers Building

Building 411 is a large, rectangular plan, steel framed curtain wall building, completed in 1947. Essentially four to five stories in height and topped by a bi-level sawtooth roof, the building has a concrete base and exterior walls clad in corrugated transite. Bands of multi-pane, steel sash windows stretch across each elevation of the principal building. Both the north and south elevations feature four sets of massive, multi-pane glazed,

[54] For the 450-Ton Bridge Crane see findings above.

steel sliding industrial doors. The eastern additions consist of two, two-story reinforced concrete buildings with vertical elevator shafts reaching four stories. Each building is glazed on both the first and second stories with continuous bands of steel, multi-pane industrial sash windows, the upper level with operable awning sashes in each window.

Austin Willmott Earl, a San Francisco Structural Engineer designed Building 411 for the Navy and Albert Kahn & Associates Architects & Engineers, Inc. appear to have been contracted as for additional design consultation. Retained as the consulting structural engineer for a number of projects at Hunters Point Shipyard, Austin W. Earl received the Civilian Merit Award for his work during World War II for the Navy's Bureau of Yards and Docks. Earl became a recognized authority on waterfront construction and was responsible for the engineering of many industrial structures at Mare Island, Hunters Point and Port Chicago. It is unclear to what extent the firm of Albert Kahn & Associates was involved in the design of this building, however, Albert Kahn himself was not involved n the design or construction for Building 411 as he died in 1942. The architectural plans are dated 1945 and the building was not completed until 1947. Barrett & Hilp constructed the building.

The sheer size of this massive industrial building distinguishes it from other shops buildings at the shipyard, however, Building 411 itself does not appear to have made a significant contribution to the ship repair function at Hunters Point during the WWII-era as it was not completed until 1947 (Criterion A/1). The building was also not found to be notably associated with persons significant to National, California, or local history (Criterion B/2). Further, it is not a distinguished example of its type, period or method of construction as steel framed, curtain wall shop buildings were a common building type for the Navy since World War I. While notable within the shipyard setting, other examples of this type can be found within the Bay Area (Mare Island) and throughout the United States. Additionally, the building is not significant as the work of a master. Austin W. Earl served as a supervising engineer in charge of the engineering section at Mare Island Naval Shipyard during World War I, where he designed many of the original seawall and harbor installations. In the early 1920s, he was the Chief Design Engineer for Alameda County, CA, where he worked on the Posey Vehicular Tunnel (a.k.a. the

"Posey Tube") connecting Oakland and Alameda, one of the first precast concrete tunnels to be constructed. After working with a private company in Vancouver, Canada, during the 1930s, Earl and opened his own firm as a consulting civil engineer in 1940. During World War II, Earl designed wharves, piers, ammunition and fuel storage facilities and other buildings for the U.S. Navy and received a Civilian Merit Award in recognition of his services.[55] As noted above, the building was not directly associated with the architect Albert Kahn and while likely designed using architectural and design principled pioneered by Kahn, Building 411 is not an example of his work. As such the building is not significant for architecture or engineering (Criterion C/3). Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Building 521 – Power Plant, South Area

Building 521 is a reinforced concrete and steel building in the south shipyard area with a rectangular plan and a flat roof. A full-height water tank with metal stairs and bi-level walkways is attached to the north elevation and two metal smokestacks pierce the roof to the south. Both the east and west elevations feature three large, vertical stacks of multi-pane steel sash windows and each end has a wall of fixed, square, 25-lite windows arranged in a six-by-six block.

Built by Barnes Construction Company, Building 521 was completed in 1948 and appears to have been built from a standard plan. It is one of two suspected sites of fuel oil burning from three OPERATION CROSSROADS target ships. The power plant building itself does not appear to have made a significant contribution to the ship repair function at Hunters Point (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is a typical utility building and not a distinguished example of its type, period or method of construction (Criterion C/3). Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

[55] Earl, Austin Wilmott, ASCE Life Member (1880-1965). (Transactions of the American Society of Civil Engineers, 1966), 894.

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Buildings 707 - Animal Hospital and waste disposal

Building 707 is a one-story, stucco clad, wood frame structure with a flat roof and irregular plan. It is located along the western edge of the shipyard in what is known as the "707 triangle".

From the beginning, NRDL occupied many buildings at the shipyard but in 1955, most of the 600 staff members moved into Building 815, which had been specifically design and built for NRDL activities and came to be known as the RADLAB. Building 707 was used as a storage and disposal facility for radioactive waste processing in the 1940s and 1950s. Animal studies were also a large component of NRDL research at the shipyard as animals were used as human substitutes for hazardous materials exposure experiments. Animals were raised and kept on site and Building 707 was used as an animal hospital and animal colony. While Building 707 is associated with the activities of NRDL at Hunters Point Shipyard, it was used for only one aspect of the research and did not house active test subjects; special rooms in Building 815 were designated for this purpose. As such, the building does not represent the depth of work completed at HPS by the nationally recognized NRDL and is not significant under Criterion A/1.

The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and is not a distinguished example of its type, period or method of construction (Criterion C/3). Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Building 709 Naval Exchange Gas Station

Building 709 is a one-story, reinforced concrete with Art Deco features. Set facing the intersection of Manseau and "I" Streets, the building has a number of large vehicular entrances, and smaller pedestrian entry openings. Any original doors and/or glazing for these openings are no longer extant and all other window and door openings are covered with plywood boards. What appears to be a decorative band of shaped metal wraps around the top of the building and two Art Deco-style pillars flank the central entrance. The metal ornament has rusted and is staining the exterior walls.

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Though architecturally distinctive when compared to the other shops buildings at the shipyard, Building 709 was completed in 1952 and does not appear to have made a significant contribution to the ship repair function at Hunters Point in the post WWII-era (Criterion A/1). The building was not found to be notably associated with persons significant to National, California, or local history (Criterion B/2) and, while interesting, is not a distinguished example of its type, period or method of construction (Criterion C/3). Furthermore, due to vandalism, removal of historic materials and exposure to the elements, this building has lost a significant amount of historic integrity. Therefore, the building does not appear to qualify for individual listing on the National, California or local registers.

Remaining Buildings

The following buildings comprise the remainder of buildings and structures extant at the Hunters Point Shipyard that are over 45 years of age. None of the buildings appear to qualify for individual listing on the NRHP, the CRHR, or for local listing. The following buildings have no known associations with events or persons important to the history of the Nation, California or the City and are not notable examples of architectural design or engineering.

Though the buildings were constructed as part of a vast support facility built to assist with the activities carried out at Mare Island and at Hunter's Point through 1974, simple association with historic events or trends is not enough, in and of itself, to qualify under Criterion A/1. Each property's specific association must also be considered important. Since none of the buildings appear to have made particularly significant contributions to the Navy's war effort or to the operations of the NRDL during that time, they don't exhibit a level of associative significance necessary for listing on the NRHP, CRHR or for local listing. From a design standpoint, the majorities of these buildings were built using standard Bureau of Yards & Docks plans or variations thereof and are similar to other WWII-era military installations located throughout the Nation. While some notable architects, engineers and contractors were involved in the design and construction of a number of buildings at the shipyard, this owes more to the fact that civilian architectural contracts were scarce during the WWII-era and military contracts abundant. Even in cases where noted architectural firms were involved in the design/construction process, it was common practice to use the many standardized Bureau of Yards & Docks plans available, adapting them to specific conditions at each base. As none of the buildings appear to be distinguished examples of their type, period or method of construction, do not represent the work of a master or possess high artistic value, they do not appear to be eligible for the NRHP, CRHR or for local listing under Criterion C/3. Further, many exhibit diminished integrity due to additions, alterations and exposure to the elements.

In general, the buildings do not qualify as contributors to a larger historic district because 1) better examples of these types of buildings are found within the proposed district, within the Bay Area, and on military bases throughout the United States; 2) inclusion of these buildings within the proposed historic district would not expand or augment the historic context or architectural value of the proposed historic district; and 3) the buildings do not retain enough integrity as a whole to justify an expansion of the proposed district.

Radiological Buildings

As discussed in Volume I: Historic Context of this document, the development and use of atomic weapons at the close of WWII had broad impacts beyond the use of weapons in Japan and in weapons testing. The military realized the immediate need of developing a facility to study the affects of atomic weapons on living organisms and military assets, as well as to develop defensive and protective measures against the effects of the weapons. In 1946, the Chief Naval Officer stipulated that a group be developed to study and advance radiological safety for the Navy; this group was first known as the Radiological Safety Section (RSS) and headquartered at Hunters Point Shipyard. The original charge of the RSS included the development of radiological detection instruments for use onboard ships and the development of methods and equipment to decontaminate ships and other equipment that had been exposed to radioactive matter. The RSS played a key role in the decontamination of OPERATION CROSSROADS ships at Hunters Point.

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By 1948, the RSS was formalized as National Radiological Defense Laboratory (NRDL) and the mission was greatly expanded with a new focus on practical and applied While NRDL activities were scattered throughout the shipyard, the headquarters for radiological study was Building 815. Many of the buildings used for NRDL purposes have been demolished in recent years as part of environmental remediation efforts. Building 815 is located just outside of the study area and was not evaluated as part of this report. However, Circa recommends that a full historic resource evaluation be completed for this building prior to any demolition proceedings as it is the best representative example to the work of the NRDL remaining at the shipyard site.

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TABLE 1 REMAINING WWII BUILDINGS NOT FOUND TO BE SIGNIFICANT				
Administrative	**Residential & Related**	**Utility**	**Warehousing, Supply & Industrial**	**Shops, Shipbuilding & Repair**
Building 121 - Submarine Offices & Apprentice School	Building 103 - Submarine Barracks	Building 122 - Substation V	Building 304 - Service/Gas station	Building 113/113A - Torpedo Storage & Overhaul Building; Tug Maintenance
Submarine Pier Office; Administration Building	Building 104 - Submarine Barracks	Building 135 - Substation G and compressors	Building 307 - Storage: Electronics & Public Works	Building 123 - Battery Overhaul & Storage Building; Substation T
Submarine Pier Office/Tug Crew's Barracks	Building 115/116 - Submarine Training School; US Navy Drill Hall, Submarine Subsistence	Building 203 - Power Plant, Substation H	Building 401 - General Warehouse; building trades shop	Building 128 - Shop Service Building; Substation U; Work Control Center No. 1
Building 238 - Misc. Admin. Building.	Building 117 - Submarine Barracks	Building 206 - Substation A and compressors	Building 402 - Supply storehouse	Building 130 - Pipefitters' Shop
	Building 120 - Enlisted Men's Club	Building 219 - Substation E	Building 412 - RR Scales	Building 146 - Industrial Photo & Laboratory Building
	Building 125 - Submarine Cafeteria	Building 229 - Substation L	Building 413 - Cable Storage Building/Supply Storehouse	Building 217 - Sheetmetal & Ship Repair Shop
	Building 218 - Latrine	Building 236 - Salt Water Pump House	Building 414 - Supply Storehouse; mold loft (1945)	Building 230 - Machine Shop
	Building 226 - Latrine	Building 300 - Substation N	Building 808 - Industrial Storage Building	Building 225 - Shop Service
	Building 228 - Central Cafeteria	Building 306 & 306A-Substation I	Building 810 - Paint & Oil Storage	Building 241 - Boilermakers' & Blacksmiths' Shop
	Building 252 - Bus Terminal/Coffee Shop	Building 308 - Salt Water Pump House/Fire Protection Pumping Station		Building 251 - Electricians' Shop
	Building 301 - Latrine			Building 272 - Riggers' & Laborers' Shop
	Building 500 - Ship's Officers' Bachelor Quarters			Building 280 - Covered Work Area
				Building 302 - Transportation Shop; Automotive vehicle Maintenance facility
				Building 303 - Transportation Shop Annex

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TABLE 1 - CONTINUED REMAINING WWII BUILDINGS NOT FOUND TO BE SIGNIFICANT				
Administrative	**Residential & Related**	**Utility**	**Warehousing, Supply & Industrial**	**Shops, Shipbuilding & Repair**
				Building 363 - Shipwrights' & Joiners' Shop; Woodworking Shop

TABLE 2 REMAINING POST WWII BUILDINGS NOT FOUND TO BE SIGNIFICANT				
ADMINISTRATION & SUPPORT	**SHIP REPAIR & OUTFITTING**	**RADIOLOGICAL LABORATORIES**	**WAREHOUSING**	**MISCELLANEOUS SHEDS/SHOPS**
Building 159 - Latrine	Building 258 - Pipefitters Shop	Building 366 - Boat/Plastics Shop and NRDL Electronics work area &lab	Building 813 - Supply Office & Storehouse	Building 377 - Workshop & Poseidon Systems Test Engineering
Building 154 - Area Time Office No. 1	Butler Buildings - 156, 271, 274, 275, 323, 324, 368, 369, 415, 416, 525, 526, 530, 704 - Storage and misc. industrial uses	Building 707 - Animal Hospital and NRDL Annex N; Animal colony and waste processing		Building 379 - Instrumentation/Control
Building 367 - Work Control Center # 3	Building 371 - Transportation Shop Annex	Building 708 - NRDL Bio-med/animal research facility; Animal psychology study colony		Building 380 - Workshop & Poseidon Systems Test Engineering
Building 370 - Latrine	409/409A - Welder Motor Generator Building			Building 417 - Acetylene Manifolding Building
Building 378 - Latrine	Miscellaneous sheds (Buildings C-K, C-G, C-J, C-F and C-I) near Building 229 – poor condition.			Building 419 - Oxygen Converter Building
Building 424 - Area Time Office No. 4				Building 420 - Oxygen cylinder charging building
Building 523 - Salt Water Pump House				Building 527 - Motor Generator Building
Building 710 - Latrine				
Building 819/823 - Sewage Pump Station A/Storage				

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Demolished Buildings

A comparison of existing buildings with the matrix included in the 1997 Survey & Evaluation Report by JRP: Historical Resources Consulting indicates that buildings demolished since 1997 include the shipyard post office (Building 102), industrial shop buildings of various sizes, latrine buildings, a sentry house, small office/administration buildings, lab buildings, storage sheds, a service station, a particle accelerator building, an Officer's Club building, water tower, clocking stations and 44 single family residences. Much of this demolition, including the entire residential district on Parcel A, was demolished as part of Hunters Point Phase I in 2006. Many buildings have been recently demolished because they were utilized for research or decontamination purposes by the NRDL and removal was necessary as part of ongoing decontamination/environmental remediation efforts by the Navy. The following buildings were extant at the time of the initial site tour for this study on July 12, 2007 but have since been demolished: Building 365 (1951), Personnel Decontamination Center; Building 408 (1947), Furnace Shelter; Building 421 (1947), Oxygen Control Building; and Building 916 (c.1930), Dago Mary's restaurant. The most recent research trip to Hunters Point Shipyard in April 2009 indicated that portions of roadways have been removed. The extent to which remaining site features such as rail spurs, paved circulation paths, light standards and street signs have been removed since that time is unknown.

Buildings that Lack Integrity

The following buildings are small utility and storage buildings that exhibit low material integrity and were not evaluated for significance; Buildings 435, 436 and 437, equipment storage sheds; Miscellaneous sheds (Buildings C-K, C-G, C-J, C-F and C-I) near Building 229; Building 410, welder motor generator building; and Building 418, metal spray building.

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Buildings Under 45 years

The following buildings are under 45 years of age and were not evaluated for significance as part of this survey: Building 281 (1970) Electronics, Weapons, Precision Facility/Antenna Repair; Building 282 (c.1970) Antenna Abrasive Cleaning Unit; Building 360 (c.1970) Test Building; Building 381 (1985) Shock test facility, Building 383 (1985) Poseidon Shipping & Receiving, Building 384 (1986) Poseidon Engineering, Building 385 (1985) Poseidon Engineering, Building 439 (1973) Equipment Storage; Sheet Metal Shop, Building 600 (1971) Bachelor Enlisted Quarters, Building 606 (1989) Police Station, Building 821 (1965) NRDL Research X-ray Lab.

CONCLUSIONS

India Basin

A number of parcels within the India Basin survey area had recently been surveyed and evaluated by Kelley & VerPlanck: Historical Resources Consulting. The study identified four properties that appear to be eligible for listing on the California Register of Historical Resources: 702 Earl Street, 900 Innes Avenue[56], 911 Innes, and 967 Innes Avenue. The former Albion Brewery building at 881 Innes Avenue was found to appear eligible for listing on the National Register of Historic Places. The India Basin survey also identified a potential California Register-eligible historic district, the India Basin Boatyards.

Also located within the India Basin survey area boundaries is the site of the former PG&E plant. This building, constructed in 1929, was determined not to be a historic resource by the San Francisco Planning Department staff in 2006 and the building demolished in 2008. The remaining parcels within the India Basin survey area are comprised of unimproved public shoreline open space, India Basin Shoreline Park, and vacant land. No other buildings or structures over 45 years old were identified.

[56] In early 2008, the Shipwright's cottage at 900 Innes Avenue became San Francisco Landmark #250.

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Candlestick Point/Alice Griffith Survey Area

The Candlestick Point survey area encompasses most of the Candlestick Point part of the BVHP Plan ("Area B"), including the Candlestick Park sports stadium (formerly Monster Park), the Alice Griffith Public Housing site and Candlestick Point State Recreation Area. Circa evaluated the Alice Griffith Housing site and found it ineligible for listing on the NRHP, the CRHR or as a local landmark. With exception of Candlestick Park stadium, no other resources over 45 years of age exist within the survey area.

Jones & Stokes completed a recent evaluation of Candlestick Park sports stadium and found the property to be ineligible for listing on the NRHP. The property has not been evaluated for California Register eligibility and has not been previously included or listed in any local survey of historic properties. It was beyond the scope of this project to conduct any additional review of the Candlestick Park stadium, however, Circa recommends that the property be evaluated for eligibility for listing on the California Register of Historical Resources and for local listing.

Hunters Point Shipyard Survey Area

In 1997, an inventory and evaluation of buildings and structures at Hunters Point Shipyard identified approximately 225 extant buildings and structures. All buildings on Parcel A, with exception of Buildings 101 and 110, were demolished in 2006-2007 as part of Hunters Point Shipyard Phase I. In July 2007, Circa: Historic Property Development began work on the development of a historic context and historic resources survey and inventory of extant buildings and structures at the Hunters Point Shipyard. A total of 134 buildings and structures were identified as existing properties at the shipyard in 2007. Since that time four buildings are known to have been demolished and a total of 130 buildings and structures were known to be extant at the conclusion of Circa's evaluation work in April 2009. Out of this total, a potential California Register eligible historic district was identified that contains containing five buildings and two structures previously determined eligible for the National Register of Historic Places (NRHP), as well as four additional buildings previously unevaluated for listing on the California Register of Historical Resources (CRHR). The proposed Hunters Point

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Commercial Dry Dock and Naval Shipyard Historic District is comprised of the following resources:

- Dry Dock 2
- Dry Dock 3
- Building 140 (Dry Dock No. 3 Pump House)
- Buildings 204 (Gate and Pump House)
- 205 (Dry Dock No. 2 Pump House)
- Buildings 207 (Latrine building)
- 208 (Shop Service, Tool Room and Canteen Building)
- Building 211 (Shipfitters/Electronics Shop)
- Building 231 (Inside Machine Shop)
- Building 253 (Optical, Electronics and Ordnance Building)
- Building 224 (air raid shelter, NRDL Annex)

In addition, Circa found that Dry Dock 4 retained a level of integrity enabling it to remain eligible for individual listing on the NRHP. A summary of findings for significant buildings is provided in Table 3 on the following page.

Of the 121 remaining buildings, 11 were less than 45 years old and six were found to lack integrity; these properties were not evaluated for significance. The remaining 104 buildings and four structures were evaluated for eligibility for listing at the national, state and local levels. None of the remaining buildings or structures were found to be individually eligible for listing on the NRHP, the CRHR or as San Francisco Landmarks. Further, they were not found to be eligible as contributors to a national, state or local historic district.

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TABLE 3 SUMMARY OF FINDINGS FOR SIGNIFICANT BUILDINGS					
	1988 Urban Programmers Report	**1993 SHPO Concurrence**	**1997 JRP Report**	**Current CRHR Status codes**	**2009 Circa Findings**
Dry Dock 1	NR District Contributor	NR District Contributor	Potential contributor to district; subsurface investigation required		Potential contributor to district; subsurface investigation required to determine if any portion is extant
Dry Dock 2	NR District Contributor	NR District Contributor	NR District Contributor. SHPO Concurred 1998	2S2	NR Eligible/ Contributor to CR District (2D2)
Dry Dock 3	NR District Contributor	NR District Contributor	NR District Contributor. SHPO Concurred 1998	2S2	NR Eligible/ Contributor to CR District (2D2)
Dry Dock 4	NR Individually Eligible	District w/ Building 253	NR District Contributor. SHPO Concurred 1998	2S2	Concur Individually eligible for NR (252)
450-ton Crane	NR Individually Eligible	Not NR Eligible -> Integrity	Not NR Eligible -> Integrity		Not NR/CR or Local Eligible (6Z)
Building 140 Pump house 3	NR District Contributor	NR District Contributor	NR District Contributor. SHPO Concurred 1998	2S2	NR Eligible/ Contributor to CR District (2D2)
Building 204 Gatehouse	NR District Contributor	NR District Contributor	NR District Contributor. SHPO Concurred 1998	2S2	NR Eligible/ Contributor to CR District (2D2)
Building 205 Pump House 2	NR District Contributor	NR District Contributor	NR District Contributor. SHPO Concurred 1998	2S2	NR Eligible/ Contributor to CR District (2D2)
Building 207 Latrine	NR District Contributor	NR District Contributor	NR District Contributor. SHPO Concurred 1998	2S2	NR Eligible/ Contributor to CR District (2D2)

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Building 208 Shop/tool Canteen	Not Contributor to District			6Y	Contributor to CR District (3CD)
Building 231 Inside Machine Shop					Contributor to CR District (3CD)

TABLE 3 CONTINUED
SUMMARY OF FINDINGS FOR SIGNIFICANT BUILDINGS

	1988 Urban Programmers Report	1993 SHPO Concurrence	1997 JRP Report	Current CRHR Status codes	2009 Circa Findings
Building 211 Shipfitters; Machinery & Electric Shop					Contributor to CR District (3CD)
Building 253 Optical, Electronics & Ordnance	NR Individually Eligible	District w/Dry Dock 4			Contributor to CR District (3CD)
Building 224 Air Raid Shelter and NRDL Annex					CR Eligible District Contributor (3CD)

VI. HISTORIC RESOURCE IMPACTS AND MITIGATIONS

INTRODUCTION

This section describes the historic resources identified within the project area as described and evaluated in Sections III-V of this report, and the potential impacts on these resources that may occur as a result of the project

PUBLIC NOTICING AND COMMENTS

PUBLIC NOTICING

A Notice of Preparation (NOP) of an Environmental Impact Report (EIR) and a Notice of Public Meetings for the was issued by the Redevelopment Agency and the Planning Department of the City and County of San Francisco in August 2007. Two Public Scoping Meetings were held on Monday, September 17, 2007, at the Southeast Community Facility, located at 1800 Oakdale Avenue at Phelps Street, San Francisco, 94124 and on Tuesday, September 25, 2007, at the Earl P. Mills Community Auditorium, 100 Whitney Young Circle, San Francisco, CA 94124. The purpose of the meeting was to receive comments on the scope and content of the environmental review to be conducted on the proposed Bayview Waterfront Project.

The Bayview Waterfront Project requires numerous review and approval actions from the San Francisco Redevelopment Agency, the City and County of San Francisco, regional agencies, state agencies, and federal agencies, including:

- San Francisco Redevelopment Agency Commission
- City and County of San of San Francisco Planning Commission
- Municipal Transportation Agency
- Recreation and Park Commission
- Public Utilities Commission
- San Francisco Housing Authority

- Port Commission
- Board of Supervisors
- Regional Agencies
- State Regional Water Quality Control Board
- San Francisco Bay Conservation & Development Commission
- Association of Bay Area Governments
- State of California
- Department of Parks & Recreation
- Department of Fish & Game
- Department of Transportation
- State Lands Commission
- Department of Toxic Substances Control
- Federal Agencies
- US Navy
- US Army Corps of Engineers
- US Fish & Wildlife Service
- US Department of Housing & Urban Development

PUBLIC COMMENTS

As of the publication of this report no comments have been received regarding historic resources.

CONSISTENCY WITH APPLICABLE POLICIES, PLANS, AND REGULATIONS

In addition to the National and State laws and regulations described in Section IV of this report, the City and County of San Francisco Planning Department has a number of Plans, Policies and Regulations to address the issue of consistency when determining if a property is a historic resource and if a proposed project will have an adverse effect on that resource. These include, but are not limited to:

- Preservation Bulletin No. 11 - Historic Resource Surveys
- Preservation Bulletin No. 16 - CEQA Review Procedures for Historic Resources
- The City of San Francisco Urban Design Element
- Draft Preservation Element of the General Plan
- Articles 10 and 11 of the San Francisco Planning Code
- Chapter 31: California Environmental Quality Act Procedures And Fees of the City And County Of San Francisco Municipal Code
- Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings or The Secretary of the Interior's Standards for Rehabilitating Historic Buildings

IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

A project is considered to have a significant impact on the environment if it would cause a substantial adverse change in the significance of a listed historic resource or resource eligible for listing such that the resource would lose its state or local designation or eligibility status. When evaluating the impacts of a project that affects a broader area it is necessary to consider the impacts on: individual resources, the immediate site context of individual resources, and the broader area context of groups of resources.

For the purposes of this EIR the following thresholds were used for determining significant impacts to cultural or historic resources.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

For the purposes of CEQA, resources eligible for or listed in the California Register are, by definition "historical resources." Additionally, resources included in a local register of historical resources or deemed significant (i.e., given a Status Code of 3 through 5 in a survey meeting the applicable policy requirements from the State Office of Historic Preservation) are presumed to be historically or culturally significant for purposes of CEQA. CEQA uses a time frame of 50+ years old as a reference point for determining the need to evaluate potential impacts on historic resources (California Code of Regulations Chapter 14 s 4852).

Under CEQA, a project that results in a "substantial adverse change in the significance of a historical resource may have a significant adverse effect on the environment (Public Resources Code Section 21084.1). The PRC defines "substantial adverse change" as "demolition, destruction, relocation or alteration" activities that would impair the significance of a historical resource (PRC Section 5020.1(q) and CEQA Guidelines Section 15064.5 (b) (1).

CEQA Section 10564.5 (b) (2) also defines activities that would impair the significance of a historical resource (i.e. that alter the physical characteristics that justify or account for its inclusion in the California Register or a local register) as follows:

The significance of a historical resource is materially impaired when a project:

A. Demolishes or materially alters in an adverse manner those physical characteristics of a historical resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in the California Register of Historic Resources; or

B. Demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historic resources pursuant to Section 5020.1(k) of the Public Resources Code or its identification in an historical resources survey meeting the requirements of Section 5024.1(g) of the Public Resources Code, unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or

C. Demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its eligibility for inclusion in the California Register of Historical

Resources as determined by a lead agency for purposes of CEQA." (CEQA Guidelines Section 15064.5(b)(2)(A)(B)(C).

According to CEQA, "generally, a project that follows the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings or The Secretary of the Interior's Standards for Rehabilitating Historic Buildings...shall be considered as mitigated to a level of less than a significant impact on the historical resource." (CEQA Guidelines Section 15064.5 (b) (3).

PROJECT AND ALTERNATIVES DESCRIPTIONS

Project as Proposed

The Bayview Waterfront Project proposes new plans for the Candlestick Point, Hunters Point Shipyard, and India Basin Shoreline areas of San Francisco and are fully described in Appendix A. The two plans, the CP-HPS Development Plan and the India Basin Plan, are designed as separate development projects.

The CP-HPS Development Plan will require the demolition of a number of buildings, structures and objects within the plan area to implement the Urban Design Plan aspect. The Plan includes the retention of the Hunters Point Commercial Dry Docks Historic District. The Plan area will be comprised of approximately 688 acres. For purposes of this report it is assumed that Candlestick Park sports stadium is not historic based on findings in the Jones & Stokes evaluation.

The India Basin Plan assumes development would occur on large parcels of land that are currently vacant or underutilized along the shoreline. When combine the parcels will be comprised of approximately 764 acres available for development. For purposes of this report it is assumed that no demolition of the identified historic resources is planned in the India Basin Plan area.

Alternatives to the Project[57]

The primary intent of the alternatives evaluation, as stated in CEQA Guidelines Section 15126.6(a), is to "describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives." Further, CEQA Guidelines Section 15126.6(b) states, "the discussion of alternatives shall focus on alternatives to the project or its location which are capable of avoiding or substantially lessening any significant effects of the project, even if these alternatives would impede to some degree the attainment of the project objectives, or would be more costly."

Alternative 1: No Project

Alternative 1 assumes that the buildout allowed under San Francisco Proposition G, the legislation that enabled the CP-HPS Development Plan, would not be pursued. Development regulations and zoning would revert to the regulations that were in place prior to passage of Propositions E and F and establishment of the Candlestick Point Special Use District. The Yosemite Slough bridge would not be constructed, and the circulation network would not be substantially altered. No new uses would be constructed at Candlestick Point, and the land use composition at Hunters Point Shipyard would be substantially different than under the Development Plan, with greater emphasis on retail and mixed-use development, and less emphasis on R&D uses. Development at India Basin would proceed as allowed under existing zoning and land uses controls.

Alternative 2: Project with No Yosemite Slough Bridge

The land use plan for Alternative 2 would be the same as that proposed under the BWP for CP-HPS Phase II Development Plan and India Basin Shoreline Plan. The number of housing units and buildout floor areas for non-residential uses would be the same as

[57] The following Alternatives are quoted from the Candlestick Point - Hunters Point Shipyard Phase II Administrative Draft EIR Ia - August 2009.

under the BWP. Population generated by this alternative would also be the same as for the BWP. As with the Development Plan, the Candlestick Point SRA land exchange would be pursued, resulting in a shift in open space area to Hunters Point Shipyard, as well as the proposed increase in the area of total open space available in the Development Plan area.

<u>Alternative 3: Reduced Development, S.F. 49ers Remain at Candlestick Point</u>

Alternative 3 is a reduced intensity alternative. This alternative assumes that no new non-residential growth would occur at Candlestick Point and that new residential uses would be scaled down by approximately 85 percent. Buildout at Hunters Point Shipyard would be similar to buildout proposed under the Development Plan; however, there would be an approximately 50 percent increase in housing over the levels proposed in the Development Plan (1,350 additional units). Total housing proposed under this alternative would represent about half of the units proposed under the BWP, excluding residential uses proposed in the India Basin Shoreline Plan. Consequently, the population growth anticipated under this alternative would be less than for the Development Plan. Land uses and development controls proposed in the India Basin Shoreline Plan would remain as proposed under the BWP.

This alternative assumes that the 49ers football team would continue to utilize the existing Candlestick Park stadium. The Candlestick Point SRA land exchange would also be pursued, resulting in a shift in open space area to Hunters Point Shipyard, as well as an increase in the area of total open space available in the Development Plan area. This alternative would also include installation of a bridge across Yosemite Slough and related circulation improvements.

<u>Alternative 4: Reduced Development, No Bridge</u>

Land uses proposed under Alternative 4 would be similar to those proposed under the BWP; however, proposed floor areas for most uses would be approximately 30 percent smaller at full buildout in comparison to buildout of the Development Plan. The 30 percent reduction would also apply to residential units; as a result, the population growth anticipated under this alternative would be less than for the BWP. This alternative also includes preservation of three potentially historic structures at HPS.

Similar to Alternative 2, this alternative does not include construction of a bridge over Yosemite Slough. Access between the two sites would be facilitated by a new bus rapid transit route that would travel along Carroll Avenue, Ingalls Street, Thomas Avenue, and Griffiths Street. This route would also serve as the main connector between the two sites for vehicles and pedestrians.

Alternative 4 assumes a scaled-back residential and commercial development program at India Basin, with a greater amount of open space combined with lower density and intensity development. The neighborhood retail square footage remains the same as in the India Basin Shoreline Plan.

Alternative 5: 49ers Stay at Candlestick Point, No Parks Land Exchange

Alternative 5 assumes that the 49ers football team would continue to utilize the existing Candlestick Park stadium. The total number of housing units would be the same as for the Development Plan; however, because this alternative would not implement the Candlestick Point SRA land exchange approximately 1,350 units would be shifted from Candlestick Point to Hunters Point Shipyard. Because the land exchange would not occur, the land area available for development would be smaller. As a result, densities at Candlestick Point would be higher than under the Development Plan and would include more mid-rise structures and towers.

Similar to Alternative 2, this alternative does not include construction of a bridge over Yosemite Slough. Access between the two sites would be provided via a bus rapid transit system that would travel along Carroll Avenue, Ingalls Street, Thomas Avenue, and Griffiths Street. This route would also serve as the main connector between the two sites for vehicles and pedestrians.

Land uses and development controls proposed in the India Basin Shoreline Plan would remain as proposed under the BWP.

IMPACTS AND MITIGATION ANALYSIS

With the exception of Alternative 4: *Reduced Development, No Bridge*, the Project and Alternatives 1,2,3,5, and 6 are identical regarding impacts to historic resources. The following impacts therefore apply to the Project and Alternatives 1,2,3,5, and 6 collectively.

Impact 1

As proposed, future redevelopment within the CP-HPS Development Plan area will result in the demolition of historic resources that are eligible for the California Register and are contributors to a proposed historic district. This is considered a significant Impact because the approach demolishes and materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its eligibility for inclusion in the California Register of Historical Resources.

Mitigation Measure 1a

Retain the historic resources identified as being eligible for the California Register and enlarge the National Register historic district to retain the district's historic integrity.

Implementation of this mitigation measure will reduce this impact to a less-than-significant level.

Mitigation Measure 1b

Rehabilitate, reuse and maintain the National Register and California Register historic resources in a manner that is consistent with the Secretary of Interior's Standards for Rehabilitation. This includes site features such as rail spurs, crane ways, light standards, bollards, dry dock pumping equipment and other built-ins, fencing and wharves that convey the district's historic significance.

Implementation of this mitigation measure will reduce this impact to a less-than-significant level.

Mitigation Measure 1c

New construction adjacent to historic resources should be designed in a manner that is consistent with the Secretary of Interior's Standards for Rehabilitation. This includes massing and scale of adjacent new construction

Implementation of this mitigation measure will reduce this impact to a less-than-significant level.

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VII. RECOMMENDATIONS

The following recommendations were developed to be consistent with applicable policies, plans, and regulations regarding the proposed Bayview Waterfront Project, specifically the CP-HPS Development Plan area where there will be a significant impact due to demolition of buildings and structures that contribute to a potential California Register historic district.

According to CEQA demolition will result in the loss of historic significance because the historical resource will be materially impaired, therefore, it will result in a significant impact.

To reduce the impact to less than significant, and thereby meet CEQA requirements, the following recommendations are presented:

1. It is recommended that Alternative 4 replace the Project and Alternatives 1,2,3,5, and 6 as part of the CP-HPS Development Plan.
2. It is recommended that Mitigation Measure 6.3-1a, b and c be adopted.
3. To avoid a significant impact in the future, Candlestick Stadium should be evaluated for the California and local register.
4. To avoid a significant impact in the future, the RADLAB should be evaluated as an individual historic resource.
5. Due to the importance of the radiological testing context, comprehensive oral histories of past employees, particularly those directly associated with the planning and testing, should be completed, professionally archived and available for research.

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IX. PREPARER'S QUALIFICATIONS

SHEILA MCELROY, Principal of Circa: Historic Property Development

Architectural Historian/Historic Preservation Specialist

Exceeds Qualification for Secretary of the Interiors Standards - for Architectural History

Ms. McElroy is dedicated to historic resource preservation by facilitating the revitalization and development of historic properties and districts. She has almost 20 years of historic preservation and architectural research, management and design-related experience with profit and non-profit corporations, including eight years of experience as executive director for Main Street towns.

Her responsibilities have included historic research, adaptive re-use, streetscape analysis, design assistance, and identification of funding resources. She works closely with local community development and planning departments, and historic commissions on issues of preservation planning, consistency with the Secretary of the Interior Standards, and historic resource development on a variety of projects.

Ms. McElroy earned a Master of Science Degree in Historic Preservation from the University of Pennsylvania, Philadelphia, PA, in 1987, with a concentration in Research and Documentation.

Her Bachelor of Art Degree is from Roger Williams College, Bristol RI, (1980) which included an emphasis on Historic Preservation, American Art, and History of Architecture. Supplemental studies included those at Columbia University, with classes in American Architectural History; Hunter College, History of American Art, and Museum Studies; The Cooper Hewitt Museum, classes in American Decorative Arts; the Main Street Certification Institute, National Main Street Center (National Trust for Historic Preservation) which included competitive sessions in design, economic restructuring, organization, and promotion.

Updated: October 2009

SARAH HAHN, Architectural Historian

Qualifies under the Secretary of the Interior's Professional Qualification Standards -

Architectural History

Ms. Hahn came to Garavaglia Architecture and Circa: Historic Property Development with a broad background in historic preservation, art history, graphic and fine arts. She is an Architectural Historian with a range of experience in the field including hands-on conservation both in the U.S. and abroad, preservation planning, interpretation and education, and extensive cultural resource documentation and evaluation. Ms. Hahn's work at Garavaglia Architecture and with Circa: Historic Property Development includes historic resource evaluations, design review, historic context statements, environmental analysis, Secretary of the Interior's Standards compliance review, historic structure reports and reconnaissance and intensive level survey work. Professional affiliations include the National Trust for Historic Preservation; the Society of Architectural Historians; and the California Preservation Foundation. Ms. Hahn's educational background includes a Master of Science in Historic Preservation from the University of Oregon and a Bachelor of Science in Graphic Design and Art History from the University of Evansville, Indiana.

BECKY URBANO, Architectural Historian, Conservator

Qualifies under the Secretary of the Interior's Professional Qualification Standards -

Architectural History

Ms. Urbano is a talented architectural conservator and historian with a solid background in historic preservation, materials investigation and historic documentation. Recognized for laboratory expertise as well as research, leadership and project management skills, her experience includes architectural conservation management plans, existing condition analysis, repair recommendations and documentation, construction specifications and identification of historic resources through field surveys and archival research.

Ms. Urbano's work at Garavaglia Architecture to date has included involvement with historic structure reports and multiple historic context statements. Her thorough research capabilities have been complemented by her excellent report and writing skills. She currently manages all preservation services, including technical reports and reviews at Garavaglia Architecture, Inc.

Ms. Urbano educational background includes a Masters of Science in Historic Preservation from Columbia University and a Bachelor of Arts in Physics from Middlebury College with Departmental Honors. She meets or exceeds the Secretary of the Interior's Professional Qualifications Standards for Architectural Historians.

Updated: October 2009

X. APPENDICES

[Appendices are available for review at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA.]

Appendix J3 CIRCA, Historic Resources Evaluation for Candlestick, April 2010

Historic Resource Evaluation for Candlestick Park Sports Stadium, San Francisco, CA

Final Draft

Prepared for PBS& J

Prepared by:

CIRCA: HISTORIC PROPERTY DEVELOPMENT

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2 APRIL 2010

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2 April 2010

Historic Resource Evaluation for Candlestick Park Sports Stadium, San Francisco, CA

INTRODUCTION

Circa: Historic Property Development has prepared this Historic Resource Evaluation (HRE) for the Candlestick Park Sports Stadium, or "Candlestick Park" (Assessor's Block 5000, Lot 001) as requested by PBS&J in conjunction with the Candlestick Point – Hunters Point Shipyard Phase 2 Waterfront Project Environmental Impact Report. Jones & Stokes evaluated the subject property in May 2007 for eligibility for listing on the National Register of Historic Places (NRHP) under Criteria Consideration G, since the building was less than fifty years of age at that time[1]. For a property to be eligible for listing on the National Register under Criterion G, exceptional significance must be demonstrated. Jones & Stokes found that Candlestick Park "did not appear to meet the threshold of NRHP exceptional significance for buildings less than 50 years old."[2] The 2007 Jones & Stokes report did not evaluate the property's eligibility for listing on the California Register of Historical Resources or as a San Francisco Landmark.

Andrew Hope, Principal Architectural Historian for the Caltrans District 4 office in Sacramento, completed a second evaluation of Candlestick Park at the request of State Historic Preservation Officer (SHPO) in January 2008. Like the Jones & Stokes report, this evaluation addressed only the National Register level of significance; however, the evaluation itself was quite thorough. Hope evaluated the property according to the standard criteria and concluded that while the subject property was found to meet National Register Criterion A (for association with the introduction of major league baseball on the west coast), and B (for association with the career of Willie Mays), "it lacks integrity to its period of significance under both criteria, due to the extensive alteration of the stadium in the early 1970s."[3] In a February 2008 letter from the California Office of Historic Preservation (OHP) to Jennifer Darcangelo of Caltrans District 4 in Oakland, OHP concurred with Caltrans' findings that Candlestick Park is not eligible for the National Register of Historic Places.[4] However, that conclusion was considered as an evaluation of the stadium as a structure less than fifty years old in 2008. Note: The Caltrans evaluation findings will be treated in the manner of a peer review in the Evaluation of Significance section of this report.

Candlestick Park stadium opened on April 12, 1960 and is 50 years old this year (2010). The stadium is presently subject to an evaluation for the National Register without Criteria Consideration G for exceptional significance. For the purposes of the California Environmental Quality Act (CEQA), "historical resources" are those properties that are listed in or formally

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[1] See documentation for Planning Department Case No. 2003.1211E and associated HRER dated 18 September 2007.
[2] Jones & Stokes, *Bayview Transportation Improvements Project (BTIP) – Evaluation Exemption for Monster Park*, Memo from Kathryn Hayley to Meg Scantlebury (15 May 2007), 9.
[3] Evaluation of Candlestick Park (Monster Park) For the Bayview Transportation Improvements Project, San Francisco City and County, California, January 2008 (DPR 523 set).
[4] Susan K. Stratton (for Milford Wayne Donaldson), OHP, to Jennifer Darcangelo, Caltrans, 6 February 2008, "Re: Determinations of Eligibility for the Bayview Transportation Improvements Project in the City and County of San Francisco, CA."

determined eligible for listing in the California Register of Historical Resources, or listed in an adopted local historic register. "Historical resources" also includes resources identified as significant in an historical resource survey meeting certain criteria.[5] To meet all levels of review required for the subject property, this HRE provides an evaluation of Candlestick Park for eligibility as a historic resource on the National, State and local levels.

Methodology
Circa: Historic Property Development Principal, Sheila McElroy and Garavaglia Architecture, Inc. Architectural Historian Sarah Hahn conducted a site visit and survey of the property's interior and exterior on January 30, 2010. Mike Gay, Chief Operations Engineer at Candlestick Park, led a tour of the property; Mr. Gay has been employed at Candlestick Park for the past 31 years. During this visit, the project team documented the building's configuration, architectural features, and alterations with photographs and field notes. Mr. Gay provided information about alterations to the property and a general historical overview. Selected historic and existing conditions photographs of the property can be found throughout the body of this document. See Appendix A for additional photographs of the subject property.

The San Francisco Planning Department and Department of Building Inspection provided selected copies of the property's building permit history for review. Since alterations have been made to the building almost continuously since it was originally constructed, and hundreds of building permit documents are on file with the City, only selected permit records were reviewed. All attempts were made to identify major alteration campaigns and review related building permits to establish a general record of alterations to the property. See Appendix B for building construction chronology matrix. (Note: this matrix is not meant to represent an exhaustive list of building alterations, but provides a record of notable changes to the building over time.)

No full size sets of original drawings were available for the subject property; however, the Department of Building Inspection uncovered a limited selection of reduced (11" x 17") plan drawings in their files. The 2007 Jones & Stokes report cited the John S. Bolles Collection held in the Special Collections Department at the Harvard University Graduate School of Design, Frances Loeb Library, in Cambridge, Massachusetts. The report noted that the author had contacted the library in an attempt to attain original drawings and other records related to Bolles' work on Candlestick Park, but the collection was in an unprocessed and inaccessible state. Circa also contacted this library in January 2010 to determine the current status of the collection and found that it remains unprocessed. Therefore, this evaluation has also been completed without the information from the John S. Bolles Collection.

Circa conducted additional archival research on the subject property and the following repositories/collections were used to complete the research process (see Bibliography section for complete list of resources):

- Department of Building Inspection, San Francisco (SF)
- SF Planning Department
- San Francisco Public Library (SFPL)
    - SF History Room
        - Biographical card files, vertical files by subject
        - SF Historical Photograph Collection
    - SF Chronicle Index (microfiche), SFPL
    - SF Chronicle/Examiner (microfilm), SFPL

[5] San Francisco Preservation Bulletin No. 16, City and County of San Francisco Planning Department, CEQA Review Procedures for Historic Resources.

Physical Description

Built in 1960, Candlestick Park is a sports stadium located at 490 Jamestown Avenue in the City and County of San Francisco and is owned by the same entity. It was originally built for baseball and is currently used primarily for football. The stadium is set on an irregularly-shaped parcel bound by Giants Drive and Gilman Avenue to the north, Hunters Point Expressway to the east, and Jamestown Avenue to the south and Jamestown Avenue/Giants Drive to the west. The large parcel, composed of artificial fill, is located adjacent to a large hill at the west, and bordered by Candlestick Point State Recreation Area to the east and south.

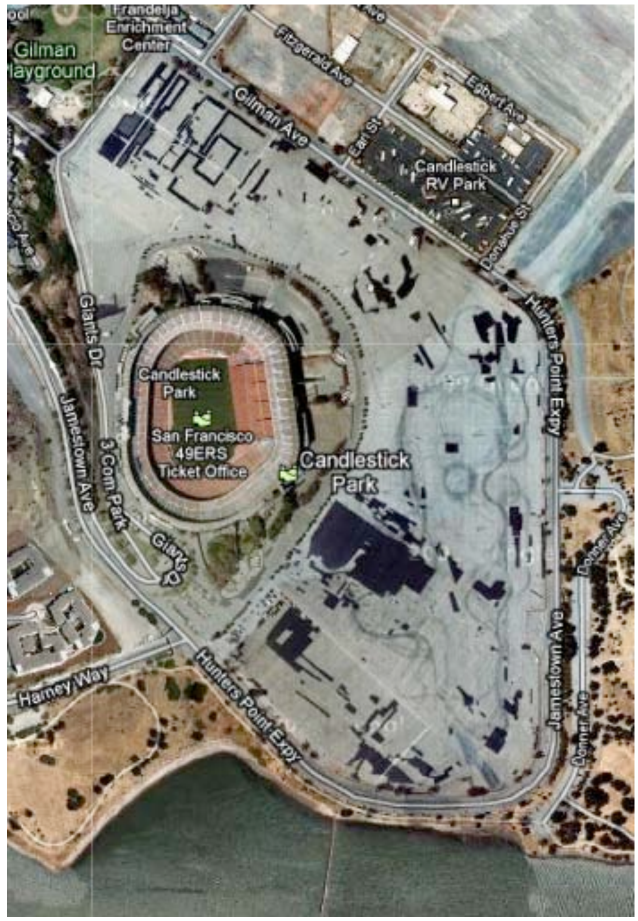

Figure 1. Aerial View, current configuration (Google maps, 2010).

The stadium is surrounded by a large, paved parking lot on the north, east, and south sides, with parking space for roughly 8,000 cars, 300 buses, 200 limousines, and 300 motor homes.[6] A chain link fence surrounds the parking lot periphery and overflow parking is located on separate parcels to the northeast. Landscaping around the stadium itself is minimal and consists primarily of clusters of trees around both the north and south (main) gates. A succession of trees defines the outside border of the main access road immediately surrounding the stadium. A guard kiosk is located at the west parking lot entrance, off Jamestown Avenue, near Gate A. Additional guard/parking attendant kiosks and accessory buildings are located at major parking lot entry points to the north, east, and south of the main parking lot.

The stadium is an enclosed, asymmetrical plan building with two main levels of seating. The upper deck seating is continuous around the perimeter of the stadium, and the lower deck has a section of retractable seating in the former right and right-center field areas. The upper deck is partially sheltered by a curved roof canopy. Curved concrete ribs support this roof and diagonal concrete braces, forming a continuous chevron-like band around the upper portion of the stadium, in turn support these ribs. An exterior concourse encircles the stadium at the upper level, between the chevron supports and the inner wall supporting the upper deck seating.[7]

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[6]San Francisco Department of Parks and Recreation website, *Welcome to Monster Park*, http://www.parks.sfgov.org/site/recpark_index.asp?id=18977 (accessed: 1 February 2010).

[7] Andrew Hope, *Evaluation of Candlestick Park (Monster Park) for the Bayview Transportation Improvements Project, San Francisco, City and County, California* (DPR 523 Series form), (Sacramento: California Department of Transportation, January 2008), pages 1 and 6 of 13.

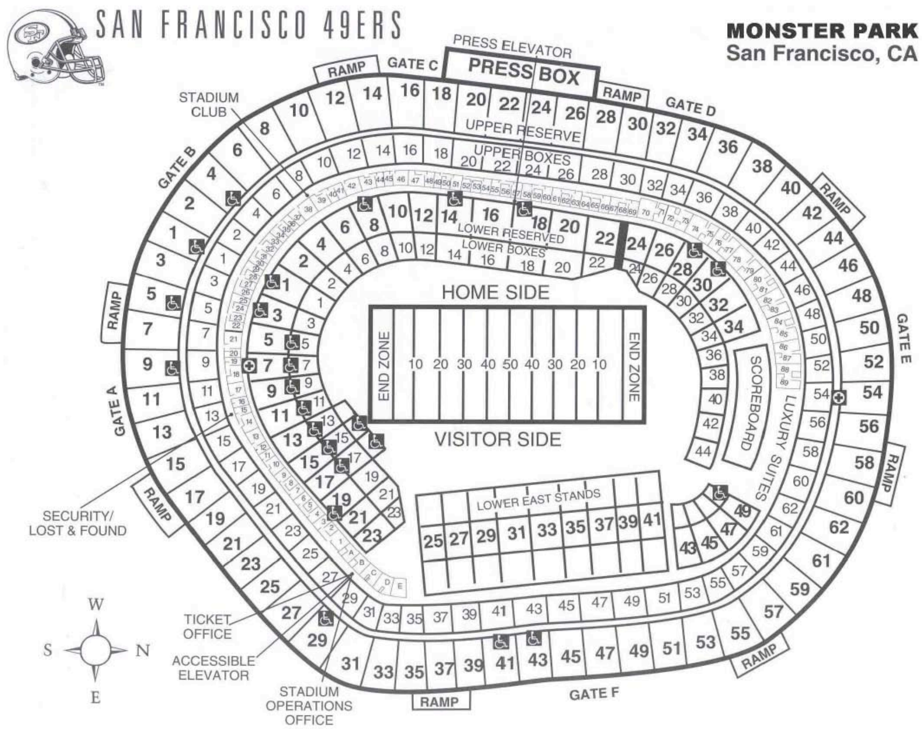

Figure 2. Candlestick Park seating map, courtesy of SF Recreation & Parks Website for Candlestick Park.

Six gates provide entrances into the stadium. The main entrances, with ticket booths and entry turnstiles, are Gates A, E, and F (south, north and east, respectively). On the south, east and north sides of the stadium, an extensive system of exterior ramps, stairs, and escalators provide access to the main entrances. Banks of lights on tall poles, standing just outside the stadium and extending above the stadium's roof, illuminate the playing field for night games.[8]

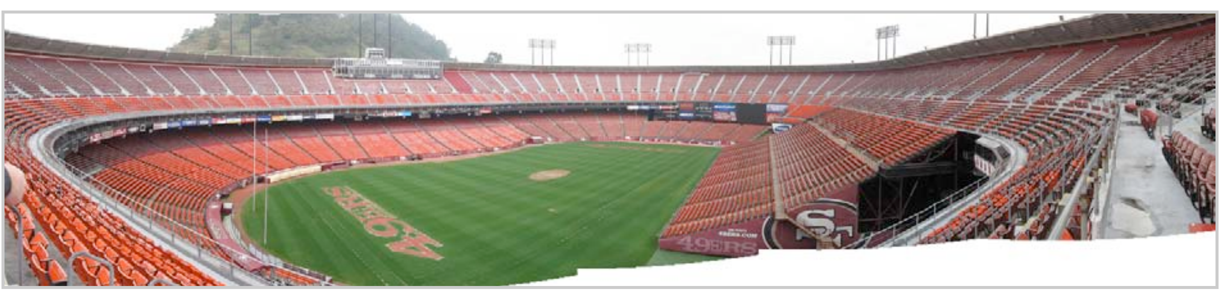

Figure 3. Interior panorama, looking northwest (Photo by Circa, January 2010).

The stadium has six escalators, three passenger elevators, and one freight elevator. There are four locker rooms, two first aid stations and 44 concession stands. The massive open-air structure is primarily comprised of reinforced concrete and steel. The current seating capacity is about 70,000. Orange plastic seats, located on multiple levels, encircle a 100-yard football field. The field is currently covered with natural grass turf. According to Chief Operations Engineer Mike Gay, Rye grass is used to cover the playing field in the winter months and Bermuda grass is used during the summer.

[8] Andrew Hope, *Evaluation of Candlestick Park, page 6 of 13*.

The west side of the stadium is the home side and the east side is for visiting fans. Enclosed suites wrap around the interior of the stadium, above the lower deck of seating, from the southeastern to the northwestern part of the building. The original baseball press box is located at the south end of the stadium in this bank of suites and has been remodeled for use by visiting press and private individuals. The current football press box is situated above the upper bank of stadium seats on the west side of the complex. The scoreboard is located at the north end of the stadium, between the upper and lower stands.

HISTORICAL BACKGROUND

Candlestick Point

The Long-billed Curlew is a large North American shorebird that was common along the shoreline of San Francisco in the early part of the 20th Century. Locally, it was known as the Candlestick Bird and it is after this waterfowl that Candlestick Point was named.[9] Prior to being known as the site of a professional sports stadium, it was a quarry, a landfill and a proposed site for a quarantine hospital, though the institution was never constructed. By the late 1950s, the area became the proposed site for San Francisco's first major league sports facility. As of this writing, the Candlestick Point vicinity is home to Candlestick Park stadium, Candlestick Point State Recreation Area, an RV park and residential buildings.

Figure 4. Seals Stadium, 1958 Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Baseball in San Francisco

Baseball has always been popular in San Francisco. Through the late 19th and early 20th centuries, the City sported several semi-professional teams that competed with other teams throughout California and the West Coast. In 1930, the owner of the minor league San Francisco Seals built a baseball stadium in the Inner Mission at 16th Street and Bryant Street.[10] The Seals enjoyed a long-term following in the first half of the 20th century. However, when the time came to lure a major league baseball team to San Francisco, the need for a new stadium was apparent. The largest stadium in the City at the time, Seals Stadium could seat only 18,600 people, nowhere near the capacity of stadiums in other cities.[11] If San Francisco wanted a professional team, they needed to provide state-of-the-art facilities.

In 1954, voters approved a $5 million bond measure for the construction of a Major League Baseball stadium. This was done before any team had committed to moving to San Francisco. It was a major gamble that was soon to pay off. When Major League Baseball approved an

[9] San Francisco Department of Parks and Recreation website, *Welcome to Candlestick Park*, (accessed 25 February 2010).
[10] Matthew Weintraub, "Giant Footprints: Building The New Ballpark Landscape In San Francisco" (M.A. Thesis, San Francisco State University, 2004), p. 12.
[11] Ballparks of Baseball, *Seals Stadium*, http://www.ballparksofbaseball.com/past/SealsStadium.htm (accessed 24 February 2010).

expansion of teams west of the Rocky Mountains, they opened the door to the eager San Francisco fans. Ultimately, Horace, Stoneham, the owner of the New York Giants, agreed to move his team from New York City, where they competed with two other major league teams, to San Francisco where they would be the City's only Major League Baseball team. At that same time, the Brooklyn Dodgers, agreed to move to Los Angeles, thus bringing their rivalry to California.

The newly renamed San Francisco Giants began their relationship with the City in 1958, playing their first two seasons at the existing Seals Stadium (demolished by 1960).[12] The new baseball stadium was finished at the end of the 1959 season and was the first stadium built for a Major League Baseball team on the West Coast, closely followed by the completion of Dodger Stadium in 1962.[13] Vice President Richard Nixon threw out the first pitch at the Giants home opening game on April 12, 1960.

Candlestick Park

Early Development

As part of a national trend starting in the 1950s, and through the 1980s, "Public subsidies to lure relocating teams to new areas became common. Municipalities usually provided large tracts of undeveloped land ...as new building sites."[14] After passage of the bond measure in 1954 and before any team had committed to moving to San Francisco then-Mayor George Christopher began investigation of possible stadium sites as early as May 1957. At that time, Charles Harney, one of San Francisco's most well known contractors, offered his property on Candlestick Point to the City for $2.7 million.[15] When studies showed that a site closer to the downtown was more expensive, the City decided to accept Harney's offer and hired him as contractor for the project. San Francisco architect John Savage Bolles was hired as the architect for the project.[16]

Charles Harney had been purchasing property in the Bayview-Hunters Point area since the 1930s and in 1953 acquired 40 acres, which brought his total land holdings in the area to 67 acres. A considerable amount of Harney's land was comprised of water lots when he purchased it, though he had filled most of it with artificial fill by the time he sold it to the City of San Francisco.[17] Harney was an avid sports fan and one of the original owners of the Oakland Raiders football team. He died in 1962. The park was initially referred to as "Harney Stadium" during the design and construction phases of development and is noted as such on the original plan drawings. However, a 1960 naming contest sponsored by the San Francisco City Recreation and Parks Commission resulted in the official name of "Candlestick Park." Harney Way, an access road that links the stadium site to U.S. 101, was named in his honor.[18]

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[12] As soon as the season ended, the Giants left Seals Stadium to the bulldozers. Demolition began in November 1959 and was completed in early 1960, before the Giants had finished a single practice on their new field.

[13] Jones & Stokes, *Bayview Transportation Improvements Project-Evaluation Exemption for Monster Park*, 5.

[14] Weintraub, 8.

[15] Charles L. Harney, Inc. was responsible for a large number of Northern California Freeway construction projects, including the Caldecott Tunnel (Jones & Stokes).

[16] Jones & Stokes, *Bayview Transportation Improvements Project-Evaluation Exemption for Monster Park*, 5.

[17] Ibid, 6.

[18] Ibid.

John S. Bolles

John S. Bolles was the architect for Candlestick Park stadium. Except where noted, the following biographical summary is quoted from the *Bayview Transportation Improvements Project-Evaluation Exemption for Monster Park*, by Jones & Stokes (15 May 2007

> In 1958, prominent Bay Area Architect John S. Bolles designed the stadium. Born in Berkley on June 25, 1905, Bolles obtained his bachelor's degree in Engineering from the University of Oklahoma in 1926, and graduated from Harvard with a Master's degree in Architecture in 1932. During the 1930s, he worked as a structural engineer in Oklahoma and as an archaeologist for the Oriental Institute of the University of Chicago on the excavations at Persepolis, the ancient capital of Persia, and for Washington's Carnegie Institute on a comprehensive study of one of the most important Mayan sites in the Yucatan.
>
> In the late 1930s, Bolles moved back to the Bay Area and joined his father's architectural firm. Father and son designed the Temple of Religion and the Christian Science Monitor building on Treasure Island for the 1939 Golden Gate International Exposition. In 1941, he passed the State of California Architectural license examination and between 1943 and 1945 Bolles served as project engineer for the Federal Public Housing Authority in San Francisco. During this time he also began collaborating with architect Joseph Francis Ward, a New Zealander, who has been associated with architect Albert Farr since 1922. Together, Bolles and Ward designed several residences in San Francisco during the 1940s and early 1950s. In 1954, Bolles began working independently on commercial, industrial, and residential buildings.[19]

Bolles was active in the local architectural community and served as Secretary of the San Francisco chapter of the American Institute of Architects (AIA) in 1945-46. He was honored as a Fellow of the AIA in 1963. The architect was also influential in public housing affairs of the 1960s and chaired San Francisco Planning and Urban Research (SPUR) committees on housing and redevelopment. He also designed a number of buildings for the San Francisco Housing Authority, including the extant high-rise senior housing complex at 2451 Sacramento Street in the Fillmore neighborhood.[20]

> A Modernist, Bolles' work often displayed a bold incorporation of modern art and sculpture. Eventually he started his own firm in San Francisco called John S. Bolles and Associates. Noteworthy designs by Bolles in San Francisco include the 1959 Ping Yuen Annex housing project, Embarcadero Park, and the Anna E. Waden Library (Bayview Branch of the San Francisco Public Library) built in 1969. He also designed a number of buildings in Northern California including the McGraw-Hill complex in Novato [most recently occupied by Birkenstock], the General Motors assembly plant in Fremont, Gallo Winery in Modesto, Downtown Plaza in Sacramento and several Macy's department stores. Additionally, Bolles designed the IBM campus in San Jose of which IBM Building 25 was found eligible for the [National Register of Historic Places, California Register of Historic Resources,] and is a San Jose Landmark candidate. While his work throughout Northern California is extensive, he is best known for designing Candlestick Park. Bolles died in 1983.[21]

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[19] Ibid.

[20] David Perry, "Bolles, John Savage," Encyclopedia of San Francisco, A Project of the SF Museum and Historical Society. Online at: http://www.sfhistoryencyclopedia.com/articles/b/bollesJohn.html (accessed 24 February 2010). Also see the AIA Historical Directory of American Architects at http://communities.aia.org/sites/hdoaa/wiki/Wiki%20Pages/Browse%20Bo.aspx (accessed 24 February 2010).

[21] Jones & Stokes, *Bayview Transportation Improvements Project-Evaluation Exemption for Monster*

From opening day, Candlestick Park began to acquire a reputation for its harsh environment for both spectators and players alike. Strong gusts caused serious problems for the players during the 1961 All Star game. At that game, some of the nation's best ball players committed seven errors and the relief pitcher was nearly blown off of the mound and the stadium became known as "the cave of wind".[22]

Though Bolles did not complete an official wind study prior to construction, the architect included two notable design elements into the stadium plans in an attempt to combat the site's cool temperatures and gusty winds. The first was a heating system for the 20,000 reserved seats and the second was the rounded roof at the upper deck that was designed to act as a wind barrier. Unfortunately, both elements eventually proved to be unsuccessful.[23]

After the 1961 All Star game, a wind study of the stadium was conducted, which found that "local geographic features and the configuration of the structure itself was causing most, if not all of the negative wind effects. The study also indicated that these could have been prevented by sitting the facility a few hundred feet further to the north."[24]

Despite decades of criticism, Bolles cited Candlestick Park as his best work. A 1965 profile in the San Francisco Examiner states that Bolles "[was] proud and happy to have designed Candlestick Park…and [requested] all critics to stop worrying about it." The architect claimed, "It is not a building, but a sculpture."[25] However, the persistent wind problems and other technical issues soon prompted the architect [Bolles] and the City to plan for various modifications to the stadium in attempts to improve conditions.

John S. Bolles retired in 1978 and his eldest son, Peter P. Bolles, continued the practice, eventually moving it to Las Vegas. John Bolles died on March 5, 1983 at his home in Santa Rosa. For further discussion of Bolles career as an architect and for definition of the term "Master Architect" please see the Evaluation of Significance: Design/Construction sections of this report.

Construction History and Development

Stadium construction began in September 1958 and problems began almost immediately, including disagreements between Bolles and Harney about the facility's design and the construction schedule. Various delays, including "a San Francisco Grand Jury investigation into stadium financing and the postponed installation of the seats because of a Teamster strike," plagued the construction process. However, the stadium was finally completed at a cost of almost $15 million and the stadium opened on April 12, 1960.[26]

Park, 6-7.

[22] Ibid, 7.

[23] Ibid.

[24] Ibid.

[25] Horace Schwartz, "Snapshots: Architect John Bolles." San Francisco: San Francisco Examiner, 28 February 1965.

[26] Jones & Stokes, 7.

Figure 5. Candlestick Park under construction, 1958. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Figure 6. Candlestick Park under construction, 1959. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Alterations to the building have been ongoing since the building's initial construction. In 1960, the seating capacity was 43,765 and by the early 1970s, it had increased to 59,000 for baseball and 62,000 for football. Today it seats over 70,000 (a roughly 60% increase in seating capacity).[27] Originally, the grandstand of the boomerang-shaped stadium:

> … consisted of two main seating decks. The lower deck extended from behind home plate down the first base line to the right field foul pole, and down the third base line and around the left field foul pole into left center field. The upper deck extended from home plate down both the first and third base lines. A small section of bleachers was located in right center field. The field surface was bluegrass and the scoreboard was located above the hitter's backdrop in center field. Behind the bleachers on the north elevation was an employee parking area.[28]

Shortly after the stadium opened it was used for both baseball and football. In 1961, the National Football League's Oakland raiders played a season at Candlestick and Bolles began working on plans to accommodate both the SF Giants and the SF 49ers by expanding the stadium and enclosing the outfield as early as 1966.[29] As part of the redesign, attempts were made to reduce some of the wind-contributing flaws of the initial construction and the San Francisco Department of Building Inspection approved Bolles' redesign plans in 1969.[30]

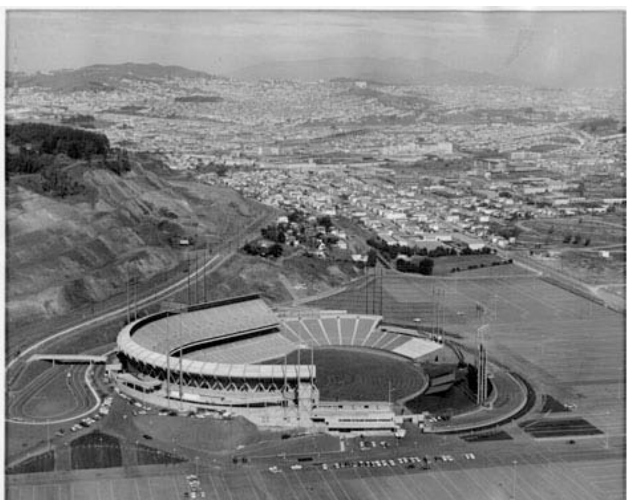

Figure 7. March 1960 view of the completed stadium, looking north. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

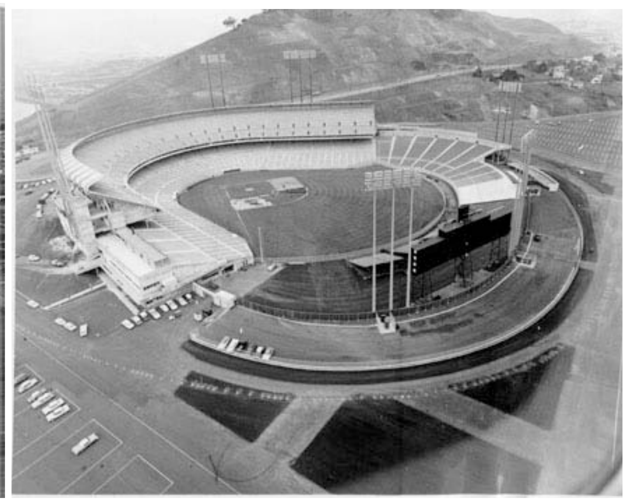

Figure 8. March 1960 view of the completed stadium, looking northwest. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

The stadium was enlarged in 1970-71 to accommodate the San Francisco 49ers. This expansion cost the City $16.1 million. As part of this expansion:

> The upper deck was extended completely around the outfield and retractable seating installed in the right-center field area at the lower level. With the sidelines of the football field roughly parallel to the third base line, this retractable seating could be extended onto the outfield area for football games. The original scoreboard was removed and a new scoreboard installed between the lower and upper decks in the left-center field area.

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[27] Ibid. Also http://www.parks.sfgov.org/site/recpark_index.asp?id=18977 (accessed 24 February 2010).
[28] Jones & Stokes, 7.
[29] Since 1946, the 49ers had played their games in Kezar Stadium near Golden Gate Park.
[30] Jones & Stokes, *Bayview Transportation Improvements Project-Evaluation Exemption for Monster Park*, 8.

> The current exterior ramps and stairs on the north and northeast sides of the stadium were installed as part of this expansion.[31]

Additional alterations that occurred during the early 1970s renovation of the stadium include the replacement of the natural grass field with Astroturf; installation of 30,000 new plastic seats to replace the original wood seats; construction of a new main Gate A, eight new ticket booths and special gates for ticket holders; construction of two new escalator towers at Gates A and E; and construction of a new entrance at Gate F. A rubberized track surrounding the field was installed; all restrooms were rehabilitated and upgraded; the baseball press box was enlarged and rehabilitated; a new press box in the upper deck for football was constructed, and foundation work including grade increases and foundation improvements at the northern part of the stadium were completed.[32] Additional concrete ramps were also installed near Gate A at this time.[33] Evidence of the expansion of Gate A is seen in the ghosting on the concrete floor (See Appendix A for existing conditions photographs). The playing field was converted back to grass in the late 1970s.[34]

The 49ers played their first season in Candlestick Park during the 1971-1972 season, winning a NFC West title that year. At the time, the stadium could seat 62,000 for football games and 59,000 for baseball.[35] Over the next decades, the stadium continued to do double duty as home to the Giants for seven months of the year and for the 49ers for four months after. Often, during football preseason games or because of baseball playoffs, the field hosted both teams simultaneously. Maintenance and conversion of the stadium between sporting seasons was expensive, costing about $150,000 per conversion for field, locker room and amenities upgrades.[36] General alterations and routine modification were ongoing.

According to building permits, eleven new exit gates were installed at the building exterior in 1982 and steel columns were installed under the existing concrete wind canopy in 1984. A number of major alterations also began in the early 1990s and continued throughout the decade.[37]

In 1991, fifty-five suites were renovated, ADA upgrades were completed at Ramps 1-8 and eight restrooms were rehabilitated. In 1992, twenty-six additional suites were upgraded, the exterior concourse was widened, the football press box windows were altered, old concrete exit stairs on the main level were replaced with new concrete stairs and the baseball press box was again renovated. The year of 1993 saw modifications to Gates A through D; main level concourse widening; seat additions at the main level; media compound site improvements; construction of Plazas A, F and E; construction of restrooms and stairs at Gate C; and the closure of twenty-two vomitories at the upper level.[38] In 1994, the stadium was further enlarged at a cost of nearly $3 million to accommodate up to 71,000 football fans.

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[31] Andrew Hope, *Evaluation of Candlestick Park,* page 6 of 13.
[32] Interview with Mike Gay, Chief Operations Engineer at Candlestick Park, 30 January 2010. Also "What it's Like at Candlestick Now," San Francisco, *San Francisco Progress*, 14 April 1971.
[33] Interview with Mike Gay.
[34] Andrew Hope, *Evaluation of Candlestick Park,* page 6 of 13.
[35] San Francisco Department of Parks and Recreation website, *Welcome to Candlestick Park!,* http://www.parks.sfgov.org/site/recpark_index.asp?id=18977 (accessed 25 February 2010).
[36] Interview with Mike Gay.
[37] See Building Construction Chronology matrix in Appendix B.
[38] See Building Construction Chronology, Appendix B. According to Merriam-Webster Online, a vomitory is "an entrance piercing the banks of seats of a theater, amphitheater, or stadium." Source: http://www.merriam-webster.com/dictionary/vomitory (accessed 25 February 2010).

Figure 9. c.1980s postcard view.

As stated previously, general alterations and facilities upgrades have been ongoing since the stadium opened in 1960. Building permit, newspaper articles and an oral interview with Mike Gay, the Chief Operations Engineer at Candlestick since 1978 describe the following regular upgrades to the facility:

- Field turf changes (ongoing since the late 1970s early1980s - Bermuda grass is used in the summer and Rye grass in the winter
- Regular systems and signage upgrades
- Alterations to food/beverage vendor facilities
- Regular expansion, alteration and replacement of stadium seating
- Lighting and scoreboard upgrade and replacement
- Regular remodel/reconfiguration of suites, skyboxes, office spaces and restrooms

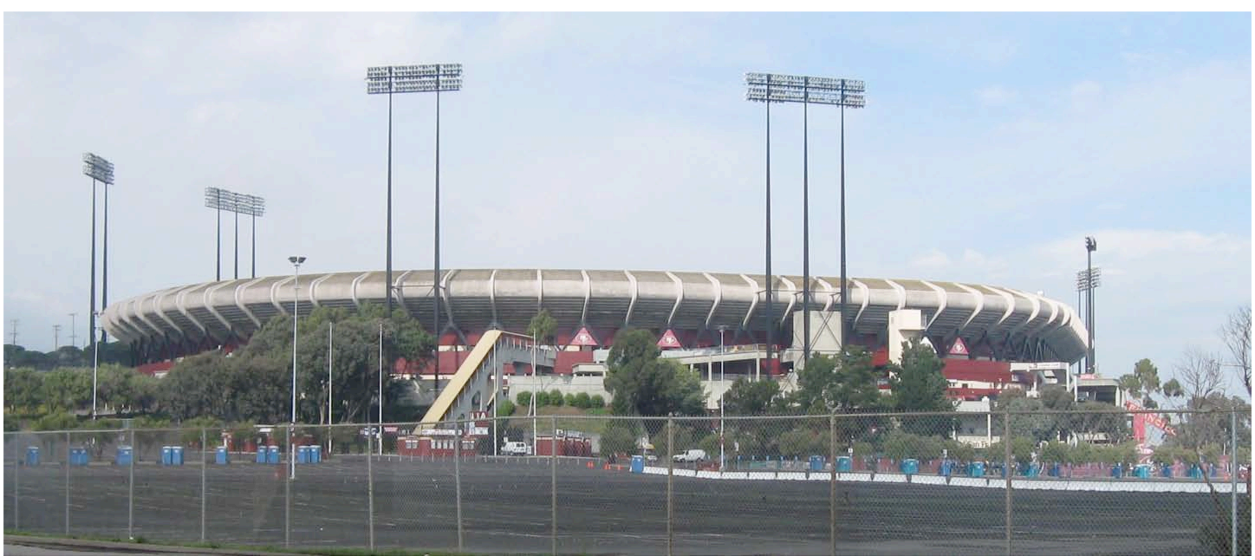

Figure 10. Current view, looking north from Hunters Point Expy. South parking lot then Gate A in foreground.

In the early 1990s, the Giants had begun to campaign for a new, baseball-only stadium closer to downtown San Francisco, though they did not leave Candlestick Park until 1999. They moved into their new stadium, now known as AT&T Park, at Mission Bay in 2000 and remain there today. The 49ers continue to play football at Candlestick Park, under a lease with the City and County of San Francisco. The Candlestick Point – Hunters Point Shipyard Phase II project under review would include a new 49ers stadium at Hunters Point Shipyard. However, the 49ers are also pursuing development of a new stadium in the City of Santa Clara.

Beyond Sports
Candlestick Park has played an important cultural role in the lives of San Franciscans beyond its nearly 40-year relationship with the Giants (1960-1999). It served as the site for numerous concerts, public events and other great sporting moments. On August 29, 1966, it hosted the Beatles last live commercial concert. It is the only stadium in the United States to host six National Football Conference championship games, three NFL Western Division Championships, 12 National Football Conference West Conference Games, two Major League Baseball World Series, and two Major League Baseball All-Star games. It was just before Game three of the 1989 World Series between the Oakland Athletics and the San Francisco Giants that the Loma Prieta earthquake was broadcast to millions of homes around the world. Remarkably, the 7.1 magnitude earthquake caused minimal damage to Candlestick Park and none of the 65,000 spectators were injured. The World Series was delayed 10 days while engineers verified the safety of the stadium.

EVALUATIVE FRAMEWORK

Evaluation Framework - National

The National Historic Preservation Act
The National Historic Preservation Act (NHPA), 16 U.S.C. §§ 470a to 470w-6, is the primary federal law governing the preservation of cultural and historic resources in the United States. The law establishes a national preservation program and a system of procedural protections that encourage the identification and protection of cultural and historic resources of national, state, tribal and local significance. Key elements of the act include:

- Establishment of a comprehensive program for identifying historic and cultural resources for listing in the National Register of Historic Places (NRHP).
- Creation of a federal-state/tribal-local partnership for implementing programs established by the act.
- Requirement that federal agencies take into consideration actions that could adversely affect historic properties listed or eligible for listing on the National Register of Historic Places, commonly known as the Section 106 Review Process.
- Establishment of the Advisory Council on Historic Preservation, which oversees federal agency responsibilities governing the Section 106 Review Process. [39]

The National Register Criteria for Evaluation
The National Register is the nation's master inventory of known historic resources. It is administered by the National Park Service (NPS) in conjunction with SHPO. The National Register includes listings of buildings, structures, sites, objects, and districts that possess historic, architectural, engineering, archaeological, or cultural significance at the national, state,

[39] National Trust for Historic Preservation website, *National Historic Preservation Act*, http://www.preservationnation.org/resources/legal-resources/understanding-preservation-law/federal-law/nhpa.html (accessed 25 February 2010).

or local level. The National Register criteria and associated definitions are outlined in National Register Bulletin Number 15: How to Apply the National Register Criteria for Evaluation. The following is a summary of Bulletin 15:

Criteria
Generally, resources (structures, sites, buildings, districts and objects) over 50 years of age can be listed in the National Register provided that they meet the evaluative criteria described below. Resources can be listed individually in the National Register or as contributors to an historic district.[40] The National Register criteria are as follows:

A. Resources that are associated with events that have made a significant contribution to the broad patterns of history;

B. Resources that are associated with the lives of persons significant in our past;

C. Resources that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. Resources that have yielded or may likely yield information important in prehistory or history.

Integrity
When nominating a resource to the NRHP, one must evaluate and clearly state the significance of that resource to American history, architecture, archaeology, engineering, or culture. A resource may be considered individually eligible for listing in the NRHP if it meets one or more of the above listed criteria for significance and it possesses historic integrity. Historic properties must retain sufficient historic integrity to convey their significance.
The National Register recognizes seven aspects or qualities that define historic integrity:

- **Location**. The place where the historic property was constructed or the place where the historic event occurred.

- **Design**. The combination of elements that create the form, plan, space, structure, and style of a property.

- **Setting**. The physical environment of a historic property.

- **Materials**. The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.

- **Workmanship**. The physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.

[40] A "contributor" is a building, site, structure, or object that adds to the historic associations or historic architectural qualities for which a property is significant. The contributor was present during the period of significance, relates to the documented significance of the property, and possesses historic integrity or provides important information about a period; or the contributor independently meets National Register criteria. A "non-contributor" does not add to the historic associations or historic architectural qualities as it was not present during the period of significance; it has experienced alterations, disturbances, additions, or other changes; or it does not independently meet the National Register criteria.

- **Feeling**. A property's expression of the aesthetic or historic sense of a particular period of time.

- **Association**. The direct link between an important historic event or person and a historic property.

To retain historic integrity, a resource should possess several of the above-mentioned aspects. The retention of specific aspects of integrity is essential for a resource to convey its significance. Comparisons with similar properties should also be considered when evaluating integrity as it may be important in deciding what physical features are essential to reflect the significance of a historic context.

Evaluation Framework - California

<u>The California Environmental Quality Act (CEQA)</u>
The California Environmental Quality Act provides the legal framework by which historical resources are identified and given consideration during the planning process. The law was adopted in 1970 and incorporated in the Public Resources Code §§21000-21177. CEQA's basic functions are to:

- Inform governmental decision makers and the public about the potential significant environmental effects of proposed activities;
- Identify ways to reduce or avoid adverse impacts;
- Offer alternatives or mitigation measures when feasible; and
- Disclose to the public why a project was approved if significant environmental effects are involved.

CEQA applies to projects undertaken, funded or requiring an issuance of a permit by a public agency. The analysis of a project required by CEQA usually takes the form of an Environmental Impact Report (EIR), Environmental Impact Statement (EIS), Negative Declaration (ND), or Environmental Assessment (EA).[41]

<u>The California Register Criteria for Evaluation</u>
The California Register of Historical Resources is the official list of properties, structures, districts, and objects significant at the local, state or national level. California Register properties must have significance under one of the four following criteria and must retain enough of their historic character or appearance to be recognizable as historical resources and convey the reasons for their significance (i.e. retain integrity). The California Register utilizes the same seven aspects of integrity as the National Register. Properties that are eligible for the National Register are automatically eligible for the California Register. Properties that do not meet the threshold for the National Register may meet the California Register criteria.

1. Associated with events that have made a significant contribution to broad patterns of local or regional history, or cultural heritage of California or the United States;

2. Associated with the lives of persons important to the local, California or national history

[41] South Coast Air Quality Management District, CEQA, http://www.aqmd.gov/ceqa/ (accessed 25 February 2010).

3. Embodies the distinctive characteristics of a design-type, period, region, or method of construction, or represents the work of a master, or possesses high artistic value; or

4. Yields important information about prehistory or history of the local area, California or the nation.

In addition to meeting one or more of the above criteria, the CRHR requires that sufficient time must have passed to allow a "scholarly perspective on the events or individuals associated with the resource." Fifty years is used as a general estimate of the time needed to understand the historical importance of a resource.[42] The OHP recommends documenting, and taking into consideration in the planning process, any cultural resource that is 45 years or older.[43]

CRHR criteria are similar to National Register criteria, and are tied to CEQA, as any resource that meets the above criteria, and retains a sufficient level of historic integrity, is considered an historical resource under CEQA. Integrity is the authenticity of an historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. Historical resources eligible for listing in the California Register must meet one of the criteria of significance described above and retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. It is possible that historical resources may not retain sufficient integrity to meet the criteria for listing in the National Register, but they may still be eligible for listing in the California Register.[44] Resources that are significant, meet the age guidelines, and possess integrity will generally be considered eligible for listing in the CRHR.

To be listed on the California Register a formal application must be completed and sent to the State Historic Resources Commission (SHRC) for consideration. Consent of the property owner is not required, but a resource cannot be listed if the owner's objects. The SHRC can, however, formally determine a property eligible for the California Register if the resource owner objects.

Evaluation Framework - Local

City of San Francisco Criteria for Evaluation[45]
City and County of San Francisco criteria for evaluation of historic resources is based on Planning Code Section 1004(a)(1): having a special character or special historical, architectural or aesthetic interest or value.

The following information is quoted from *San Francisco Preservation Bulletin #5: Landmark and Historic District Designation Procedures*:[46]

> The City of San Francisco maintains a list of locally designated City Landmarks and Historic Districts, similar to the National Register of Historic Places but at the local level. Landmarks can be buildings, sites, or landscape features. Districts are defined generally

[42] CCR 14(11.5) §4852 (d)(2).
[43] California Office of Historic Preservation, 1995, p.2. Instructions for Recording Historical Resources. Office of Historic Preservation, Sacramento.
[44] California Office of Historic Preservation, 2006, p.2. California Register and National Register: A Comparison. Technical Assistance Series No. 6. California Department of Parks and Recreation, Sacramento. Assistance Series No. 6. California Department of Parks and Recreation, Sacramento.
[45] San Francisco Preservation Bulletin #5 is quoted here as no criteria for evaluation are presented in Article 10 of the San Francisco Planning Code. Article 10 establishes only the procedures for designation.
[46] This bulletin is available on the SF Planning Department website:
http://www.sfgov.org/site/planning_index.asp?id=24996.

as an area of multiple historic resources that are contextually united. The regulations governing Landmarks, as well as the list of individual Landmarks and descriptions of each Historic District, are found in Article 10 of the Planning Code.

A landmark may include any structure, landscape feature, site or area having historic, architectural, archaeological, cultural or aesthetic significance in the history of San Francisco, the State of California or the nation. Examples of local landmarks include such diverse structures as monumental as City Hall and the Ferry Building as well as small scaled, rare, surviving structures such as a Blacksmith Shop and a 1906 Refugee Shack.

According to San Francisco Preservation Bulletin #5, the San Francisco Landmarks Advisory Board and the Planning Commission use the National Register Criteria for evaluating potential historic properties.[47]

These criteria are quoted below for informational purposes. Properties considered historically significant are those:

Criterion A: that are associated with events that have made a significant contribution to the broad patterns of our history; or

Criterion B: that are associated with the lives of persons significant in our past; or

Criterion C: that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

Criterion D: that have yielded, or may be likely to yield, information important in prehistory or history.[48]

EVALUATION OF SIGNIFICANCE

National Register of Historic Places (NRHP)

<u>Criterion A (Associative Value - Event)</u>:
To be considered for listing under Criterion A, a property must be associated with one or more events important within a defined historic context. Criterion A recognizes properties associated with single events, such as the founding of a town, or with a pattern of events, repeated activities, or historic trends, such as the gradual rise of a port city's prominence in trade and commerce. The event or trends, however, must clearly be important within the associated context: settlement, in the case of the town, or development of a maritime economy, in the case of the port city. Moreover, the property must have an important association with the event or historic trends, and it must retain historic integrity.[49]

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[47] It should be noted that the San Francisco Landmarks Advisory Board was replaced by the Historic Preservation Commission in November 2008.
[48] San Francisco Preservation Bulletin No. 5: Landmark and Historic District Designation Procedures (page 6). SF Planning Department website: http://www.sfgov.org/site/planning_index.asp?id=24996.
[49] National Park Service, National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation, Rebecca H. Shrimpton, ed., 2002.

The following is a direct quote from the historic resource evaluation completed by the California Office of Transportation (Caltrans) in 2008. The California Office of Historic Preservation (OHP) concurred with this finding in 2008. Circa: Historic Property Development also concurs with the finding.

> *Criterion A: Association with significant events - expansion of Major League baseball to the West Coast*
>
> Prior to the 1958 baseball season, the 16 Major League teams (eight in the American League and eight in the National League) were concentrated in the northeastern quarter of the country. The westernmost teams in 1957 were the Kansas City Athletics of the American League and the St. Louis Cardinals of the National League. The Athletics had relocated from Philadelphia only in 1955. The Brooklyn Dodgers and New York Giants, both of the National League, relocated to California prior to the start of the 1958 baseball season, with the Dodgers going to Los Angeles and the Giants to San Francisco.
>
> The Dodgers and Giants were not the first teams to move from one city to another. In addition to the previously mentioned Athletics, the Boston Braves moved to Milwaukee in 1953 and the St. Louis Browns moved to Baltimore in 1954, changing their name to the Orioles. However, the relocation of the Dodgers and Giants to the West Coast greatly expanded the geographical reach of Major League baseball. The two teams' move west reflected the rapid postwar population growth of California and other Western states, compared to the relatively slower rate of growth in the Northeast and Midwest.
>
> The Dodgers and Giants took advantage of the expanding market for professional sports in the West. The relocation of these two teams initiated the westward expansion of Major League baseball, which currently has teams in Houston, the Dallas-Fort Worth area, Denver, Phoenix, and Seattle, in addition to the California cities of San Diego, Anaheim, Los Angeles, Oakland, and San Francisco. The move to the West Coast in the late 1950s also reflected improvements in transportation, with the advent of jet travel making the nationwide distribution of sports teams feasible. In November of 1954, San Francisco's voters approved a bond measure for the construction of a baseball stadium, in the hope of enticing a major league team to move to their city. However, no team acted on this offer until 1957. Horace Stoneham, owner of the New York Giants, and Walter O'Malley, owner of the Brooklyn Dodgers, jointly considered moving to the West Coast at that time. It was thought that two teams needed to move in order to make the relocation economically feasible. The cost of travel to games would be prohibitive for a single team, with every other team in their league more than 1,500 miles away.
>
> On August 19, Stoneham announced his intention to move the Giants to San Francisco, and O'Malley announced on October 8 that the Dodgers would move to Los Angeles. The Dodgers played their home games from 1958 through 1961 at the Los Angeles Coliseum, until the completion of Dodger Stadium at Chavez Ravine in 1962. The Coliseum was built as a football stadium in the early 1920s and enlarged for the 1932 summer Olympics. Inserting a baseball diamond into the Coliseum was a difficult fit, with the left-field foul line only 250 feet from home plate to the outfield fence and the right-field line a very deep 390 feet. (Although distances to the outfield fences are not uniform among Major League ballparks, 330 feet is typical.)
>
> The Giants played their first two seasons in California at Seals Stadium, while Candlestick Park was under construction. Seals Stadium, built in 1931 at the comer of 16th and Bryant Streets, had been the home of the minor league San Francisco Seals of the Pacific Coast League. The city purchased the land at Candlestick Point in

southeastern San Francisco from Charles Harney, a contractor who also built the stadium. Construction began in September 1958 and the stadium opened on April 12, 1960. The cost of the new stadium was nearly $15 million.

The stadium was named Candlestick Park as a result of a naming contest run by the city's Recreation and Parks Department. It was renamed 3 Com Park in 1996, when the 3 Com Corporation paid for the naming rights. The Giants left the stadium after the 1999 season, moving to a new baseball-only stadium in the city's South-of-Market area. The Monster Cable Products Company bought the naming rights in 2004, and the stadium has been called Monster Park since that time.

...The stadium meets criterion A for its association with the expansion of Major League baseball to the West Coast in the late 1950s. Although the stadium was not ready for the Giants until the 1960 season, planning and financing began even before Stoneham's announcement of his intent to relocate the team to San Francisco, and the move was predicated on the city's construction of a stadium. Completed two years before Dodger Stadium in Los Angeles, Candlestick Park was the first stadium built for Major League baseball west of Kansas City.

Criterion A: Association with significant events - sporting, entertainment and other events

Sports stadiums and arenas are inherently important as the home field for their cities' professional sports teams. They are places of tradition and accumulated memories for thousands of sports fans, and an important component of each metropolitan area's civic identity. Candlestick Park has hosted many memorable sporting events since its opening in 1960. The Giants played two World Series' at the stadium, losing to the New York Yankees in 1962 and to the Oakland Athletics in 1989. The 1989 series was disrupted by the Loma Prieta earthquake, which occurred during the third game of the series with a sellout crowd at Candlestick Park. Although there was some damage to the stadium, no one at the game was injured. One of the greatest pitching duals of all time took place at Candlestick Park on July 2, 1963. Juan Marichal of the Giants and Warren Spahn of the Milwaukee Braves, both later inducted into the baseball Hall of Fame, battled for 16 innings. Neither team scored a run until a home run by Willie Mays in the bottom of the 16th inning gave the Giants a 1-0 victory. The most notable events in football occurred in 1980 and 1982. Described by sportswriter Nick Peters as "the greatest comeback in NFL history," the 1980 contest between the 49ers and the New Orleans Saints was 35-7 in favor of the Saints at halftime. Quarterback Joe Montana passed for 247 yards in the second half to tie the game which the 49ers won with an overtime field goal. Two years later, in a game against the Dallas Cowboys, Montana completed a touchdown pass to Dwight Clark, known simply as "the catch" to football fans, to give the 49ers their first conference championship. In addition to baseball and football games, Candlestick Park has hosted many other notable events, such as the last live performance of the Beatles in 1966 and a Mass celebrated by Pope John Paul II in 1987.

Although these events are important to those who witnessed them, they do not qualify Candlestick Park for National Register listing under Criterion A. Over time, any major sports stadium will accumulate its share of memorable contests, championship victories, records set and broken, and feats of athleticism. Only a stadium's greater age, and therefore its greater store of memorable events, distinguishes one stadium from another in this respect. Such events are the common legacy of all major sports stadiums, and they do not qualify their respective venues for National Register listing, either individually or collectively. In addition, all of the notable sporting, entertainment, and other events at Candlestick Park have occurred since 1960, and none are of such exceptional significance that they would qualify the stadium for National Register listing under criteria consideration G for properties that have achieved significance within the last fifty years.[50]

Criteria Consideration G: The National Register Criteria generally exclude properties that have achieved significance within the past fifty years unless they are of exceptional importance. "Fifty years is a general estimate of the time needed to develop historical perspective and to evaluate significance. This consideration guards against the listing of properties of passing contemporary interest and ensures that the National Register is a list of truly historic places." The phrase "exceptional importance" may be applied to the extraordinary importance of an event...or association [and] "properties that are more than fifty years old, but whose significant associations or qualities are less than fifty years old, must be treated under the fifty-year consideration." [51]

Despite the fact that the Caltrans evaluation was developed before the stadium reached the fifty-year mark, the same conclusions discussed above regarding to Criteria Consideration G can be applied. [52] A property does not become a resource simply by crossing the 50-year mark and a collection of notable, but not nationally significant events, does not qualify the stadium for listing on the National Register.

A national historical event occurred here during the 1989 World Series when the Loma Prieta earthquake of October 17, 1989 shook Candlestick Park and postponed the World Series between the Giants and Oakland A's. However, this event at the stadium was not one that changed, altered or influenced any aspect of San Francisco or Nation. Indeed, the quake had a much greater effect on buildings, structures, objects and people in other areas of San Francisco and Northern California than did the delay of a sporting event. While ESPN broadcast the quake at the stadium — through microwave feed, thereby changing the role of sport broadcasting[53] — more significant earthquake events occurred, including the deaths of 62 people in Northern California (including 42 deaths due to the collapse of the Cypress Freeway in Oakland), collapse of part of the Bay Bridge, injuries (3,757 people) and homelessness (3,000-12,000 people). [54] (Note: see below for discussion of Criterion G and the property's associations with important people that have achieved significance into a period less than fifty years.)

Candlestick Park appears to be eligible for the National Register under Criterion A for its association with the expansion of Major League baseball to the West Coast in the late 1950s/early 1960s.

Criterion B (Associative Value - Person):
Properties may be eligible for the National Register if they are associated with the lives of persons significant in our past. According to National Register Bulletin 15, persons "significant in our past" refers to individuals whose activities are demonstrably important within a local, State, or national historic context. Properties eligible under this criterion are usually those associated with a person's productive life, reflecting the time period when he or she achieved

[50] Andrew Hope, California Department of Transportation, DPR 523 A & B, January 2008.
[51] National Park Service Bulletin 15 (accessed 3.26.2010)
http://www.nps.gov/nr/publications/bulletins/nrb15/nrb15_7.htm#crit%20con%20g
[52] National Park Service Bulletin 15.
[53] http://search.espn.go.com/1989-world-series/ (accessed 22 March 2010).
[54] http://www.vibrationdata.com/earthquakes/lomaprieta.htm (accessed 22 March 2010).

significance. The best representatives usually are properties associated with the person's adult or productive life.[55]

The following is a direct quote from the historic resource evaluation completed by Caltrans in 2008. The California OHP concurred with this finding in 2008. Circa: Historic Property Development also concurs with the finding.

> Candlestick Park does not meet National Register Criterion B for association with any of the Giants former field managers or executive office personnel. With the exception of team owner Horace Stoneham's role in bringing Major League baseball to the West Coast, none of these people played significant roles in baseball history during their time in San Francisco. The movement of the Giants and Dodgers to the West Coast in 1958 is discussed above under Criterion A.
>
> The Giants had several outstanding players who spent a large part of their careers in San Francisco during the Candlestick Park years. Those players now in the baseball Hall of Fame include Orlando Cepeda, Juan Marichal, Willie Mays, Willie McCovey, and Gaylord Perry. Of these, Mays stands above the rest as one of the game's greatest players. His small circle of peers would include only the best players of all time, such as Ty Cobb, Babe Ruth, Joe DiMaggio, Ted Williams, and Hank Aaron. When he retired after the 1973 season, Mays was third on the career home run list with 660, trailing only Babe Ruth (714) and Hank Aaron (713). Mays is currently fourth on the list, having been passed by Barry Bonds. Mays' accomplishments during his Candlestick Park years include leading the National League in hits in 1960, runs scored in 1961, and home runs in 1962, 1964, and 1965. He received the Most Valuable Player award in 1965, and nine Gold Glove awards for fielding excellence, from 1960 through 1968.
>
> Candlestick Park meets National Register Criterion B for association with the career of Willie Mays. Starting with the New York Giants in 1951, Mays moved with the team to San Francisco and stayed until 1972, when he was traded to the New York Mets early in the season. He finished his playing career with the Mets, retiring after the 1973 season. Of his 22 seasons in the major leagues, Mays spent 14 full seasons and a small portion of a 15th in San Francisco, with Candlestick Park as his home field during all but two of these. Approximately 60 percent of his career home games were played at Candlestick Park, compared to approximately 25 percent at the Polo Grounds in New York, ten percent at Seals Stadium, and five percent at Shea Stadium in New York with the Mets. As the Polo Grounds and Seals Stadium are no longer extant, and Mays' tenure with the Mets was brief, Candlestick Park is the property most closely associated with his career and accomplishments in baseball. Mays' career at Candlestick Park began with the opening of the stadium in 1960, slightly less than 50 years ago, and continued to 1972, only 36 years ago. However, he is the one player in San Francisco Giants history whose achievements could be considered to be of exceptional significance in the history of baseball. In addition, enough time has passed to accurately evaluate the significance of Mays' career, and his stature among the greatest players of all time will not diminish in the future, even as later players surpass his accomplishments.

As discussed above, a property may be considered eligible for the National Register under Criteria Consideration G if the property achieved significance within the past fifty years and is of *exceptional importance*. The National Register discourages the nomination of such properties associated to a person still living unless sufficient scholarship and evidence of historical

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[55] Matt Weintraub, "Giant Footprints: Building The New Ballpark Landscape In San Francisco" (M.A. Thesis, San Francisco State University, 2004)

perspective exist and whose active life in their field of endeavor is over. Further, Criteria Consideration G must be considered for a property that "continues to achieve significance into a period less than fifty years". [56] According to the National Park Service,

> …the more recently a property has achieved significance, generally, the more difficult it is to demonstrate exceptional importance. The case for exceptional importance is bolstered when there is a substantial amount of professional, documented materials on the resource and the resource type. A property listed in the National Register 10 or 15 years after it has achieved significance requires clear, widespread recognition of its value to demonstrate exceptional importance."[57]

Mays' career at Candlestick Park began with the opening of the stadium in 1960, 50 years ago at the time of this evaluation, and continued to 1972, 38 years ago. Other notable players associated with Candlestick Park have more recent associations with the property. As such, the evaluation below is discussed in terms of both Criterion B and Criteria Consideration G.

Mays is considered one of the greatest all-around players in the history of baseball and his achievements can "be considered to be of exceptional significance in the history of baseball." A simple library search for Mays identifies a substantial number of printed publications dedicated to Mays' life and career in baseball. Various biographies and historical studies exist that discuss the player's unique life story, as well as his place within the history of the sport and the larger social history of the nation during the span of his active career. As almost 40 years have passed since the end of Mays' baseball career at Candlestick and a number of documentary studies have been completed about his career in professional sports, Circa concurs with the above finding that Candlestick Park appears eligible for the National Register for association with Willie Mays under Criterion B/G. While Candlestick Park was found to meet National Register Criterion B/G for association with the baseball career of Willie Mays, its association to other sport figures within the past fifty years did not meet exceptional importance. This includes other notable players that are associated with Candlestick Park such as Barry Bonds, Joe Montana, and Jerry Rice.

Barry Bonds, left fielder in the National Baseball League, played for the San Francisco Giants from 1986 to 2007. He holds the record for the most career home runs, 756, and was voted Most Valuable Player seven times, the Hank Aaron Award three times, and Major League Player of the Year three times.[58] Bonds will become eligible for considerable for induction into the Baseball Hall of Fame in 2013.[59] Bonds played seven years at Candlestick (1993 -1999) and eight years at AT&T Park (2000-2007).

Joe Montana, quarterback in the National Football League, played for the San Francisco 49ers from 1979 to 1992. He led the 49ers to four Super Bowl wins (Super Bowls XVI, XIX, XXIII, and XXIV) and was named Super Bowl MVP three times. When he retired, he ranked fourth in career passing yardage (40,551 yards), attempts (5,391), and passing touchdowns (273). His 3,409 completions ranked third all-time, and his career passer rating of 92.3 was second all-time. He holds numerous records and awards including being name All-NFL three times, All-NFC

[56] National Park Service, National Register Bulletin 22: Guidelines for Evaluating and Nominating Properties that Have Achieved Significance within the Past Fifty Years, Carol D. Shull, ed., 1990. Online at http://www.nps.gov/nr/publications/bulletins/nrb22/nrb22_V.htm (accessed 3.26.2010). See also National Register Bulletin 15.

[57] National Register Bulletin 22.

[58] Baseball Reference.Com web site (accessed 14 March 2010) www.baseball-reference.com/players/b/bondsba01. shtml?redir.

[59] National Baseball Hall of Fame web site (accessed 14 March 2010) www.community.baseballhall.org/Page.aspx? pid=414.

five times, and voted to the Pro Bowl eight times. He was inducted into the Football Hall of Fame Class in 2000.[60] No Super Bowl games were ever played at Candlestick Park.[61]

Jerry Rice, wide receiver in the National Football League, played for the San Francisco 49ers from 1985-2000. When he retired, he was the most prolific wide receiver in NFL history with records for receptions (1,549); receiving yards (22,895 yards); most 1,000-yard receiving seasons (14); total touchdowns (208); and combined net yards (23,546). Rice holds many NFL playoff and Super Bowl records. He played in eight conference championships and four Super Bowls. He earned three Super Bowl rings with the 49ers and was named the Most Valuable Player of San Francisco's Super Bowl XXIII. He was inducted into the Football Hall of Fame in 2010.[62]

For Bonds, Montana, and Rice, all outstanding athletes in their own right, the case for *exceptional importance* under Criterion Consideration G cannot be made. All of their achievements have been made in the very recent past, and Bonds earned most of his awards when the team was based at AT&T Park. Joe Montana's active career ended eighteen years ago, Jerry Rice's ten years ago, and Barry Bonds' three years ago. Sufficient historical perspective does not exist to determine that Candlestick Park is exceptionally important for its association with these players.

Candlestick Park appears to be eligible for the National Register under Criterion B/Criteria Consideration G for association with the baseball career of Willie Mays.

<u>Criterion C (Design/Construction)</u>:
This criterion applies to properties significant for their physical design or construction, including such elements as architecture, landscape architecture, engineering, and artwork. To be eligible under Criterion C, a property must meet at least one of the following requirements: Embody distinctive characteristics of a type, period, or method of construction.

- Represent the work of a master.
- Possess high artistic value.
- Represent a significant and distinguishable entity whose components may lack individual distinction.

The following direct quotes are from the historic resource evaluation completed by Caltrans in 2008. The California OHP concurred with this finding in 2008. Circa: Historic Property Development also concurs with the finding.

> The stadium's designer, John S. Bolles, was a prominent Bay Area architect who began his independent practice in the mid-1950s. His varied practice included a number of corporate and industrial facilities, such as the Gallo Winery in Modesto, the General Motors assembly plant in Fremont, and the IBM complex in San Jose. [Jones & Stokes: Appendix B, p. 7.] However, as many of his designs (including Candlestick Park) are not yet 50 years old, it is premature to consider Bolles a "master" architect under National Register criterion C.
>
> Sports stadiums are a rare property type, with most metropolitan areas having only one or two, in addition to college and university stadiums. Consequently, they are difficult

[60] Pro Football Hall of Fame web site (accessed 14 March 2010), www.profootballhof.com/hof/member.aspx? player_id=154.
[61] Super Bowl History (accessed 3.26.2010) http://www.superbowlhistory.net/superbowl/index.php.
[62] Football Hall of Fame web site (accessed 14 March 2010), www.profootballhof.com/hof/member.aspx?PlayerId=290.

to evaluate in a strictly local context. An evaluation of Candlestick Park under National Register criterion C therefore requires an understanding of its place in the evolution of baseball stadium design nationwide. There are presently 30 major league baseball stadiums (29 in the United States and one in Toronto) as well as several former stadiums that are still used for football or other events or are now vacant. None of the stadiums currently in use are listed on the National Register of Historic Places. However, two former stadiums have been listed: Municipal Stadium in Cleveland (built in 1931 and demolished in 1996) and Tiger Stadium in Detroit (built in 1912, [demolished 2008-09]). Of the three pre-World War II stadiums currently in use, Fenway Park in Boston (1912) and Wrigley Field in Chicago (1914) may be eligible for National Register listing, while Yankee Stadium in New York (1923) lacks integrity due to extensive renovations carried out in the 1970s.

A period of new stadium construction began with the Toronto Skydome of 1989 and accelerated with the opening of Oriole Park at Camden Yards in Baltimore in 1992. Oriole Park's neo-traditional design was extremely influential, leading to the construction of similar baseball stadiums in more than a dozen cities, including San Francisco. As a result, there are presently only nine current and three former major league baseball stadiums in the United States that are more than thirty years old, and only four of these are more than 50 years old.

The stadiums dating to the first half of the twentieth century were constructed of concrete and steel, and often consisted of a series of expansions undertaken over the course of several decades. They all had steel columns supporting their upper grandstands and roofs, creating obstructed-view seats below. These stadiums were generally located in older urban neighborhoods, accessible by streetcars. Only three new major league baseball stadiums were constructed in the 1950s. The earliest was Memorial Stadium in Baltimore, which opened in 1950 for the minor league Orioles and the professional football Colts. The upper deck was added in 1954, when the Major League St. Louis Browns relocated to Baltimore and became the Orioles. County Stadium in Milwaukee was built in 1953, when the Boston Braves relocated to that city. Finally, Metropolitan Stadium was constructed in suburban Minneapolis in1956, for the minor league Millers. It was expanded for the 1961 season when the Major League Washington Senators relocated to the Twin Cities and became the Minnesota Twins. The stadiums in Milwaukee and Minneapolis were similar in construction and appearance to the prewar stadiums, while Memorial Stadium in Baltimore had a distinctly modem appearance, with a somewhat sculptural use of concrete to support the upper deck.

Candlestick Park opened for use by the Giants in 1960. It exhibited some innovations in design, including a more extensive use of concrete than in most previous stadiums. The upper deck was pulled well back from the front of the lower deck, allowing columns to be placed near the rear of the lower-deck stands and greatly reducing the number of obstructed-view seats. The outer support for the upper deck consists of diagonal bracing, with each inverted "V" shape supporting a concrete rib that continues upward to support the curved roof that covers a portion of the upper deck. This was an even more distinctly modem, sculptural use of concrete than was seen at Baltimore a few years earlier.

Following the construction of Candlestick Park, a new stadium was completed in the City of Washington [D.C.] that housed the football Redskins beginning with the 1961 season and the expansion Senators of the American League beginning with the 1962 baseball season. Dodger Stadium in Los Angeles opened in 1962, and was followed by several new stadiums in the later 1960s, including Shea Stadium (New York Mets, 1964), the Astrodome (Houston Astros, 1965), Fulton County Stadium (Atlanta Braves, 1966), Busch Stadium (St. Louis Cardinals, 1966), and the Oakland Coliseum (Athletics, 1968). These new stadiums were typically located in outlying areas of their cities or in the suburbs, and were surrounded by extensive parking lots, in contrast to the urban settings of older stadiums. Designed for both baseball and football, these new stadiums were mostly circular or elliptical in plan. In the case of Shea Stadium and the Oakland Coliseum, they were built as a portion of a circle that could later be expanded to form a complete ring. These modern-era stadiums were all built with the upper tiers of seating pulled back farther from the playing field than the lower level, with concrete cantilevers allowing the complete elimination of interior columns. The Astrodome has the additional distinction of being the first stadium for baseball or football to be completely covered.

Candlestick Park does not meet National Register criterion C for its design qualities. In the evolution of baseball stadium design, Candlestick Park can more accurately be considered the last of the old-style ballparks rather than the first of the modern type, or a transitional design between the historic and modern types. The first entirely modern baseball stadiums were District of Columbia Stadium (renamed Robert F. Kennedy Memorial Stadium) and Dodger Stadium in Los Angeles. Although modern in appearance, Candlestick Park's innovations were limited and tentative. A heating system was installed as part of the original construction. This would have made Candlestick the first unenclosed but heated stadium, but the system never worked properly and was soon abandoned. More importantly, all of the modern stadiums are devoid of interior columns, eliminating the obstructed-view seats that are a problem for all of the older stadiums. Candlestick Park has interior columns, although they are located to reduce the number of obstructed view seats compared to earlier stadiums.

Candlestick Park accommodated both baseball and football even before its expansion for the San Francisco 49ers in the early 1970s. The Oakland Raiders, at that time part of the new American Football League, played their final three home games of 1960 and all of their 1961 home games at the stadium. However, the stadium is not significant in this regard, as dual-purpose stadiums were built both before and after Candlestick Park. In the years before professional football became the major sport that it is today, many football teams played in their cities' baseball stadiums. Most of those stadiums were not specifically designed for football, but could accommodate a football field and were often the only venue that provided a large seating capacity. Similarly, Candlestick Park could accommodate football but was designed and used primarily for baseball until the expansion of the early 1970s. At least two of the stadiums that predate Candlestick Park, Municipal Stadium in Cleveland and Memorial Stadium in Baltimore, were specifically designed for both sports. These two stadiums have the oval shape that is characteristic of football stadiums, with a somewhat widened oval to accommodate a baseball diamond.

Following the construction of Candlestick Park, the circular stadiums of the later 1960s and 1970s were all designed for both sports. In conclusion, Candlestick Park does not meet National Register Criterion C.

A property is eligible for listing under Criterion C if it embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; possesses high artistic value; or, represents a significant and distinguishable entity whose components may lack individual distinction. As discussed above, the original baseball turned dual use stadium was not the first of its type or method of construction; it was neither the first concrete stadium nor a prototype for the multi-purpose stadiums that were built shortly after Candlestick Park was constructed.

With regard to consideration of the stadium as the work of a master, John S. Bolles was a prolific Bay Area architect whose San Francisco work includes the 1959 Ping Yuen Annex housing project, Embarcadero Park, and the Anna E. Waden Library in San Francisco. While he was a well-known architect within the Bay Area, sufficient time has not passed to sufficiently evaluate Bolles' status as a "master" architect. According to National Register Bulletin 15, a "master is a figure of generally recognized greatness in a field, a known craftsman of consummate skill, or an anonymous craftsman whose work is distinguishable from others by its characteristic style and quality." For a property to be eligible under this criterion it "must express a particular phase in the development of the master's career, an aspect of his or her work, or a particular idea or theme in his or her craft. A property is not eligible as the work of a master, however, simply because it was designed by a prominent architect."[63] Bolles' commissions were diverse over his nearly 40-year career and included commercial, industrial, site planning, interior design commissions and major residential projects, most of which incorporated modern art and sculpture. Some of his major clients included IBM, Macy's, General Motors, and Gallo and Paul Masson wineries.[64] The architect's active career ended only about 30 years ago and the historical value of Candlestick Park within the larger body of his work cannot be adequately assessed due to a lack of historical perspective. Despite the fact that the artist considered his original design for Candlestick Park more sculptural than architectural, the building does not possess high artistic value. Further, the building has been significantly altered from the original design and configuration. Therefore, Candlestick Park stadium is not considered the work of a master.

Candlestick Park does not appear to be eligible for the National Register under Criterion C for design/architecture.

Criterion D (Information Value):
Criterion D most commonly applies to properties that contain or are *likely* to contain information bearing on an important archeological research question.

Candlestick Park is situated on an area that is comprised largely of fill. The Candlestick Point – Hunters Point Shipyard Phase III EIR archaeological research found that archaeological resources expected to be found on the Candlestick Point site could have important research value and would, therefore, be legally significant under CEQA. Examples of research themes that have been proposed to which expected archaeological resources could contribute significant data include the spatial organization and historical development of Chinese fishing camps and prehistoric shell mounds. Any potential archeological resources that are covered by existing development will remain covered and unavailable unless the site is redeveloped. Adverse effects of construction-related activities to archaeological resources at Candlestick Point, including demolition of the stadium, would be less-than-significant through implementation of the Candlestick Point – Hunters Point Shipyard Phase III Archaeological Research Design and Treatment Plan.

Candlestick Park does not appear to be eligible for the National Register under Criterion D for Information Value.

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[63] National Register Bulletin 15.

[64] David Perry, "Bolles, John Savage," Encyclopedia of San Francisco, A Project of the SF Museum and Historical Society. Online at: http://www.sfhistoryencyclopedia.com/articles/b/bollesJohn.html (accessed 29 March 2010).

California Register of Historical Resources (CRHR)
The California Register of Historical Resources and the National Register of Historic Places significance criteria are essentially the same. The California Register criteria are consistent with the National Register, however they "...have been modified for state use in order to include a range of historical resources which *better reflect the history of California* [emphasis added]." (California Code of Regulations (CCR) §4852)[65] It is recognized that a property may not retain enough integrity to meet the NRHP but they may still be eligible for listing in the California Register. The following criteria evaluation is based on Candlestick Park's significance as it relates primarily to California history. Resources that are significant, meet the age guidelines, and possess integrity will generally be considered eligible for listing in the CRHR.

<u>Criterion 1 (Events):</u>
Associated with events that have made a significant contribution to broad patterns of local or regional history, or cultural heritage of California or the United States.

As discussed in more detail under Criterion A above, Candlestick Park appears to meet Criterion 1 for its association with the expansion of Major League baseball to the West Coast in the late 1950s. Completed two years before Dodger Stadium in Los Angeles, Candlestick Park was the first stadium built for Major League baseball on the West Coast. Candlestick Park does not appear to be eligible for listing on the California Register for its association with events such as the 1989 earthquake during the World Series, "the Catch", the 1966 Beatles concert or a visit by Pope John Paul II in 1987. As stated by Andrew Hope, while "these events are important to those who witnessed them, they do not qualify [the property for] listing...Over time, any major sports stadium will accumulate its share of memorable contests, championship victories, records set and broken, and feats of athleticism."[66] Though notable, these events did not have an enduring impact on the State or region. Further, these events all happened less than fifty-years ago and do not rise to a level of significance that would make the subject property eligible for listing on the California Register.

Candlestick Park appears eligible for listing on the California Register of Historical Resources under Criterion 1 for association with the expansion of Major League baseball to the West Coast in the 1950s/1960s.

<u>Criterion 2 (People)</u>
Associated with the lives of persons important to the local, California or national history

As described in more detail above under Criterion B, Candlestick Park appears eligible for association with Willie Mays' baseball career. Mays' career at Candlestick Park began with the opening of the stadium in 1960, 50 years ago at the time of this evaluation, and continued to 1972, 38 years ago. Other notable players associated with Candlestick Park have more recent associations with the property.

Mays is considered one of the greatest all-around players in the history of baseball and his achievements can be considered to be of exceptional significance in the history of baseball. While Candlestick Park appears to meet California Register Criterion 2 for association with the baseball career of Willie Mays, sufficient time has not passed to understand the historical importance of other notable players that are associated with Candlestick Park such as Barry Bonds, Jerry Rice and Joe Montana.

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[65] California Office of Historic Preservation, 2006, p.2. California Register and National Register: A Comparison. Technical Assistance Series No. 6. California Department of Parks and Recreation, Sacramento. Assistance Series No. 6. California Department of Parks and Recreation, Sacramento.
[66] Andrew Hope, California Department of Transportation, DPR 523 A & B, January 2008.

Barry Bonds, left fielder in the National Baseball League, played for the San Francisco Giants from 1986 to 2007. He holds the record for the most career home runs, 756, and was voted Most Valuable Player seven times, the Hank Aaron Award three times, and Major League Player of the Year three times.[67] Bonds will become eligible for considerable for induction into the Baseball Hall of Fame in 2013.[68] Bonds played seven years at Candlestick (1993 -1999) and eight years at AT&T Park (2000-2007).

Joe Montana, quarterback in the National Football League, played for the San Francisco 49ers from 1979 to 1992. He led the 49ers to four Super Bowl wins (Super Bowls XVI, XIX, XXIII, and XXIV) and was named Super Bowl MVP three times. When he retired, he ranked fourth in career passing yardage (40,551 yards), attempts (5,391), and passing touchdowns (273). His 3,409 completions ranked third all-time, and his career passer rating of 92.3 was second all-time. He holds numerous records and awards including being name All-NFL three times, All-NFC five times, and voted to the Pro Bowl eight times. He was inducted into the Football Hall of Fame in 2000.[69] No Super Bowl games were ever played at Candlestick Park.[70]

Jerry Rice, wide receiver in the National Football League, played for the San Francisco 49ers from 1985-2000. When he retired, he was the most prolific wide receiver in NFL history with records for receptions (1,549); receiving yards (22,895 yards); most 1,000-yard receiving seasons (14); total touchdowns (208); and combined net yards (23,546). Rice holds many NFL playoff and Super Bowl records. He played in eight conference championships and four Super Bowls. He earned three Super Bowl rings with the 49ers and was named the Most Valuable Player of San Francisco's Super Bowl XXIII. He was inducted into the Football Hall of Fame in 2010.[71]

For Bonds, Montana and Rice, all outstanding athletes in their own right, the case for CRHR listing under this criterion cannot be made because sufficient time has not passed to obtain a scholarly perspective on the importance of their achievements within their respective sports. All of their achievements have been made in the very recent past. Joe Montana's active career ended only eighteen years ago, Jerry Rice's ten years ago, and Barry Bonds three years ago. Sufficient historical perspective does not exist to determine that Candlestick Park is significant to the history of California for its association with these players.

Candlestick Park appears to be eligible for the California Register under Criterion 2 for association with the baseball career of Willie Mays.

<u>Criterion 3 (Design/Construction)</u>
Embodies the distinctive characteristics of a design-type, period, region, or method of construction, or represents the work of a master, or possesses high artistic value.

As discussed in greater detail under Criterion C above, Candlestick Park does not meet California Register Criterion 3 for its distinctive design/construction characteristics of design-type, period, region, or method of construction. Hope states that "Candlestick Park opened for use by the Giants in 1960. It exhibited some innovations in design, including a more extensive

[67] Baseball Reference.Com web site (accessed 14 March 2010) www.baseball-reference.com/players/b/bondsba01. shtml?redir.
[68] National Baseball Hall of Fame web site (accessed 14 March 2010) www.community.baseballhall.org/Page.aspx? pid=414.
[69] Pro Football Hall of Fame web site (accessed 14 March 2010), www.profootballhof.com/hof/member.aspx? player_id=154.
[70] Super Bowl History (accessed 3.26.2010) http://www.superbowlhistory.net/superbowl/index.php.
[71] Football Hall of Fame web site (accessed 14 March 2010), www.profootballhof.com/hof/member.aspx? PlayerId=290.

use of concrete than in most previous stadiums. In the evolution of baseball stadium design, Candlestick Park can more accurately be considered the last of the old-style ballparks rather than the first of the modern type, or a transitional design between the historic and modern types... Although modern in appearance, Candlestick Park's innovations were limited and tentative..."[72] The original baseball stadium turned dual use stadium was not the first of its type or method of construction. The stadium has been extensively altered since the early 1970s, especially with the expansion and enclosure of the stadium seating, and removal of the baseball diamond and conversion to a football field. The formerly open outfield area was enclosed by the extension of the upper deck around the entire perimeter of the playing field. The expansion more than doubled the amount of upper-deck seating, and added both fixed and moveable lower-deck seating in the outfield areas. This resulted in the need for new ramps and stairs that significantly altered the stadium's exterior appearance.

John S. Bolles was a prolific Bay Area architect whose San Francisco work includes the 1959 Ping Yuen Annex housing project, Embarcadero Park, and the Anna E. Waden Library in San Francisco. While he was a well-known architect within the Bay Area, sufficient time has not passed to sufficiently evaluate Bolles' status as a "master" architect. According to National Register Bulletin 15, a "master is a figure of generally recognized greatness in a field, a known craftsman of consummate skill, or an anonymous craftsman whose work is distinguishable from others by its characteristic style and quality." For a property to be eligible under this criterion it "must express a particular phase in the development of the master's career, an aspect of his or her work, or a particular idea or theme in his or her craft. A property is not eligible as the work of a master, however, simply because it was designed by a prominent architect."[73]

Bolles' commissions were diverse over his nearly 40-year career and included commercial, industrial, site planning, interior design commissions and major residential projects, most of which incorporated modern art and sculpture. Some of his major clients included IBM, Macy's, General Motors, McGraw-Hill and Gallo and Paul Masson wineries.[74] The architect's active career ended only about 30 years ago and a number of his designs are not yet 50 years old. Because of this lack of historical perspective, it is premature to consider Bolles a "master" architect since the historical value of Candlestick Park within the larger body of his work cannot be adequately assessed. Despite the fact that the artist considered his original design for Candlestick Park more sculptural than architectural, the building does not possess high artistic value. Further, the building has been significantly altered from the original design and configuration.

Candlestick Park does not appear to be eligible for the California Register under Criterion 3 for design/architecture.

Criterion 4 (Information Potential):
Yields important information about prehistory or history of the local area, California or the nation.

Candlestick Park is situated on an area that is comprised largely of fill. The Candlestick Point – Hunters Point Shipyard Phase III EIR archaeological research found that archaeological resources expected to be found on the Candlestick Point site could have important research value and would, therefore, be legally significant under CEQA. Examples of research themes

[72] Hope, 11 of 13.
[73] National Register Bulletin 15.
[74] David Perry, "Bolles, John Savage," Encyclopedia of San Francisco, A Project of the SF Museum and Historical Society. Online at: http://www.sfhistoryencyclopedia.com/articles/b/bollesJohn.html (accessed 29 March 2010).

that have been proposed to which expected archaeological resources could contribute significant data include the spatial organization and historical development of Chinese fishing camps and prehistoric shell mounds. Any potential archeological resources that are covered by existing development will remain covered and unavailable unless the site is redeveloped. Adverse effects of construction-related activities to archaeological resources at Candlestick Point, including demolition of the stadium, would be less-than-significant through implementation of the Candlestick Point – Hunters Point Shipyard Phase III Archaeological Research Design and Treatment Plan.

Candlestick Park does not appear to be eligible for the California Register under Criterion 4 for information potential.

City of San Francisco Standards for Evaluation

City and County of San Francisco criteria for evaluation of historic resources is based on Planning Code Section 1004(a)(1): having a special character or special historical, architectural or aesthetic interest or value.

"The Code does not contain specific criteria on how to survey, identify, evaluate and document cultural resources. Consequently, the Landmarks Board recognized the need to adopt a uniform system to evaluate cultural resources once they are identified. To that end, in June 2000, the Landmarks Board adopted by Resolution 527, the Secretary of Interior's Standards, and the California State Office of Historic Preservation Recordation Manual (DPR 523 series) for use in Landmark and Historic District Designation Reports and nominations, and Structures of Merit nominations under Article 10 of the Planning Code."[75]

While the City of San Francisco Landmarks Preservation Advisory Board adopted the National Register criteria for evaluation as policy for evaluation, they did not adopt considerations or establish any bar by which significance is measured.

<u>Criterion A (Events):</u>
As discussed in more detail under National Register Criterion A above, Candlestick Park appears to meet Criterion A for its association with the expansion of Major League baseball to the West Coast in the late 1950s. Completed two years before Dodger Stadium in Los Angeles, Candlestick Park was the first stadium built for Major League baseball on the West Coast. Candlestick Park does not appear to be eligible for listing on the California Register for its association with events such as the 1989 earthquake during the World Series, "the Catch", the 1966 Beatles concert or a visit by Pope John Paul II in 1987. As stated by Andrew Hope, while "these events are important to those who witnessed them, they do not qualify [the property for] listing...Over time, any major sports stadium will accumulate its share of memorable contests, championship victories, records set and broken, and feats of athleticism."[76] Though notable, these events alone did not have an enduring impact on the City of San Francisco. Further, these events all happened less than fifty-years ago and do not rise to a level of significance that would make the subject property eligible for local listing under this criterion.

Candlestick Park appears to be eligible for local listing under Criterion A for association with the expansion of Major League Baseball to the West Coast in the late 1950s/early 1960s.

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[75] San Francisco Preservation Bulletin No. 5: Landmark and Historic District Designation Procedures (page 6). SF Planning Department website: http://www.sfgov.org/site/planning_index.asp?id=24996.
[76] Andrew Hope, California Department of Transportation, DPR 523 A & B, January 2008.

Criterion B (People)
Associated with the lives of persons important to the local, California or national history

As described in more detail above under National Register Criterion B, Candlestick Park appears eligible for association with Willie Mays' baseball career. Mays' career at Candlestick Park began with the opening of the stadium in 1960, 50 years ago at the time of this evaluation, and continued to 1972, 38 years ago. Other notable players associated with Candlestick Park have more recent associations with the property.

Mays is considered one of the greatest all-around players in the history of baseball and his achievements can be considered to be of exceptional significance in the history of baseball. While Candlestick Park appears to meet local criteria for association with the baseball career of Willie Mays, sufficient time has not passed to understand the historical importance of other notable players that are associated with Candlestick Park such as Barry Bonds, Jerry Rice and Joe Montana.

For Bonds, Montana and Rice, all outstanding athletes in their own right, the case for local listing under this criterion cannot be made because sufficient time has not passed to obtain a scholarly perspective on the importance of their achievements within their respective sports. All of their achievements have been made in the very recent past. Joe Montana's active career ended only eighteen years ago, Jerry Rice's ten years ago, and Barry Bonds' three. Sufficient historical perspective does not exist to determine that Candlestick Park is significant to the history of San Francisco for its association with these players.

Candlestick Park appears to be eligible for local listing under Criterion B for association with the baseball career of Willie Mays.

Criterion C (Design/Construction)
Embodies the distinctive characteristics of a design-type, period, region, or method of construction, or represents the work of a master, or possesses high artistic value.

As discussed in greater detail under Criterion C above, Candlestick Park does not meet Criterion C for its distinctive design/construction characteristics of design-type, period, region, or method of construction. Hope states that "Candlestick Park opened for use by the Giants in 1960. It exhibited some innovations in design, including a more extensive use of concrete than in most previous stadiums. In the evolution of baseball stadium design, Candlestick Park can more accurately be considered the last of the old-style ballparks rather than the first of the modern type, or a transitional design between the historic and modern types... Although modern in appearance, Candlestick Park's innovations were limited and tentative..."[77] The original baseball stadium turned dual use stadium was not the first of its type or method of construction. The stadium has been extensively altered since the early 1970s, especially with the expansion and enclosure of the stadium seating, and removal of the baseball diamond and conversion to a football field. The formerly open outfield area was enclosed by the extension of the upper deck around the entire perimeter of the playing field. The expansion more than doubled the amount of upper-deck seating, and added both fixed and moveable lower-deck seating in the outfield areas. This resulted in the need for new ramps and stairs that significantly altered the stadium's exterior appearance.

John S. Bolles was a prolific Bay Area architect whose San Francisco work includes the 1959 Ping Yuen Annex housing project, Embarcadero Park, and the Anna E. Waden Library in San

[77] Hope, 11 of 13.

Francisco. While he was a well-known architect in San Francisco during his tenure, sufficient time has not passed to sufficiently evaluate Bolles' status as a "master" architect. According to National Register Bulletin 15, a "master is a figure of generally recognized greatness in a field, a known craftsman of consummate skill, or an anonymous craftsman whose work is distinguishable from others by its characteristic style and quality." For a property to be eligible under this criterion it "must express a particular phase in the development of the master's career, an aspect of his or her work, or a particular idea or theme in his or her craft. A property is not eligible as the work of a master, however, simply because it was designed by a prominent architect."[78]

Bolles' commissions, located throughout the Bay Area, were diverse over his nearly 40-year career and included commercial, industrial, site planning, interior design commissions and major residential projects, most of which incorporated modern art and sculpture. Some of his major clients included IBM, Macy's, General Motors, and Gallo and Paul Masson wineries.[79] The architect's active career ended only about 30 years ago and a number of his designs are not yet 50 years old. Because of this lack of historical perspective, it is premature to consider Bolles a "master" architect since the historical value of Candlestick Park within the larger body of his work cannot be adequately assessed. Despite the fact that the artist considered his original design for Candlestick Park more sculptural than architectural, the building does not possess high artistic value. Further, the building has been significantly altered from the original design and configuration.

Candlestick Park does not appear to be eligible for local listing under Criterion C for design/architecture.

<u>Criterion D (Information Potential)</u>
Yields important information about prehistory or history of the local area, California or the nation.

Candlestick Park is situated on an area that is comprised largely of fill. The Candlestick Point – Hunters Point Shipyard Phase III EIR archaeological research found that archaeological resources expected to be found on the Candlestick Point site could have important research value and would, therefore, be legally significant under CEQA. Examples of research themes that have been proposed to which expected archaeological resources could contribute significant data include the spatial organization and historical development of Chinese fishing camps and prehistoric shell mounds. Any potential archeological resources that are covered by existing development will remain covered and unavailable unless the site is redeveloped. Adverse effects of construction-related activities to archaeological resources at Candlestick Point, including demolition of the stadium, would be less-than-significant through implementation of the Candlestick Point – Hunters Point Shipyard Phase III Archaeological Research Design and Treatment Plan.

Candlestick Park does not appear to be eligible for local listing under Criterion D for information potential.

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[78] National Register Bulletin 15.
[79] David Perry, "Bolles, John Savage," Encyclopedia of San Francisco, A Project of the SF Museum and Historical Society. Online at: http://www.sfhistoryencyclopedia.com/articles/b/bollesJohn.html (accessed 29 March 2010).

INTEGRITY

To retain integrity a property must have most of the seven aspects of integrity as defined by the National Register. Integrity must also be assessed with reference to the particular criteria under which significance is established. Caltrans, the State Office of Historic Preservation, and Jones & Stokes have all previously evaluated the property and found that Candlestick Park exhibits a significantly diminished level of integrity due to 35+ years of on-going alterations. These alterations, both major and minor, have resulted in a cumulative decrease of the property's material and design integrity.

Candlestick Park operates as an athletic facility, therefore, the activities and operations related to this function go beyond that of the fan's game-day experience in the stands. Food and beverage concessions, souvenir counters and comfort facilities add to the fans experience. VIP/hospitality suites allow for another level of the fan's experience for those who prefer a more private spectatorship. Crowd control is managed with multiple ticket booths and entry gates, and through circulation routes consisting of stairs, ramps, escalator and elevators, and a system of parking lots and access roads. The playing area consists of the playing field (in-field/out-field/field diamond/batter's box/pitcher's mound/dugout/bases for baseball, and field of play/sidelines/endlines/yard markers/endzones/goal posts/marker numbers for football), and surrounding the field are the seats, press boxes, scoreboards, and lights. Behind the scenes operations provide areas for broadcasting, interviews and video and audio taping, and operation and security offices. Not to be forgotten are the players support areas: locker rooms, weight rooms and lounge areas. These stadium operations characteristics were all considered in the analysis of integrity.

As discussed in previous sections above, Candlestick Park has been substantially altered since the early 1970s. These alterations, both major and minor, greatly diminished the park's integrity of design, setting, materials, workmanship, feeling, and association. While the initial expansion was carried out in a manner generally consistent with the original design, it significantly altered the stadium's original form and appearance.

Location
The property remains in the original location where it was constructed and therefore retains integrity of location.

Design
The stadium has been extensively altered over the course of thirty years since the early 1970s, especially with the enclosure of the stadium seating and removal of the baseball diamond for football use. "The formerly open outfield area was enclosed by the extension of the upper deck around the entire perimeter of the playing field. This closed off views to the north and northeast from within the stadium for both players and fans. The expansion more than doubled the amount of upper-deck seating, and added both fixed and moveable lower-deck seating in the outfield areas. In addition, extension of the upper deck and the resulting need for new ramps and stairs significantly altered the stadium's exterior appearance."[80] Nearly all of the support and operational aspects of the stadium have been significantly altered, removed and/or replaced.

A comparison of Figures 7 and 9 clearly illustrates the extensive changes to the stadium's exterior and playing field area. Appendix A, Figures 7-19, shows historic photos and examples of new additions/alterations. The enclosure of the outfield closed off views of the surrounding area for the players and fans. As a result, the stadium's original U-shaped form and is now

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[80] Andrew Hope, *Evaluation of Candlestick Park, 11.*

irregular in plan and unrecognizable as a baseball field. Due to the extensive alterations over time, Candlestick Park is not a clear representation of its association with baseball (Criterion A/1); indeed, the only remnant of baseball use is the home team dugout with racks for bats and helmets (see Appendix A, Figure 20).

The property does not retain integrity of design.

Setting
The stadium is located on an 81-acre site and is surrounded by a paved parking lot with a chain link fence. Landscaping is minimal and consists primarily of clusters of trees around both the north and south (main) gates; a succession of trees defines the outside border of the main access road immediately surrounding the stadium. The setting has been altered due to the modification of the stadium envelope. The once U-shaped form is now an irregular oval, and nearly double its original size and height. The addition and alteration of existing gates around the building's perimeter have also altered the building's approach and appearance from the period of significance.

The property retains some integrity of the surrounding setting.

Materials
The stadium retains the original reinforced concrete and steel shell, but this original structure has been enlarged and altered over the course of 30-years. The majority of the character defining elements that characterize a baseball stadium (diamond field layout with bases, pitcher's mound, catcher's box, home plate, infield, outfield and foul lines; score board; original seating and press boxes; hospitality suites; concession stands; entrance/exist pavilions with turnstiles, ticket booths, stairwells, and elevators, etc.) have been removed or significantly altered since the 1970s. Extension of the upper deck required the addition of ramps, stairs and significantly altered the stadium exterior appearance, obscuring much of the original reinforced concrete.

The property does not retain integrity of materials.

Workmanship
Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory. It is the evidence of artisans' labor and skill in constructing or altering a building, structure, object, or site. While Bolles considered Candlestick Park more sculptural than architectural, the building does not possess high artistic value or exhibit any particular craft or workmanship therefore this aspect does not apply.

The property does not retain integrity of workmanship.

Feeling
Candlestick Park was designed and constructed as a baseball stadium; its redesign to accommodate football was to maximize investment and is not a prototype of dual use. The enclosure of the stadium seating around the original outfield, reconfiguring of the seating and alteration of the diamond configuration eliminated the feeling of a baseball field. While it reflects the feeling of a stadium it does not reflect that of a *baseball* stadium and the property have been found significant for its association with the expansion of Major League Baseball to the West Coast and with baseball legend Willie Mays.

The property does not retain integrity of feeling.

Association
Candlestick Park's historic association was once that of the first major league baseball park on the West Coast. Its change to a dual purpose (baseball/football) and ultimate conversion for primary use as a football stadium has removed the park's baseball association.

The property's association with the introduction of Major League Baseball on the West Coast would not extend to the 1970s. By that time, there were Major League Baseball teams in Anaheim, Oakland, and San Diego, in addition to San Francisco and Los Angeles. The property's association with the career of Willie Mays would extend only to the early part of 1972, before Mays was traded to the New York Mets. Mays played only 19 games with the Giants in 1972 (out of a 162-game season), while playing 69 games with the Mets. Almost 99 percent of the home games that Mays played during his Candlestick Park years were in the pre-expansion stadium, with its open outfield and upper deck seating only in the infield areas.[81]

The property does not retain integrity of association.

SUMMARY

Candlestick Park was evaluated in May 2007 for eligibility for listing on the National Register of Historic Places (NRHP) under Criteria Consideration G, since the building was less than fifty years of age at that time. Jones & Stokes found that Candlestick Park "did not appear to meet the threshold of NRHP exceptional significance for buildings less than 50 years old."[82] At that time the stadium was not evaluated for its eligibility for listing on the California Register of Historical Resources or as a San Francisco Landmark.

In April 2008 Andrew Hope, Principal Architectural Historian for the Caltrans District 4 office in Sacramento, completed a second evaluation of Candlestick Park at the request of the California Office of Historic Preservation and only addressed the park's eligibility to meet the National Register level of significance. The California Office of Historic Preservation concurred that the stadium did not retain enough physical integrity to be considered a historic resource.

Circa: Historic Property Development finds these reports to be consistent and thorough. On the basis of those reports and the additional information gathered and evaluated in this HRE, Circa concludes that the property known as Candlestick Park Sports Stadium (Block 5000, Lot 001) does not retain enough integrity to adequately communicate its historical significance as representative of the expansion of Major League Baseball to the West Coast or association with the baseball career of Willie Mays. Since properties must both exhibit historical significance and retain integrity, Candlestick Park does not qualify as a historical resource at the National, State or local levels.

This concludes the evaluation for Candlestick Park. Please see the appendices attached.

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81 Ibid 12.
82 Jones & Stokes, *Bayview Transportation Improvements Project (BTIP) – Evaluation Exemption for Monster Park*, Memo from Kathryn Hayley to Meg Scantlebury (15 May 2007), 9.

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http://www.sfgov.org/site/planning_index.asp?id=77300

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http://www.ballparksofbaseball.com/past/SealsStadium.htm

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http://www.parks.ca.gov/default.asp?page_id=519

Encyclopedia of San Francisco: John Savage Bolles
http://www.sfhistoryencyclopedia.com/articles/b/bollesJohn.html

APPENDIX A: Photographs

Appendix A: Photographs

Historic Photographs

Figure 1. Candlestick Park in its original configuration for the 1961 All-Star Game, July 12, 1961. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Figure 2. Candlestick Park fans watching a game c.1960. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Figure 3. Original wood seats, 1963. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Figure 4. Original scoreboard, 1960. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Figure 5. Candlestick Park c.1975. Photo used with permission from the San Francisco History Center, San Francisco Public Library.

Figure 6. 1964 Postcard view

Existing Conditions Photographs

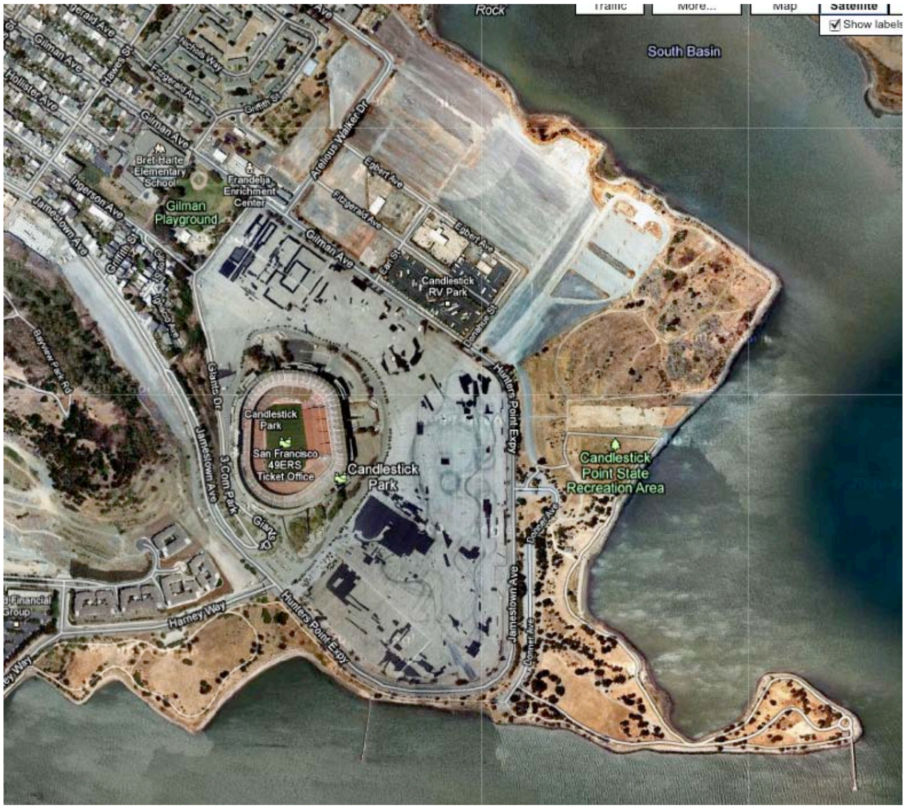

Figure 7. Candlestick Point aerial. (Google Maps), 2010.

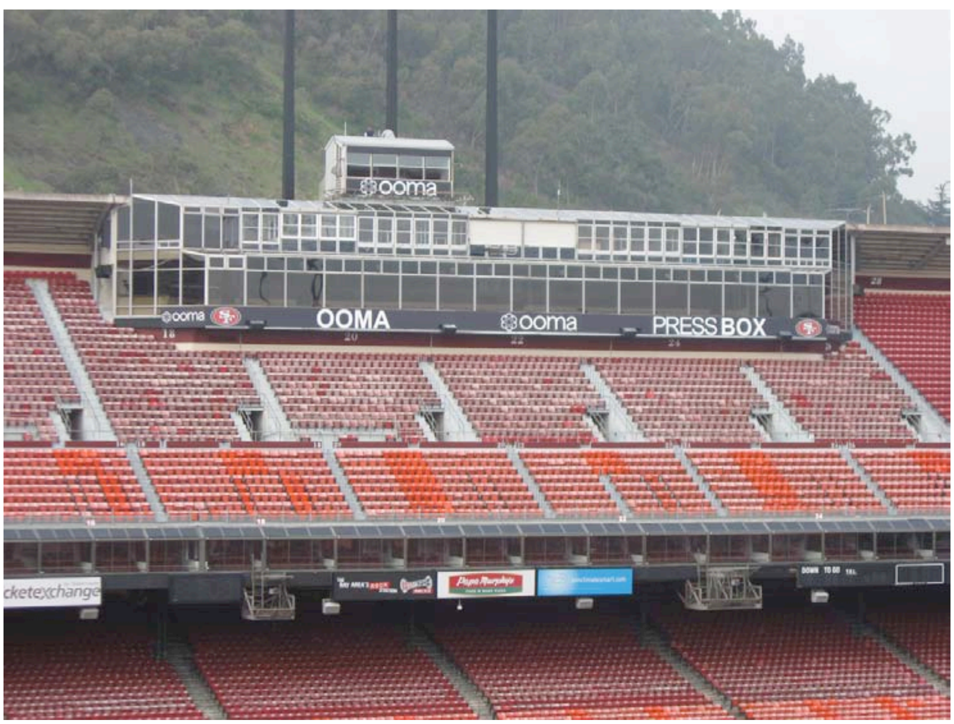

Figure 8. Football Press Box (built in the 1970s, addition in late 1980s (Mike Gay),note enclosed box suites below. (Photo by Circa, 30 January 2010).

Figure 9. Enclosed box suites, built in 1980s (Mike Gay) – interior view. (Photo by Circa, 30 January 2010).

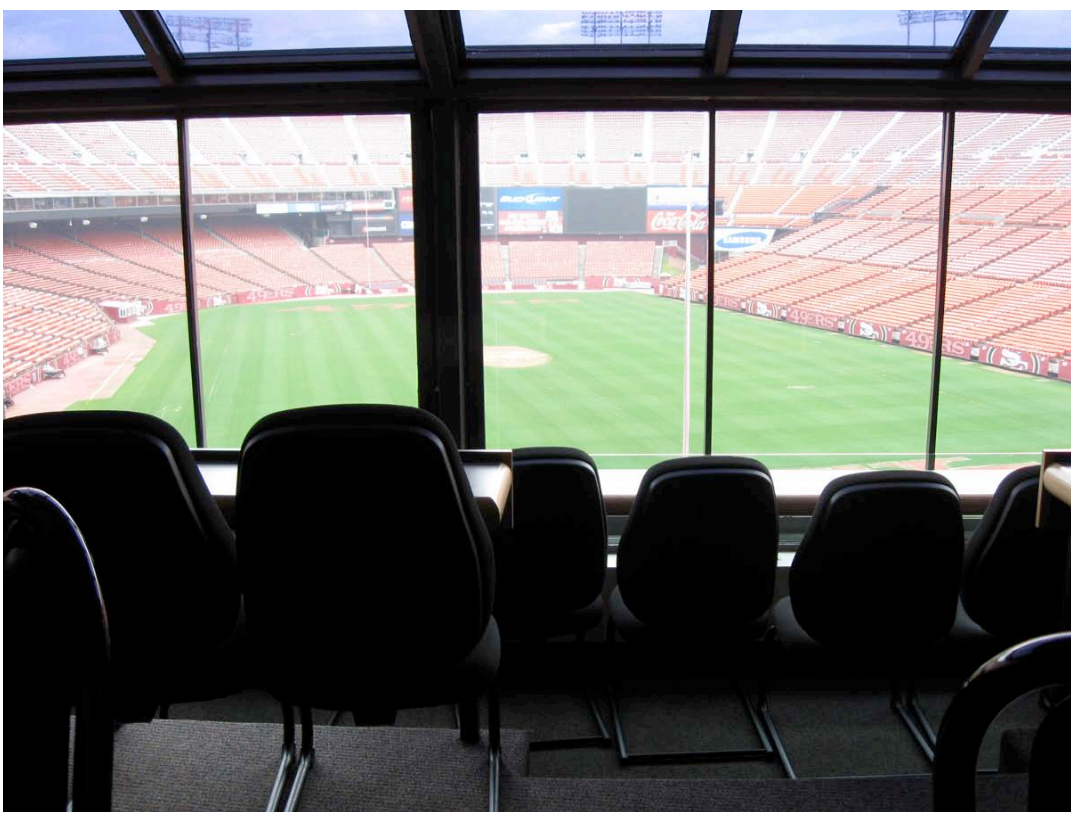

Figure 10. View from suites (Photo by Circa, 30 January 2010).

Figure 11. Gate A from upper concourse – note ghosting on floor where earlier turnstiles/ gate features have been replaced. (Photo by Circa, 30 January 2010).

Figure 12. Concourse and modern restaurant storefronts. (Photo by Circa, 30 January 2010).

Figure 13. Original concourse (right) and later (c.1970) ramp (left), note differences in concrete. (Photo by Circa, 30 January 2010).


Figure 14. Lower concourse, note modern staircase and concession stands. (Photo by Circa, 30 January 2010).

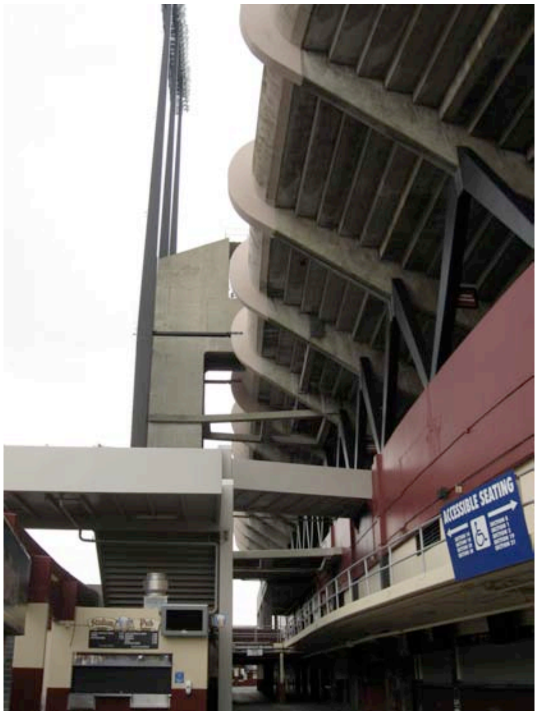

Figure 15. Concrete buttress (in front of light tower) added c.1970 (Mike Gay). (Photo by Circa, 30 January 2010).

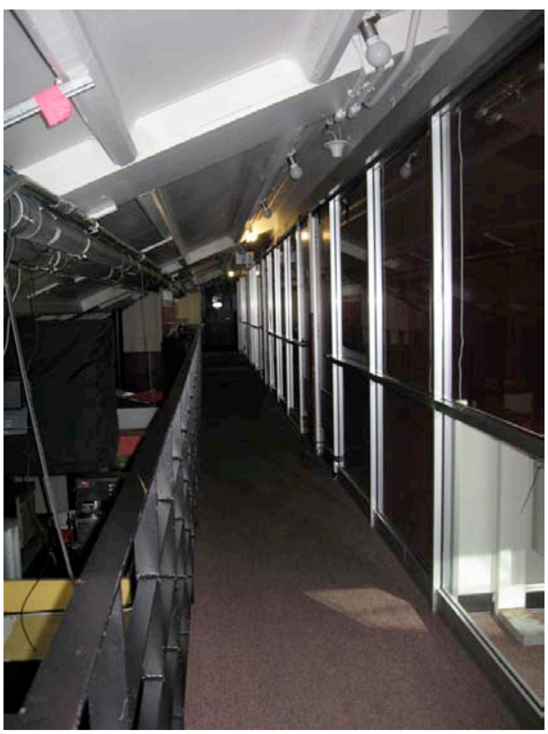
Figure 16. Football press box interior corridor (Photo by Circa, 30 January 2010).

Figure 17. Visitor's locker room. (Photo by Circa, 30 January 2010).

Figure 18. 49ers locker room (Photo by Circa, 30 January 2010).


Figure 19. 49ers locker detail (Photo by Circa, 30 January 2010).

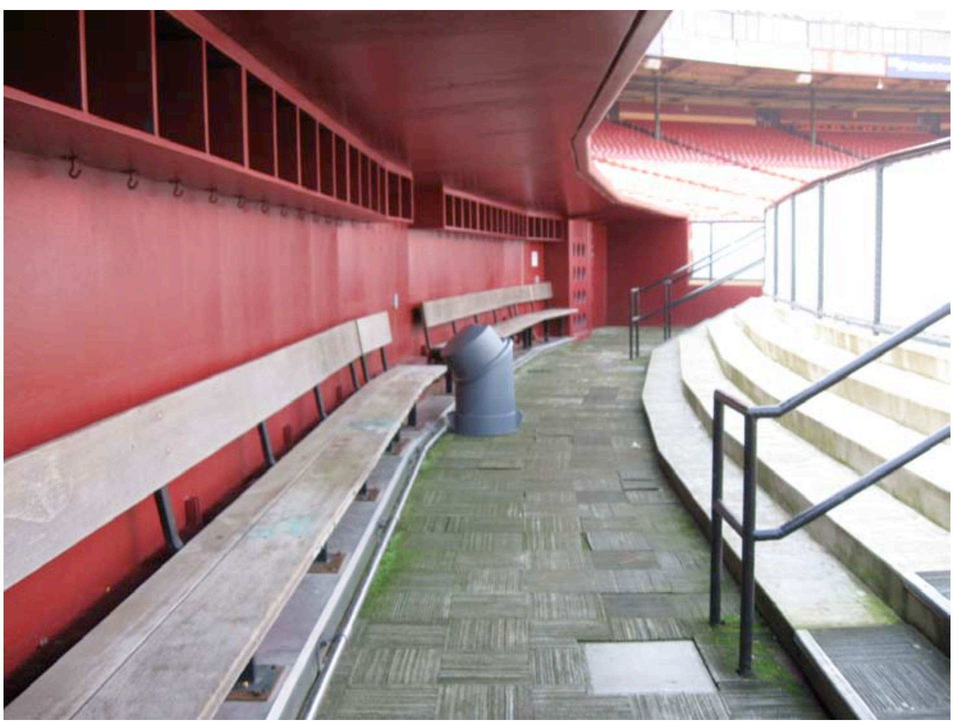
Figure 20. Former home team baseball dugout, note cubbies for helmets (above seats) and bats (far end). (Photo by Circa, 30 January 2010).

Figure 21. Gate A entry turnstiles. (Photo by Circa, 30 January 2010).

APPENDIX B: Construction Chronology Matrix

Candlestick Park - Construction Chronology Matrix

Year	Alterations	Events
1953		By 1953, SF contractor Charles Harney owns a total of 67 acres in Candlestick point area
1954		Mayor George Christopher promises to build 40,000-seat stadium if major league baseball team moves to area; SF voters approve $5 million bond for stadium construction (Jones & Stokes)
1957		April - Mayor Christopher flies to NY to talk NY Giants owner Horace Stoneham into bringing the Giants to SF. May - Mayor George Christopher initiates surveys of possible sites to construct more specialized baseball facilities; City selects CP property owned by Harney as site for stadium and purchases land for $2.7 million; Harney hired as contractor for stadium construction
1958	Construction begins in September of this year; construction cost $15 million (Jones & Stokes)	John S. Bolles designs stadium.
1960	Install Stadium Club facilities (restaurant), (December 20 building permit), cost $190,000. Construct precast reinforced concrete traffic control tower on promenade level; cut doorway opening in exterior wall and construct boardwalk approach to tower (13 July building permit), cost $25,500	April 12 - Opening Day; first stadium built for a major league baseball team on west coast (dodger Stadium completed in 1962)
1961	Construction of "visual background fence behind the centerfield fence in Candlestick Park" (March 7 building permit, cost $36,200)	
1962		Charles Harney dies
1966		Aug 29 - Beatles' last live commercial concert. Bolles begins plans to expand and enclose the stadium for both football and baseball use

1967	Installation of bleachers for football (October 18 building permit), cost $10,000	
1968	Install additional seating (November 7 building permit), cost $19,000	
1969 - 1971	Stadium expanded to seat 62,000 during football games and 59,000 during baseball games (Parks website). Alterations: Astroturf installed in place of natural grass; 30,000 new red & orange plastic seats replace original wood; new main Gate A - eight new ticket booths and special gates for ticket holders; 2 new escalators at Gate A and at Gate E; Gate F, a new entrance, is constructed in right field section of park; moveable stands installed; rubberized track surrounding field installed; new scoreboard in left centerfield; restrooms rehabbed; press box enlarged and rehabbed; new press box in upper deck for football; new lights/extra light tower added. (SF Progress article); Foundation work (Nov 14 Building permit with John S. Bolles Assoc. as architect of record), cost $331,000.	Bolles' plan for new addition approved by SF Bureau of building Inspection
1971	Construct 28'6" x 107' electric scoreboard and new advertising panels at north side of stadium (24 November building permit), cost $130,000. Construct 4' x 109' scoreboard south side of stadium (24 November building permit), cost $14,000	SF 49ers (NFL) move in

1973	Excavation, paving and synthetic surfacing of outfield warning track (March 19 Building permit), cost $70,000. Install new restaurant, John Bolles Assoc. architects of record on building permits/drawings (April 23 building permit), cost $78,000. Note: unknown if restaurant still exists - no location map on scattered drawings available. Highly likely this restaurant has been remodeled/reconfigured since 1973.	
1977	Construct new food stand, lower level - concrete block walls, all new systems, rolling door over counter (February 16 building permit), cost $35,000; Rooms 400 & 401 on promenade remodeled; room 402 remodeled by the 49ers for office space; 406 remodeled with new metal roll up door for use as cushion storage (February 23 building permit), cost $40,000	
1979		Survey by Giants shows that 72 percent of fans said they would go to more games if stadium had a dome
1981	Misc. interior office improvements for SF Giants: new interior partitions, suspended ceiling, new lighting, new finishes (March 24 building permit), cost $36,000	
1982	Installation of eleven (11) exit gates at building exterior (September 8 building permit), cost $75,000	Giants Owner Robert Lurie proposes construction of a new stadium or putting a dome on Candlestick; Mayor Dianne Feinsteinforms Stadium Task Force to explore options for new stadium or dome for Candlestick

1983		SF Bureau of Architecture Department of Public Works and Interactive Resources, Inc., Structural Engineers issue a *Report on the Deterioration of Structural and Architectural Components at Candlestick Park* - report explores water penetration issues and resulting deterioration at Candlestick
1984	Steel columns installed under existing concrete wind baffle girders - part of seismic retrofit (March 29 building permit), cost $14,000	
1985	Various seismic improvements completed as per Feinstein's directives (Mike Gay)	Feinstein steps forward in favor of upgrading stadium facilities for $5 million
1986	Earliest suites installed - have been constantly upgraded since that time (Mike Gay)	SF 49ers threaten to leave Candlestick - team demands luxury suites for attendees, upgraded facilities (Mike Gay)
1987	Addition to football press box (Mike Gay)	
1989		October 17: World Series - SF Giants and Oakland A's/Loma Prieta Earthquake
1991	Fifty-five (55) suite renovations; sixteen (16) vomitory enclosures; modify eight (8) toilet rooms; ADA upgrades at ramp 1-8; conference facility to replace woodworking shop; convert existing Janitor's and storage closets to construct four new shops at Ramp 6 (January 31 building permit), cost $1,640,500.	

1992	Twenty-six (26) suites renovated; football press box windows renovated; luxury suites corridor renovation; concourse widening; Twenty-six (26) suites renovated; football press box windows renovated; luxury suites corridor renovation; baseball press box renovation; remove existing concrete exit stairs on main level and install new concrete exit stairs; baseball press box renovation; remove existing concrete exit stairs on main level; install new concrete exit stairs (January 21 building permit), cost $748,800	
1993	Modifications to Gates 'A' through 'D'; main level concourse widening; seat additions at main level; media compound site improvements; construct Plazas 'A', 'F' and 'E'; new Plaza restrooms & stairs at 'C' Gate; close twenty-two (22) vomitories at upper level (January 28 building permit), cost $2,400,000	Giants begin lobbying for new ball park
1994	Seat alterations; new C Gate stairs; new elevator and ADA improvements (January 1994 building permit) cost $2,689,000. Remodel approx. 2,200 s.f. of office space for Volume Services, located in lower level of CP (building plan set dated Sept. 24, 1995), Nilmeyer & Nilmeyer, architects	
1995	Modify 40 concession stands for handicap access (December 27 building permit), cost $116,100; remodel existing storage room for use as exercise room (July 13 building permit), cost $35,000)	

1996	Modification of stadium seating for disabled access - Sections 5 through 23, lower decks and Sections 1 through 30, upper decks (January 29 Building permit), cost $325,000	Candlestick renamed 3Com park
1997	Modify and install new seats in Sections 3, 5, 7, 8, 9, 14, 18, 19, 21, 28, 32, 34 - work included new accessible seats and handrails (February 13 building permit), cost $375,000	
1998		construction of new Giants ballpark in downtown SF begins
1999	Modify and install new seats in Sections 8, 16, 20, 31, 35, 39, 47 - work included new accessible seats, handrails and path of travel (January 1 building permit), cost $500,000	Sept 30 - last Giants game
2000	Stadium converted to football only facility	
2004		Stadium renamed Monster Park after Monster cable Products, Inc.
2009	construct hospitality seating at dugout ($20, 000)	
ONGOING ALTERATIONS: field turf changes have been ongoing since the 1980s. Regular systems and signage upgrades, as well as changes to food/beverage vendor facilities; remodeling of box seats; expansion, alteration and replacement of stadium seating; and lighting and scoreboard changes have been continual since stadium was constructed. Suites, skyboxes, office spaces and restrooms regularly upgraded, reconfigured and remodeled.		

Appendix J4 CIRCA, Rarity of HPS Military/Industrial Buildings, April 2010

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16 April 2010
Re: Rarity of HPS Military/Industrial Buildings

I. INTRODUCTION

On 16 December 2009, the City of San Francisco's Historic Preservation Commission (HPC) met to discuss the findings of the cultural resources element of the Draft Environmental Impact Report for the proposed Candlestick Park/Hunters Point Shipyard Phase II project. The Draft EIR analysis is based on the Circa: Historic Property Development's *Bayview Waterfront Project Historic Resources Evaluation: Volume II, Historic Resource Survey and Technical Report,* October 2009 (the Technical Report). The Technical Report evaluated the buildings and structures at HPS. Some structures at HPS have been previously identified as significant historic resources as part of the National Register of Historic Places (NRHP)-eligible Hunters Point Commercial Dry Dock Historic District ("identified historic district"). The Technical Report also identified the California Register of Historical Resource (CRHR)-eligible Hunters Point Commercial Drydock and Naval Shipyard Historic District. As stated in the Technical Report the proposed Hunters Point Commercial Drydock and Naval Shipyard Historic District represents the broad history of HPS. The potential Hunters Point Commercial Dry Dock and Naval Shipyard Historic District is comprised of a collection of buildings, structures, and objects associated with the area's transition from early commercial drydock operation through its period of radiological research. The district encompasses a range of buildings from each of the three primary periods of significance for HPS: early drydocks, Navy use in World War II, and radiological research in the World War II and post-war periods. One issue on which the HPC and other EIR commentators requested clarification was the possibility of a larger district. The HPC also raised a question regarding buildings at Hunters Point Shipyard (HPS) that were once considered common but had the potential to now be considered rare due to the extent of recent military base closures and their redevelopment.

As discussed in the Technical Report (p. 11-16), extensive research was conducted at multiple locations to complete *Bayview Waterfront Plan Historic Resources Evaluation, Volume I: Historic Context Statement* and *Bayview Waterfront Project Historic Resources Evaluation: Volume II, Historic Resource Survey and Technical Report* for the Bayview Waterfront Project (BWP) Environmental Impact Report (EIR). However, the Technical Report scope did not include site visits to other Bay Area military establishments for an in-depth review of existing buildings. To address the HPC's question about the "rarity" of the military/industrial buildings at Hunters Point Shipyard, Circa conducted additional research and site visits to further inform the findings. This memorandum discusses methodology in the following section, and addresses rarity and integrity ("larger district issue") findings in Section III.

Summary of Conclusions

As concluded in the Technical Report, Hunters Point Shipyard is significant to World War II (WWII) military history in the Bay Area, although most remaining buildings are related to ship repair functions as a support facility to the Mare Island Shipyard, Vallejo. Mare Island, and other Bay Area bases and shipyards were historically more significantly associated with the shipbuilding effort and earlier involved in the WWII campaign than HPS, such as those Alameda and Richmond.

Circa found that the most significant theme at HPS, and the one most unique to this site within the Bay Area, is the HPS's role as the National Radiological Defense Laboratory (NRDL) headquarters and radiological research facility (p. 95-96). Unfortunately, most of the buildings associated with the NRDL have been demolished. Beyond these buildings, the most significant remaining building with a direct association to the NRDL is RADLAB (Building 815). That building is located outside the Candlestick Park/Hunters Point Shipyard Phase II project site and will not be affected by Project development.

The boundaries of the proposed extended Hunters Point Commercial Dry Dock and Naval Shipyard California Register Historic District were identified in the Technical Report as encompassing a district that is contiguous, with buildings, structures and objects that are representative of all phases of historic development at Hunters Point Shipyard (through the period of significance) and retains a high level of integrity. While this is true of the proposed district, the same cannot be said of the remaining portions of HPS given the extent of loss of integrity and lack of rarity compared to buildings and districts at other intact military installations in the Bay Area.

II. METHODOLOGY

Rarity

To address the rarity issue, Circa proceeded to compare facilities at Bay Area military installations, using information from the National Park Service and the Base Realignment and Closure Commission (BRAC) website. According to the National Park Service's *World War II in the San Francisco Bay Area* website and the BRAC website, the San Francisco Bay Area's major contribution to WWII was shipbuilding. This was accomplished by a cooperative effort initially of "over 30 shipyards, large and small, and scores of machine shops, and metal and wood fabricators [that] joined together to create the world's largest combined shipbuilding complex...sprawled across hundreds of square miles"[1]. Initial research on several Bay Area bases showed that they are all at various levels of redevelopment, primarily with established

[1] National Park Service, *World War II Shipbuilding in the San Francisco Bay Area*, www.nps.gov/nr/travel/wwIIbayarea/shipbuilding.

redevelopment plans; many of these bases have been found eligible for the National Register or are listed National Register historic districts.

PBS&J staff made initial contact with selected municipalities or other agencies involved with re-use or redevelopment of Bay Area military establishments (both WWII Navy and Army installations). PBS&J conducted research on former bases that had approved redevelopment plans. Circa then reviewed relevant information on these military installation and compiled brief status summaries for each (see Findings section below for summaries). The establishments reviewed include the following:

- **Alameda Naval Air Station** (WWII Association)
- **Mare Island Naval Shipyard** (WWII and Shipbuilding)
- **Moffett Field Naval Air Station / Naval Air Station, Sunnyvale** (WWII Association)
- **Oakland/Alameda Annex** (WWII Association)
- **Department of Defense (DoD) Housing Facility, Novato** (WWII Association)
- **Presidio of San Francisco** (WWII Association)
- **Fort Cronkhite (Presidio)** (WWII Association)
- **Richmond Shipyards** (WWII and Shipbuilding)
- **Oakland Army Base** (WWII Association)
- **Treasure Island Naval Station** (WWII Association)

See below for links to applicable base plans.

After initial PBS&J contacts and research, Circa visited selected former WWII military installations that had the most potential to retain similar building types to those at HPS. These buildings were then were documented for comparative purposes. The general building types documented fell into three general categories: 1) warehousing, supply and industrial support, 2) shops/ship repair and outfitting (large machine/assembly shops, wood-clad shops and metal-clad shops), and 3) administrative, residential and personnel support services. Because of the standardization typical of WWII-era military architecture, buildings within these categories share many of the same functional and design characteristics. The characteristics are commonly found not just in WWII-era buildings on Naval sites but on Army bases, supply depots and other military installations of that period. These general categories exemplify the predominant building types extant at HPS outside of the proposed historic district boundary.

At HPS buildings categorized under the warehousing, supply and industrial support heading are generally located in the south shipyard area of HPS. Storage buildings are somewhat varied in design and nearly all were built along standard Bureau of Yards and Docks designs, modified on occasion to fit specific requirements. The predominant warehouse type is a rectangular plan, warehouse building with redwood shiplap siding, wood-sash windows or wood louver vents, and a monitor roof. This standard plan was used alone or in groupings of two or more.

Buildings categorized under the shops, ship repair and outfitting heading are represented at HPS in three general forms: large machine/assembly shops, wood clad shops and metal-clad shops. Like the warehouses, nearly all were built along standard Bureau of Yards and Docks designs and modified to fit specific functional requirements. The shops are generally rectangular plan buildings, some quite substantial in footprint as well as height. Most of the buildings are wood or steel framed and were originally clad in wood shiplap siding or corrugated steel panels. These shops range in size from smaller gable-roofed buildings with large vehicular entry doors and limited window openings, to one- and two-story full height shop buildings with shallow gabled roof monitors and shed-roofed side wings. The large machine/assembly shops are fewer in number and are either reinforced concrete or steel framed curtain wall shop buildings that are clad in a combination of corrugated steel or transite (cementitious) siding and corrugated safety glass.

Buildings categorized under the administrative, residential and personnel support services heading are typically one- to two-story buildings with wood shiplap siding, horizontal massing and flat or low-pitched gable roofs. These buildings are usually rectangular in plan or irregular plan buildings built in an additive fashion with boxlike additions projecting from a central building mass. This was common as the standardized plans developed by the Army and Navy were adapted by the architectural and engineering firms on site to meet specific circumstances at each military base.

Circa selected sites to visit determined by 1) proximity, 2) reasonably similar historic context and 3) the above-mentioned building typologies. The site visits were conducted at Mare Island Navel Shipyard, Richmond Shipyards, Alameda Naval Air Station and Oakland Army Base on February 19, 2010. A comparison matrix of extant similar building types found at these bases is included in Appendix A. This matrix demonstrates that a number of similar building types exist among the four sites, and that those located outside of the potential district boundaries at HPS are not the only or last remaining buildings of their type in the Bay Area. Because a building-by-building comparison of HPS buildings to those at other installations would be an extensive effort beyond the scope of this study, the general building typologies described above (and used in the matrix headings of Appendix A) identify general architectural features and functional typologies for comparative purposes. The survey matrix shows the results of the site visits to the above listed bases only, and does not include similar extant building types from other known Bay Area military installations. However, the comparative survey provides substantial information to support the conclusion.

Larger District

As noted above, the HPC and other EIR commentators raised the question of the potential of a larger district beyond the proposed extended Hunters Point Commercial Dry Dock and Naval Shipyard California Register Historic District (that also includes National Register eligible buildings) identified in the Technical Report. The following discusses the question of whether a larger CRHR-eligible historic district should be included.

As stated above, PBS&J staff made initial contact with selected Bay Area military establishments and conducted research on former bases that had approved redevelopment plans. This research found that Alameda Naval Air Station, Mare Island Navel Shipyard, Moffett Field Naval Air Station, Presidio of San Francisco, Fort Cronkhite, Department of Defense (DoD) Housing Facility (Novato) and the Richmond Shipyards all have historic districts that are either listed as a National Register Historic District (NRHD) or eligible as such. While the historic district evaluations were not reviewed, it is assumed that the district evaluations are competent and contain sound conclusions. Of the selected sites visited noted above Mare Island Navel Shipyard, Richmond Shipyards, and Alameda Naval Air Station have historic districts. Circa found Mare Island to have a superior, more comprehensive, and much larger collection of similar building types from the WWII period. All of the individual buildings retain a higher level of physical integrity and are within a significant concentration and continuity of physical development and context to constitute a historic district as compared to those at Hunters Point Shipyard.

A review of HPS maps and photographs from past time periods, as well as written documentation, demonstrates that substantial demolition occurred at HPS since 1974. Of the roughly 530 buildings/structures existent at the height of operation, over 400 have been demolished.[2] The 130 buildings remaining as of 2008 represent less than 25 percent of what was there originally. Circa compared the HPS documents to the established historic districts at military installations noted above. Only those remaining in the proposed extended Hunters Point Commercial Dry Dock and Naval Shipyard California Register Historic District best represent the HPS during the period of significance. The resulting data was applied against the National Register definition of and criteria for "historic districts". This topic is discussed below under Findings.

III. FINDINGS

Rarity Issue

Circa reviewed preliminary research on closed bases as summarized below.

The findings of the preliminary information survey are summarized using information from relevant redevelopment/reuse agencies and data from the BRAC website.

- **Name: Alameda Naval Air Station**
  Summary: Commissioned in 1940 and supported the Navy's defense until its closure in 1997. It contains a National Register eligible WWII Historic District. The Reuse Plan was adopted in 1996, http://www.alameda-point.com/AP.html

- **Name: Mare Island Naval Shipyard**
  Summary: Commissioned in 1854 for shipbuilding operations and was the first naval station on the Pacific Coast. The shipyard was closed in 1996. It contains a National Register Historic District with buildings built from 1854 until the end of WWII. The Specific Plan was adopted in 1999, amended 2008, http://www.ci.vallejo.ca.us/GovSite/default.asp?serviceID1=549

- **Name: Moffett Field Naval Air Station / Naval Air Station, Sunnyvale**
- **Summary:** Commissioned in 1933 to support a "lighter-than-air" program but was soon turned over for flight training and was used to support Navy aeronautical activities. The

[2] See NAVSEA, Hunters Point Shipyard. Final Historical Radiological Assessment: History of the use of General Radioactive Materials, 1939-2003. San Francisco, 2004. *Table 3-3: Current and Former Facilities at HPS by Building Number*.

air station was closed for Navy use in 1994 but has continued in research for NASA Ames Research Center. It contains the Shenandoah Historic District. The Redevelopment/Historic District Development Plan was adopted in 2002, http://www.researchpark.arc.nasa.gov/Public/publicDocs.html

- **Name: Oakland/Alameda Annex**
- **Summary:** Commissioned in 1941 for use as Army airport depot and later used by the Navy (1946) as a main supply center supporting the operation of fleets. The center was closed in 1998. As of the writing of this report no redevelopment plan was received however the BRAC office states that the "intended reuse includes residential and commercial/industrial components"[3]

- **Name: Department of Defense (DoD) Housing Facility, Novato**
- **Summary:** Commissioned in the early 1940s by the Air Force until 1974 when the Navy took over the housing and community services and the Army took over the runway and related structures. The center was closed in 1997. According to the Redevelopment Office " The 600 acre former military base is one of the most successful base reuse projects in the country. Over a billion and a half dollars in private investment in 10 years. Over 2,000 new homes ... one of the largest wetlands restoration projects in the history of the country; numerous recreational facilities, open space and trails and a museum; & affordable artist studios in an art center. The hangars have been redeveloped and renovated for office and technology space. A few sites and buildings remain vacant or underutilized."[4] As of the writing of this report no redevelopment plan was received however according to the City of Novato a plan was adopted in 1999.

- **Name: Presidio of San Francisco**
- **Summary:** Established by Spain in 1776 the Presidio became a Mexican outpost in 1822 and then taken over by the U.S Army in 1847. It is the oldest military installation in the west. The US Army closed the Presidio as a military base in 1994, and transferred it to the National Park Service. In 1996, the Presidio Trust Act gave jurisdiction of the 1,168-acre inland area of the Presidio to the Presidio Trust; the NPS continues to manage the shoreline. Congress created the Presidio Trust to manage the Presidio, with a focus on preservation and leasing of its buildings. The Presidio is a National Historic Landmark of which over 450 buildings are on the National Register. Since 1996, the Presidio Trust has managed and rehabilitated about 2/3 of the over 800 buildings at the Presidio. The Redevelopment/Management Plan was adopted in 2002, http://www.presidio.gov/trust/documents/environmentalplans/ptmp.htm

- **Name: Fort Cronkhite**
- **Summary:** The National Park Service considers Fort Cronkhite (along with Forts Baker and Barry) to be excellent examples of early coastal defense structures from 1918 until after 1945. Fort Cronkhite was closed in 1974, just after the property was listed in the

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[3] Base Realignment and Closure (BRAC), *Former Fleet and Industrial Supply Center Oakland/Alameda Annex*, www.bracpmo.navy.mil/basepage.aspx?baseid...alameda_annex

[4] Email communication Ron Gerber**,** Redevelopment Administrator, Community Development Department Planning Division, email: rgerber@cityofnovato.org

National Register of Historic Places as the Forts Baker-Barry-Cronkhite Historic District. It was then transferred to the National Park Service. The Golden Gate National Recreation Area (GGNRA) General Management Plan was adopted in 1980 http://www.nps.gov/goga/parkmgmt/completed-plans-and-projects.htm

- **Name: Richmond Shipyards**
- **Summary:** No shipyards existed in Richmond prior to WWII. The four Kaiser shipyards (some in partnership with the established Todd Shipyards) grew seemingly overnight between 1941-1942 to meet wartime demand. These private facilities closed in 1945. The Richmond Shipyard # 3 is part of the *Rosie the Riveter/World War II Home Front National Historical Park*, and is listed on the National Register. Its General Management Plan was released in January of 2009. The plan explores three different alternatives for developing and managing the new national park in Richmond, California, http://www.nps.gov/rori/parkmgmt/planning.htm

- **Name: Oakland Army Base**
- **Summary:** Commissioned in 1941 to augment the cargo facilities at Fort Mason in San Francisco. The facilities were closed in 1999. Much of former base is being used by lessees of the Port of Oakland and Oakland Redevelopment Agency to generate income for future development. The Oakland Army Base (Army Base) Redevelopment Area Plan was adopted in 2002, http://www.business2oakland.com/main/oaklandarmybase.htm

- **Name: Treasure Island Naval Station**
- **Summary:** The man-made island was constructed in 1936 for the purpose of hosting (along with Yerba Buena Island) the Golden Gate International Exposition Worlds Fair (1939-1940). The Navy acquired the island in 1942 for a primary use as a military personnel-processing center. The island was closed for Navy use in 1997 and is currently being maintained by Treasure Island Development Authority through a cooperative agreement with the Navy. A Development Plan and Term Sheet developed in 2006 and serves as the basis for the Redevelopment Plan. The final project approvals are expected in early 2011.

This preliminary review of existing military installations also helped to inform the sites chosen for the field survey. Selection of sites to visit was determined by 1) proximity, 2) reasonably similar historic context (WWII defense/ship repair/military architecture/radiological research) and 3) the above-mentioned building typologies.

In comparing the remaining buildings at Hunters Point Shipyard with similar buildings at the identified military installations, survey findings show that the buildings outside of the identified CRHR-eligible Hunters Point Commercial Dry Dock and Naval Shipyard Historic District are not the last remaining or best examples of their types. In most cases, the HPS buildings are inferior to similar buildings at other bases in regard to physical integrity and condition. Most, if not all, of the similar buildings at the other bases retain their original cladding materials – undamaged or obscured by secondary siding materials - and original wood windows, among other character defining features. Furthermore, Alameda Naval Air Station and Mare Island

Naval Shipyard both exhibit a high degree of overall integrity, retaining and reusing a number of administrative, residential, industrial and storage type buildings similar to those at HPS.

As can be seen in the chart in Appendix A, Mare Island has a superior, and more comprehensive, collection of similar shop, storehouse and residential and related building types from the WWII period, all with a higher level of physical integrity than those at Hunters Point Shipyard (see panorama view of shop/storage buildings at Mare Island below.

Figure 1. Mare island shop/storage buildings in historic district (photo by Circa, February 2010).

Various iterations of the warehousing, supply and industrial support buildings can be seen on other bases, as can similar wood and metal clad shop buildings. Similar examples of large machine/assembly shops are also seen at Mare Island, in the protected industrial historic district area. Better examples of WWII residential and related buildings, including barracks, can also be found at The Presidio, Fort Baker, or Fort Cronkhite.

Review of adopted redevelopment plans for the former bases and site visits show that many of these similar buildings types are being retained and are planned for reuse. Many have been successfully reused for years and are important contributors to the economic health of the reused military sites. A number of these sites have been found eligible for the National Register or are listed as National Register historic districts. Alameda Naval Air Station, Mare Island Navel Shipyard, Moffett Field Naval Air Station, Presidio of San Francisco, Fort Cronkhite, Department of Defense (DoD) Housing Facility and the Richmond Shipyards all have historic districts that contain WWII buildings currently being reused or planned for reuse. A number of the implemented redevelopment plans have preserved, rehabilitated and/or reused scores of buildings that are a model for economic success while retaining a high level of historic significance and integrity.

The remaining buildings outside of the identified CRHR-eligible Hunters Point Commercial Dry Dock and Naval Shipyard Historic District are not the last remaining or best examples of their types. The majority of the remaining buildings at the HPS are inferior to like-buildings at other Bay Area bases. In addition, similar buildings at the other bases retain their original materials and character-defining features at a higher level of integrity, and convey the historic context within their period of significance. All of the seven National Register (or NR eligible) historic districts historic are retaining, rehabilitating and reusing buildings similar to those at HPS.

LARGER DISTRICT ISSUE

The Technical Report found that the extant buildings located outside of the proposed Hunters Point Commercial Dry Dock and Shipyard Historic District do not qualify as contributors to a larger historic district because:

1) Better examples of these types of buildings are found within the proposed district, within the Bay Area, and on military bases through the United States;
2) Inclusion of these buildings within the proposed historic district would not expand or augment the historic context or architectural value of the proposed historic district;
3) The site does not retain enough integrity as a whole to justify an expansion of the proposed district.

As a whole, the physical integrity of Hunters Point Shipyard has been compromised as a result of ongoing demolition at the site since base closure. This loss of historic fabric includes the demolition of all buildings on Parcel A (except Building 101); the removal of numerous buildings and structures on Parcels B, C, and E; and the demolition of a significant number of buildings, structures and objects - including recent removal of sections of the roadway system, rail spurs, signage and light standards - on Parcel D. All dry dock cranes, with the exception of the bridge crane at the regunning pier, have also been removed from the site.[5] See below for recent photos showing roadway removal, and Appendix B for figures illustrating the extent of the site during wartime.

Figure 2. View south on Cochrane Street, looking toward west elevation of Building 351A (Photo by Mike Mentink, June 2008).

[5] Many of the remaining buildings have been leased for other uses since base closure. These later uses may have resulted in further degradation of the interior integrity of the buildings, though the extent to which interior alterations have altered original configurations unknown. Circa's survey work was limited to exterior review only.


Figure 3. View toward north elevation of building 411 (Photo by Mike Mentink, June 2008).

As discussed above, demolition has been a common factor at HPS since it was decommissioned as a Naval base in 1974. Of the roughly 530 buildings/structures that existed at the height of production at HPS, about 400 have been demolished. The 130 buildings remaining in 2008-9 represent less than 25 percent of the original built environment.

The 130 buildings remain outside the identified historic district 116 are categorized in Appendix C by the three building types, and identified by building number and original use. The remaining fourteen buildings that do not fall into these general categories are considered minor buildings (i.e. windowless substations or small pump houses) or have low integrity. They would not be considered primary contributors to a historic district.

- Building 122 (Substation "V" and Compressor Plant)
- Building 135 (Substation "G")
- Building 206 (Substation "A")
- Building 229 (Substation "L")
- Building 236 (Salt Water Pump House)
- Building 238 (Unknown)
- Building 300 (Substation "N")
- Building 306/306A (Substation "I")
- Building 308 (Salt Water Pump House)
- Building 412 (R.R. Scales)
- Building 521 (Power Plant - South Area)
- Building 523 (Fire Protection Pump Station)
- Building 707 (Animal hospital building; NRDL annex N; Animal colony; waste processing)
- Building 708 (NRDL Bio-med Facility/animal research; Animal psychology study colony)

Below is a summary listing of the buildings that have been lost since HPS was in full operation:[6]

Parcel A:

- A residential district containing about 50 residential buildings, some built in the early decades of the 20th century and others constructed by the Navy when it acquired the shipyard; these residential buildings were used as for married personnel quarters between 1939-1974 when HPS was an active Navy base. This collection of residential buildings included the following:

    - Buildings A-O – 17 Officers' Quarters
    - Buildings E, R and S-Z - Residences
    - Buildings R-3 to R-119 – 26 civilian residential quarters
    - Building 19 – Apartment house
    - 13 Homoja Homes (Quonset huts)
    - Associated greenhouses, garages, a water tank and gardener's tool houses

- Building 100 - Main Electrical Substation for Navy power
- Building 102 – Personnel building, Office of Naval Research, Security Administration and Post Office
- Building 106 – Watch tower, gatehouse
- Building 151 –Bus Shelter
- Building 158 - Sentry House and Main Gate
- Building 322 – Guard and Pass Office
- Building 805 – Guard Shelter/Personnel Shelter
- Building 816 – High Voltage Particle accelerator and Van De Graff Accelerator (RADLAB related)
- Building 818 – Water treatment plant
- Building 901 – Officers' Mess Building, Officers' Club and rental housing
- Building 908 – Garages, 5 cars
- Building 915 – Bank Building
- Building 916 – Chief Petty Officer's Club and Package Liquor Store
- Building 917 – Grocery Store
- Building 921 – Bachelor Officers Quarters
- Building S-807 – Small arms magazine

Parcel B:

- 23 Apartment Buildings – area shown as Soloman Village, adjacent to submarine repair area and across from residential district (Parcels A & B)

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[6] NAVSEA, Hunters Point Shipyard. Final Historical Radiological Assessment: History of the Use of General Radioactive Materials, 1939-2003 (San Francisco, 2004) *Table 3-3: Current and Former Facilities at HPS by Building Number* and Appendix C: Historical Drawings and Photographs. Also, JRP Historical Consulting Services, *Historic Context and Inventory and Evaluation of Buildings and Structures: Hunters Point Shipyard*. Prepared for Engineering Field Activity West, Naval Facilities Engineering Command (September 1997), DPR forms; and 'Building List as of 30 June 1973: Hunters Point Naval Shipyard, San Francisco, California" by the Public Works Engineering Division (held at the San Francisco History Room, San Francisco Public Library).

- Building 27 - Clocking Station
- Building 105 – Watch tower/Gatehouse
- Building 108 – Temporary Marine Barracks and Electronics
- Building 114 – Submarine Barracks, Design Branch, Technical Library and Administrative Building
- Building 118 – Submarine Bachelor's Officers' Quarters and Administration
- Building 119 – Medical Stores and Temporary Training School and Infirmary
- Buildings 127, 144 – Latrines
- Building 131 – Substation "U"
- Building 141 – Dock Shipwrights' Shop
- Building 142 - Air Raid Shelter "A", Personnel Shelter
- Building 143 – Joiner/Carpenter Shop (DD3)
- Building 145 – Saltwater Pumphouse
- Buildings 150, 152 – Bus/Personnel Shelters
- Building 155 – Area Time Office #2
- Buildings 161, 162 – Maintenance service center and paint storage

Parcel C

- Buildings 34, 72 – Clocking Stations
- Building 111 – Lubricating Oil Pump house
- Building 112 – Diesel Oil Pump house
- Building 126 – Submarine Pier Office
- Building 201 – Tugmaster's Office and Administration Building
- Building 210 – Dispensary
- Building 232 – Bus shelter
- Building 234 – Ship Superintendent Office and Administration Building, latrine
- Building 235 – Shop 38 Central Tool Room Annex and General Warehouse
- Building 257 – Galvanizing Plant
- Building 270 – Paint Shop/Ship Repair Shop
- Various substations and storage facilities

Parcel D

- Building 305 – Storage
- Building 311 – Latrine, Ship Superintendent's Office and Administration building
- Building 313 – National Radiological Defense Laboratory (NRDL)
- Building 313A – RADIAC Instrument Development, Instrumentation Lab, Lab Offices
- Building 322 – NRDL Instrumentation Branch Offices
- Building 364 – Animal Irradiation Facility, Research Animal Facility
- Buildings 374-377 – Instrumentation and Control facilities
- Building 408 – Furnace Shelter
- Building 434 – Supply Storehouse
- Building 501 – Ships' Barracks and Teen Club
- Building 502 - Ships' Barracks
- Building 503 – Navy Exchange, Launderette, Ships Subsistence and Laundry
- Building 504 – Laundry office

- Building 519 –Chapel
- Building 522 – Bus shelter

Parcel E

- Building 506 – Housing, Navy Exchange and ROICC Offices; Low Power neutron Generator, Nuclear and Physical Chemistry Branch (NRDL)
- Building 507 – Public Works Office
- Building 508 – Locker Club, Barracks, Temporary Barracks, Employee Relations; NRDL Annex J
- Building 509 – Enlisted Personnel and Disbursing Office, Library
- Building 510/510A – naval investigation Service/Naval Ordinance Laboratory
- Building 511/511- Pacific Reserve Fleet Headquarters/Administrative building; material shelter and hobby shop
- Building 512 – Elementary School
- Building 513 – Ships Barracks
- Building 514 - Ships Barracks
- Building 515 - Ships Barracks
- Building 516 - Ships Barracks
- Building 517 – Marine Storage, NRDL Bio-med Lab, General Research Labs
- Building 518 – Motion Picture Theater
- Building 520 – Dental Clinic
- Building 524 – Pacific Reserve Fleet Supply Building and General Warehouse
- Building 803 – Commissary
- Buildings E-1 to E-120 - Homoja village - 120 Homoja huts (Quonset huts)
- Buildings M-1 to M-17 - 17 Homoja huts
- Buildings O-1 to O-38 - 38 Homoja huts
- Various warehouses and storage facilities

Given the historic contexts of early commercial docking facilities, state-of-the-art ship repair and activities associated with a major national research institution (NRDL), Circa considered the potential that HPS could contain a larger historic district. However, due to the lack of physical integrity (of the individual remaining buildings and the larger site as a functional whole) resulting from the factors listed below, it was concluded that only very few buildings retained enough integrity to warrant further evaluation as historic resources or consideration as contributors to a larger historic district. These factors include:

- extensive demolition of important buildings and structures;
- maintenance deferral/deterioration/neglect;
- extensive use of secondary (asbestos) siding on many of the buildings and/or removal or replacement of original features;
- removal of character-defining features of the site and the altered relationship between some of the buildings and structures.

For purposes of evaluating *physical* integrity of individual buildings at HPS, the following definitions for each level of integrity were developed. The seven aspects of integrity as identified by the National Park Service are location, design, setting, materials, workmanship, feeling, and association. These are discussed in the following section. This integrity evaluation scale was developed for use in the field to categorize buildings without having any information as to the property's associative significance (association with significant events/people). As such, discussion of the Association aspect of integrity is not included in the scale below. Integrity of location is also not discussed in the scale below as it is assumed, based on the lack of documentation to prove otherwise, that none of the HPS buildings were relocated. This scale deals with the more tangible qualities of physical integrity retention – those materials and features that are still extant and appropriate to the period. The Integrity Matrix in Appendix D identifies physical integrity as defined below only, for each of the remaining buildings.

> High: Buildings that exhibit an excellent degree of integrity of design, materials, feeling, workmanship and setting. Such buildings retain, to a high degree, original materials and features including exterior siding and window materials, architectural detailing and stylistic features. Their general setting and physical context is intact. These buildings may have modest alterations, additions and/or are in good to excellent physical condition (that has not had an impact on the structural condition) that have had little impact on the overall historic integrity of the property.

> Moderate: Buildings that exhibit a moderate degree of integrity of design, materials, feeling, workmanship and setting. Such buildings retain approximately 50 percent or more of the building's original materials, form and features including one or more of the following: exterior siding and window materials, architectural detailing and stylistic features. Their general setting and physical context is somewhat intact. These properties may have alterations or additions but the general form, massing and original stylistic features of the building – the basic elements that allow it to communicate its historic character - remain intact, and are in fair to good physical condition (that has not had an impact on the structural condition).

> Low: Buildings that exhibit a low or negligible degree of integrity of design, materials, feeling workmanship and setting. Buildings with low integrity are those with two or more of the following: removal and replacement of original windows with modern sash (vinyl or aluminum, usually), a majority of siding replacement, significant alterations to the setting/physical context and/or notably incompatible or out of scale additions, and/or are in poor to fair physical condition that has had an impact on the structural condition. Buildings that rank low are not considered to retain a degree of physical integrity that would warrant listing as an individual resource or as part of a district.

When assessing a potential historic resource, one must evaluate and clearly state the significance of that resource to American history, architecture, archaeology, engineering, or culture. A resource may qualify as a historic resource if it meets one or more of the applicable (National, state, or local) criteria for significance *and* possesses historic integrity. Historic properties must retain sufficient historic integrity to convey their significance. According to the Office of Historic Preservation's Technical Assistance Series Bulletin #6:

> Integrity is the authenticity of an historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance.

> Historical resources eligible for listing in the California Register must meet one of the criteria of significance described above and retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. It is possible that historical resources may not retain sufficient integrity to meet the criteria for listing in the National Register, but they may still be eligible for listing in the California Register.[7]

The National Register recognizes seven aspects or qualities that define historic integrity:

- Location: The place where the historic property was constructed or the place where the historic event occurred.
- Design: The combination of elements that create the form, plan, space, structure, and style of a property.
- Setting: The physical environment of a historic property.
- Materials: The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- Workmanship: The physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- Feeling: A property's expression of the aesthetic or historic sense of a particular period of time.
- Association: The direct link between an important historic event or person and a historic property.

To retain historic integrity, a resource should possess several of the above-mentioned aspects. The retention of specific aspects of integrity is essential for a resource to convey its significance. Comparisons with similar properties should also be considered when evaluating integrity as it may be important in deciding what physical features are essential to reflect the significance of a historic context.

To assess a building's ability to contribute to a historic district, the above-listed attributes must be applied. Applying the identified historic contexts of early commercial docking facilities, state-of-the-art ship repair and activities associated with a major national research institution (NRDL), the 130 remaining buildings (more than 45 years old) located outside the identified Hunters Point Commercial Dry Dock and Shipyard Historic District were reviewed for their ability to be contributors to an extension of the proposed Historic District or as a separate historic district(s):

Location: Based on the lack of documentation to prove otherwise, it is assumed that none of the HPS buildings were relocated; therefore, they retain integrity for Location.

Design: The design of the remaining buildings outside the proposed historic district are primarily derived or adapted from standard plans from the Bureau of Yards & Docks. Better examples of these types of buildings are found within the proposed district, within the Bay Area, and on military bases through the United States. Because of alterations of individual buildings and

[7] Office of Historic Preservation, Department of Parks and Recreation. California Register and National Register: A Comparison. Technical Assistance Series No. 6.

extensive base wide demolition, the remaining HPS buildings display a significantly diminished degree of physical integrity and condition.

Setting: The physical integrity of the HPS site has been compromised as a result of ongoing demolition, including the demolition of all buildings but one on Parcel A; the removal of numerous buildings and structures on Parcels B, C, and E; and the demolition of a significant number of buildings, structures, and objects (sections of the roadway system, rail spurs, signage and light standards) on Parcel D. The remaining HPS buildings display a significantly diminished degree of integrity of Setting.

Materials: The materials of the remaining buildings outside the proposed Historic District are generally intact; however most of the buildings have secondary cladding materials and window alterations/replacement. Original machinery and other character defining features have been removed. In addition, most suffer from various degrees of deterioration and neglect, and many are in poor condition; they display a significantly diminished degree of integrity of Materials.

Workmanship: The remaining HPS buildings were built from standard plans from the Bureau of Yards & Docks and do not exhibit any particular evidence of "craft". They are inferior to similar buildings at other bases, and therefore they do not display integrity of Workmanship.

Feeling: Of the roughly 530 buildings and structures that existed at the height of operation at HPS, over 400 have been demolished. Due to the extensive demolition of at the site many of the 130 remaining buildings have lost their relationship to one another. In addition, sections of the roadway system, rail spurs, signage, light standards, and dock cranes have been removed, a cumulative impact that has further decreased the integrity of feeling at this former WWII Naval facility. Mare Island has a superior and more comprehensive collection of WWII-era buildings, all with a higher level of physical integrity and sense of place. The areas outside the identified historic district display a significantly diminished degree of integrity of Feeling.

Association: While the remaining buildings are linked to WWII military history, most remaining buildings are related to ongoing the HPS ship repair function as an annex to the shipyard at Mare Island. Other bases and shipyards were more directly associated with shipbuilding and earlier involvement with the WWII campaign and retain a higher level of physical integrity. Further, the site has not been used by the Navy since base closure in 1974 and has lost integrity of association.

In addition to its role in ship repair, HPS was uniquely associated with Cold-War-era radiological research and served as the NRDL headquarters. However, most of the buildings outside the identified historic district associated with the NRDL have been demolished and therefore do not retain integrity of Association with that context.

Therefore, the buildings extant at the HPS as of 2008-9 outside the identified historic district, and the larger shipyard site as a whole, do not retain a level of historic integrity to fully communicate their historic significance that would justify a larger historic district. HPS fails to meet the integrity criteria when compared to other military installations in the Bay Area that have similar buildings used for similar uses and that display higher levels of integrity that strongly convey their historic significance. Information based on records and plans, and site visits provide a substantial basis for concluding that the buildings at HPS are not rare such that they would be considered individual historic resources or contributors to a larger historic district.

It should also be noted that in the comparison of military installations it became apparent that while these bases supported integrated WWII activities during the period of significance, bases were also very self-sufficient in nature with their own chapels, movie theaters, recreational playing fields, housing, and personnel support facilities - as well as the industrial-related buildings. Due to extensive demolition, this pattern is no longer reflected in the built environment at HPS. Since the extant buildings located outside the identified historic district boundaries display (both individually and as a whole) a significantly diminished level of integrity, inclusion of the remaining buildings outside of the Historic District would diminish the integrity of the identified historic district as a whole.

Though HPS is significant to WWII military history in the Bay Area, most remaining buildings are related to ship-repair functions, as an annex to the shipyard at Mare Island. In addition to Mare Island, other bases and shipyards such as Alameda and Richmond, were more significantly associated with the shipbuilding effort and involved earlier in the WWII campaign than HPS.

Furthermore, in our professional opinion, the most significant theme at HPS, and the one most unique to this installation within the Bay Area, is the site's role as the NRDL headquarters and radiological research facility. As part of recent environmental remediation efforts, most of the buildings associated with the NRDL have been demolished. However, Dry Docks 2 and 3, Building 224 (bomb shelter, NRDL Annex K), and Building 253 (Optical, Ordinance and Electronics Shop), located in the identified potential historic district, were used in various functions by the NRDL. Beyond these buildings, the most significant remaining building with a clear association to the NRDL is Building 815 that is outside the project site.

The boundaries of the proposed historic district were identified as encompassing a district that is contiguous, with buildings, structures and objects that are representative of all phases of historic development at Hunters Point Shipyard (through the period of significance) and retains a high level of integrity. While this is true of the proposed district, the same cannot be said of the remaining portions of the shipyard given the widespread loss of integrity and lack of rarity compared to other intact military installations in the Bay Area.

Should there be any questions please contact me 415-362-7711.

Sincerely,

Sheila McElroy
Principal, Circa: Historic Property Development

APPENDIX A

Appendix A: Building Comparison Matrix

Building Category/Type	HUNTERS POINT SHIPYARD	MARE ISLAND	OAKLAND ARMY BASE	ALAMEDA NAVAL BASE
WAREHOUSING, SUPPLY AND INDUSTRIAL SUPPORT				
	 Building 400 (1943) - Supply storehouse  Building 404 (1943) - Supply storehouse  Building 810 (1943) - Paint and Oil Storage	 Building 527  Unnumbered storage buildings (1940s)  Unnumbered storage building (1940s)  Building 571 (1940s-1950s)	 Supply Storehouse 1 (1940s)  Supply Storehouse 2 (1940s)	 Building 91 and neighbor (1940s)

SHOPS, SHIP REPAIR & OUTFITTING

Large Machine/Assembly Shops

Building 411 (1947) - Shipfitters, Welders & Boilermakers Shop; Ship Repair Shop

Building 382 (1941) - Sub Assembly Shop

Building 231 (1942-1945) - Inside Machine shop; Ship Repair Shop
Located within proposedexpanded historic district

Building 386/388/390 (1920/1922/1922) - Forge Shop/Structural Shop/Shipfitting Shop

Building 351 (1945/1960 addition) - NRDL Annex E (late 1940s through early 1950s); Electronics Shop

Building 680 (1940) - Machine & Optical Shop/Masonry Industrial Shop

Building 503 (c.1940) - unidentified

Appendix A: Building Comparison Matrix

Wood-Clad Shops


Building 251 (1942) - Storage & Issue Building; Electricians' Shop


Unnumbered shop building (1940s)


Building 230 (1943) - Shop Service building; Machine Shop

Building 639 - wood-clad gabled shop building (1940s)

Metal-Clad Shops


Building 123 (1943) - Battery Overhaul & Storage

Building 213 (1917) - Storage/Metal Clad Industrial, Ordinance Storage or Warehouse


Unnumbered shop building (c.1950s?)


Building 274 (1950) - Sheetmetal Annex


Building 115 (1901) - Electric Shop


Building 366 (1952) - Boat Shop/plastic shop

Appendix A: Building Comparison Matrix

ADMIN, RESIDENTIAL & PERSONNEL SUPPORT SERVICES

Building 228 (1944) - Central Cafeteria

Building 737 (1944) - WAVES Officer's Subsistence/Barracks

Building 505 (1943) - Navy Exchange Building and Gymnasium

Building 115/116 (1943-44) - Submarine Applied Training School; Submarine Subsistence

Building 137 (c.1940s) - personnel services type

Building 500 (1943) - Barracks; Ship Officers Bachelors Quarters

Building 733 (1944) - WAVES Officer's Quarters/Barracks

Unnumbered U-plan building (c.1940s) - barracks/personnel services type

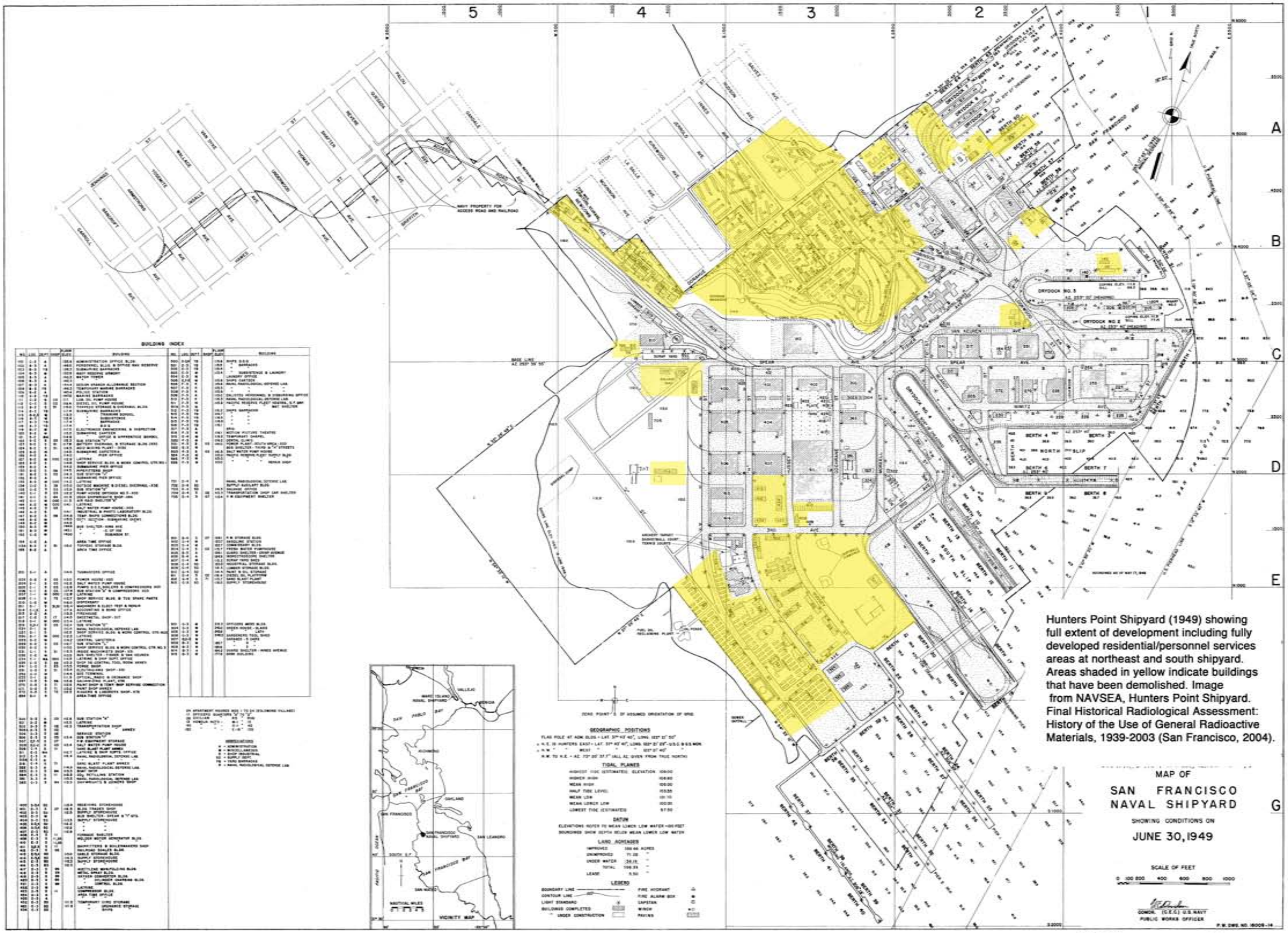
Building 117 (1943) - Submarine Barracks

Building 78 (c.1940s) - barracks

APPENDIX B

Appendix B: Photographs and Maps

Hunters Point Shipyard (ca. 1945) showing full extent of development. Image from NAVSEA, Hunters Point Shipyard. Final Historical Radiological Assessment: History of the Use of General Radioactive Materials, 1939-2003 (San Francisco, 2004).



Hunters Point Shipyard (1949) showing full extent of development including fully developed residential/personnel services areas at northeast and south shipyard. Areas shaded in yellow indicate buildings that have been demolished. Image from NAVSEA, Hunters Point Shipyard. Final Historical Radiological Assessment: History of the Use of General Radioactive Materials, 1939-2003 (San Francisco, 2004).

APPENDIX C

Appendix C: Buildings Listed by General Category

Warehousing, supply & industrial support		Shops, ship repair and outfitting		Administrative, Residential & Personnel support services	
Building 400	Supply storehouse	**Building 113**	Torpedo Storage & Overhaul/Tug Maintenance; non-destructive testing (X-ray) - NRDL related	**Building 101**	Administration Building, Civilian Cafeteria
Building 402	Supply storehouse	**Building 123**	Battery Overhaul & Storage; Substation "T"	**Building 103**	Submarine Barracks; Personnel Decontamination Center for OPERATION CROSSROADS
Building 404	Supply storehouse	**Building 128**	Substation "U"; Work Control Center #1; Shop Services; Ship Repair Shop	**Building 104**	U.S. Naval Reserve Training Center, Naval Reserve Armory; Submarine Barracks
Building 405	Supply storehouse	**Building 130**	Pipefitter's Shop; Shipbuilding & repair shop	**Building 109**	Lincoln restaurant; HPSY Police Station
Building 406	Supply storehouse	**Building 134**	Outside Machine Shop; Diesel Overhaul; Quality Assurance Offices	**Building 110**	Marine Barracks & Mess
Building 407	Supply storehouse	**Building 146**	Industrial Photo & Laboratory Building; Electronics Repair & Storage	**Building 116**	Submarine Applied Training School; Submarine Subsistence
Building 413	Supply storehouse; Cable storage building	**Building 156**	Rubber Shop; Pipefitters Shop Annex	**Building 117**	Submarine Barracks
Building 414	Supply storehouse; Mold loft (1945); radium storage area	**Building 217**	Sheetmetal Shop & Ship Repair Shop	**Building 120**	Canteen, Enlisted Men's Club
Building 415/416	Supply storehouse	**Building 225**	Shop Service building; Work Control Center #2	**Building 121**	Submarine Offices; Apprentice School; Submarine Repair Shop; Administration Building; Civilian Training center
Building 435	Equipment Storage; General Warehouse	**Building 230**	Shop Service building; Machine Shop	**Building 125**	"Submarine Cafeteria"
Building 436	Paint & lumber storage	**Building 241**	Boilermakers & Blacksmiths' Shop; Forge Shop; Ship Repair Shop	**Building 129**	Administration Building, Substation "U-2"; Submarine Pier Office (Pier B)

Appendix C: Buildings Listed by General Category

Building 437	Pipe Storage; General Warehouse	**Building 251**	Storage & Issue Building; Electricians' Shop (through 1950); Central Tool Room; Sheetmetal shop	**Building 132**	Submarine Pier Office; Substation "U-1"; Tug crew barracks (Pier C)
Building 704	Equipment holding shed; Radioactive Material Storage Area; Transportation Shop car shelter	**Building 258**	Pipefitter's Shop	**Building 154**	Area Time Office #1; Administration Building
Building 808	Industrial Storage building	**Building 271**	Paint Shop Annex; Equipment Storage; Sandblast Facility; Paint Lab	**Building 159**	Latrine
Building 809	Lumber Storage/Supply Storehouse	**Building 272**	Riggers & Laborers Shop	**Building 226**	Latrine
Building 810	Paint & Oil Storage	**Building 275**	Sheetmetal Annex	**Building 228**	Central Cafeteria/Civilian cafeteria
Building 813	Supply storehouse & office; general Warehouse	**Building 302**	Transportation Shop; Automotive Vehicle Maintenance Facility	**Building 252**	Bus Terminal; Golden Anchor Coffee Shop
Building 819/823	819: Sewage Dump Station A (1957); 823: Storage Building (1976)	**Building 303**	Transportation Shop Annex	**Building 274**	Decontamination Training Building; Office Space
		Building 323	Boat Shop; Shore Activities/Electronics	**Building 301**	Latrine
		Building 351/351A	NRDL Annex E (late 1940s through early 1950s); Electronics Shop; Chemical Technical Development Branch; General Research Labs	**Building 367**	Work Control Center #3; Administration building, field office
		Building 363	Shipwrights & Joiners Shop; Woodworkers shop	**Building 370**	Latrine
		Building 366	Boat Shop/plastic shop; NRDL Electronics Work Area; Radiography shop; Chemical Research Lab	**Building 378**	Latrine
		Building 368	Shop Service Building #1- Ship Repair Shop and Pipefitting Shop	**Building 424**	Area Time Office #4; Administration Building

Appendix C: Buildings Listed by General Category

		Building 369	Shop Service Building #2- Ship Repair Shop and Pipefitting Shop	**Building 500**	Barracks; Ship Officers Bachelors Quarters; Ships Canteen, Laundry;NRDL Admin. Offices
		Building 371	Transportation Shop Annex; automotive shop building	**Building 505**	Navy Exchange Building and Gymnasium; Bowling alley; canteen
		Building 411	Shipfitters, Welders & Boilermakers Shop; Ship Repair Shop; Civilian Cafeteria; Radiography	**Building 710**	Latrine
		Building 417	Acetylene Manifolding Building		
		Building 419	Oxygen Converter		
		Building 420	Oxygen Cylinder Charging		
		Building 530	Auto Hobby Shop		

APPENDIX D

Appendix D - Integrity Matrix

Building #	Name/Use	Built	Parcel	Integrity	Condition
Building 101	Administration Building, Civilian Cafeteria	1943	A	H	Good
Building 103	Submarine Barracks; Personnel Decontamination Center for OPERATION CROSSROADS	1943	B	M - asbestos shingle cladding over original redwood siding	Fait to good
Building 104	U.S. Naval Reserve Training Center, Naval Reserve Armory; Submarine Barracks	1943	B	M - asbestos shingle cladding over original redwood siding	Fair to good
Building 109	Lincoln restaurant; HPSY Police Station	1934	B	L - window infill/modifications, missing architectural details	Fair to poor condition
Building 110	Marine Barracks & Mess	1943	A	H	Good

Hunters Point Shipyard - Integrity Matrix

Building 113	Torpedo Storage & Overhaul/Tug Maintenance; non-destructive testing (X-ray) - NRDL related	1943	B	L - asbestos shingle cladding over original redwood siding (partial); window removal	Poor condition - building severely deteriorated
Building 115	"US Naval Reserve Drill Hall"; Submarine Training School	1944	B	M - asbestos shingle cladding over original redwood siding	Fair condition
Building 116	Submarine Applied Training School; Submarine Subsistence	1943	B	M - asbestos shingle cladding over original redwood siding	Fair condition
Building 117	Submarine Barracks	1943	B	M - asbestos shingle cladding over original redwood siding	Fair condition
Building 120	Canteen, Enlisted Men's Club	1943	B	L - wood shingle cladding over original redwood siding	Fair to poor condition

Hunters Point Shipyard - Integrity Matrix

Building 121	Submarine Offices; Apprentice School; Submarine Repair Shop; Administration Building; Civilian Training center	1944	B	L - asbestos shingle cladding over original redwood siding (partial); window modifications	Very poor condition
Building 122	Substation "V" and Compressor Plant	1944	B	M - addition	fair condition
Building 123	Battery Overhaul & Storage; Substation "T"	1943	B	H	fair condition
Building 125	"Submarine Cafeteria"	1944	B	H	fair condition
Building 128	Substation "U"; Work Control Center #1; Shop Services; Ship Repair Shop	1944	B	L - infilled bays; most windows missing	poor condition - building severely deteriorated

Hunters Point Shipyard - Integrity Matrix

Building 129	Administration Building, Substation "U-2"; Submarine Pier Office (Pier B)	1943	B	L - windows/doors missing	Pier B disentegrating; building in v. poor condition
Building 130	Pipefitter's Shop; Shipbuilding & repair shop	1944	B	L	most windows in monitor broken, building in v. poor condition
Building 132	Submarine Pier Office; Substation "U-1"; Tug crew barracks (Pier C)	1943	B	L - windows/doors missing	Pier C disentegrating; building in v. poor condition
Building 134	Outside Machine Shop; Diesel Overhaul; Quality Assurance Offices	1945	B	H	Good
Building 135	Substation "G"	1943	B	M - addition	Good
Building 146	Industrial Photo & Laboratory Building; Electronics Repair & Storage	1945	B	H	Fair condition

Hunters Point Shipyard - Integrity Matrix

Building 154	Area Time Office #1; Administration Building	1953	C	L - secondary siding, windows missing	Poor condition, building deteriorating
Building 156	Rubber Shop; Pipefitters Shop Annex	1953	B	M - addition	Fair condition
Building 159	Latrine	1956	B	M	Fair condition
Building 203	Powerplant-Substation "H"; oil fired heating plant; CROSSROADS ship fuel Burn	1943	C	H	Good
Building 206	Substation "A" & Compressors	1943	C	M - portion of building below water, deteriorated	Fair to poor condition
Building 215	Firestation #1 / Hunters Point Fire Department	1942	C	H	Good
Building 217	Sheetmetal Shop & Ship Repair Shop	1943	C	M - asbestos shingle over redwood	Fair condition

Hunters Point Shipyard - Integrity Matrix

Building 225	Shop Service building; Work Control Center #2	1943	C	L - windows broken/missing	Poor condition - building severely deteriorated
Building 226	Latrine	1943	C	M	Fair condition
Building 228	Central Cafeteria/Civilian cafeteria	1944	C	L - most windows/doors missing	Poor condition - building severely deteriorated
Building 229	Substation "L"	1943	C	L - addition; door missing	Poor condition
Building 230	Shop Service building; Machine Shop	1943	C	L - windows broken/missing	Poor condition - building severely deteriorated
Building 236	Salt Water Pump House	c.1943	C	H	G
Building 238	Unknown	c.1943	C	L - most windows/doors missing	Poor condition - building severely deteriorated

Hunters Point Shipyard - Integrity Matrix

Building 241	Boilermakers & Blacksmiths' Shop; Forge Shop; Ship Repair Shop	1945	C	L - secondary siding, windows missing	Poor condition - building severely deteriorated; interior machinery not extant
Building 251	Storage & Issue Building; Electricians' Shop (through 1950); Central Tool Room; Sheetmetal shop	1942	C	L - secondary siding, windows missing	Poor condition
Building 252	Bus Terminal; Golden Anchor Coffee Shop	1944	C	M - window modifications, secondary siding?	Fair condition
Building 258	Pipefitter's Shop	1948	C	L - full stucco cladding, multi-story addition w/ tower element	Fair condition
Building 271	Paint Shop Annex; Equipment Storage; Sandblast Facility; Paint Lab	1947	C	H	Fair condition
Building 272	Riggers & Laborers Shop	1942	C	M - asbestos shingle cladding over original redwood siding (partial); window removal	Fair to poor condition

Hunters Point Shipyard - Integrity Matrix

Building 274	Decontamination Training Building; Office Space	1950	D	M - window modifications	Fair condition
Building 275	Sheetmetal Annex	1953	C	M	Fair to poor condition
Building 280	Covered Sheet Metal Work Area	c.1945	C	L - wall missing	Poor condition - building deteriorated
Building 300	Substation "N"	1943	C	H	Good; concrete building, no windows.
Building 301	Latrine	1943	C	H	Fair condition
Building 302	Transportation Shop; Automotive Vehicle Maintenance Facility	1943	D	M - asbestos shingle cladding over original redwood siding (partial); windows missing, some door replacemnt	Fair condition
Building 303	Transportation Shop Annex	1944	D	L - secondary siding, windows/doors removed	Fair to poor condition
Building 304	Service/Gas Station	1943	D	L - secondary siding, doors removed	Poor condition - building severely deteriorated

Hunters Point Shipyard - Integrity Matrix

Building 306/306A	Substation "I"	1943	D	L - secondary siding, windows/doors missing; large addition	Poor condition - building severely deteriorated
Building 307	Electronic Storage; Public Works Equip. Storage; Electronic Assembly	1944	D	H	Good
Building 308	Salt Water Pump House; Fire Protection Pumping Station	1943	D	M - addition	Fair to good
Building 323	Boat Shop; Shore Activities/Electronics	1946	D	L - secondary siding, windows removed/replaced	Poor condition - building deteriorated
Building 324	CO2 Refilling Station	1946	D	L - window modifications	Poor condition - building deteriorated

Hunters Point Shipyard - Integrity Matrix

Building 351/351A	NRDL Annex E (late 1940s through early 1950s); Electronics Shop; Chemical Technical Development Branch; General Research Labs	1945/1960	D	M - addition	Fair to poor condition
Building 363	Shipwrights & Joiners Shop; Woodworkers shop	1943	D	M - secondary siding	Fair condition
Building 366	Boat Shop/plastic shop; NRDL Electronics Work Area; Radiography shop; Chemical Research Lab	1952	D	M - window modifications/removal	Fair condition
Building 367	Work Control Center #3; Administration building, field office	1953	C	H-M	Good
Building 368	Shop Service Building #1- Ship Repair Shop and Pipefitting Shop	1953	C	H	Good

Hunters Point Shipyard - Integrity Matrix

Building 369	Shop Service Building #2- Ship Repair Shop and Pipefitting Shop	1953	D	H	Good
Building 370	Latrine	1953	D	H	Good
Building 371	Transportation Shop Annex; automotive shop building	1953	D	M - siding modification?	Fair to good
Building 377	Work Shop & Poseidon Systems Test Engineering	1962	D	H	modern type
Building 378	Latrine	1963	D	M - secondary siding	Fair to good
Building 379	Instrumentatio n/Control - Poseidon Engineering	1962	D	M - siding modification?	Fair to good
Building 380	Work Shop & Poseidon Systems Test Engineering	1962	D	M - siding modification?	Fair to good
Building 400	Supply storehouse	1943	E	H	Good

Hunters Point Shipyard - Integrity Matrix

Building 401	Building trades shop/general warehouse; Public Works Shop	1943	D	M - asbestos siding over original redwood	Fair condition
Building 402	Supply storehouse	1943	D	H	Fair condition
Building 404	Supply storehouse	1943	D	H	Fair condition
Building 405	Supply storehouse	1943	E	H	Fair condition
Building 406	Supply storehouse	1943	E	H	Fair condition
Building 407	Supply storehouse	1943	D	H	Fair condition
Building 409/409A	Welder Motor Generator Building	1947	D	L - doors missing, all equipment removed	poor condition
Building 410	Welder Motor Generator Building	1947	D	L - portions of siding mission, all equipment removed	poor condition

Hunters Point Shipyard - Integrity Matrix

Building 411	Shipfitters, Welders & Boilermakers Shop; Ship Repair Shop; Civilian Cafeteria; Radiography	1947	D	M	Fair to good;cranes and other equipment removed
Building 412	R.R. Scales	1943	D	H	
Building 413	Supply storehouse; Cable storage building	1944	D	H	Fair condition
Building 414	Supply storehouse; Mold loft (1945); radium storage area	1944	E	M	Fair condition

Hunters Point Shipyard - Integrity Matrix

Building 415/416	Supply storehouse	1946-7	D	H	Fair condition
Building 417	Acetylene Manifolding Building	1947	D	L - full T-111 siding	Fair condition
Building 418	Metal Spray Building	1947	D	L - windows/doors missing; secondary siding	Fair condition
Building 419	Oxygen Converter	1947	D	M	Fair condition
Building 420	Oxygen Cylinder Charging	1947	D	L - front wall/portions of siding missing	Poor
Building 424	Area Time Office #4; Administration Building	1947	D	L - additions	Fair to poor
Building 435	Equipment Storage; General Warehouse	1946	D	L - doors missing, all equipment removed, secondary siding	Fair to poor
Building 436	Paint & lumber storage	1946	D	L - doors missing, all equipment removed, secondary siding	Fair to poor
Building 437	Pipe Storage; General Warehouse	1954	D	L - front wall/doors missing, secondary siding	Fair to poor

Hunters Point Shipyard - Integrity Matrix

Building 500	Barracks; Ship Officers Bachelors Quarters; Ships Canteen, Laundry;NRDL Admin. Offices	1943	D	L - most windows missing, doors & stairwells removed	Poor - building severely deteriorated
Building 505	Navy Exchange Building and Gymnasium; Bowling alley; canteen	1943	D	L - asbestos siding covering original redwood; missing windows	Poor - building severely deteriorated
Building 521	Power Plant - South Area	1948	E	H	Fair
Building 523	Fire Protection Pump Station; Salt Water pump house	1948	D	M - large portion of exterior wall missing	Poor - building deteriorated
Building 525	Pacific Reserve Fleet Supply Building	1948	D	H	Fair condition
Building 526	Pacific Reserve Fleet Repair Shop	1948	D	H	Fair condition
Building 527	Motor generator building on pier 2	1947	E	L - windows missing	Poor condition - building and pier severly deteriorated

Hunters Point Shipyard - Integrity Matrix

Building 530	Auto Hobby Shop	1953	D	M	Fair to good
Building 704	Equipment holding shed; Radioactive Material Storage Area; Transportation Shop car shelter	1946	E	H	Fair condition
Building 707	Animal hospital medical building; NRDL annex N; Animal colony; waste processing	1950	E	M - secondary siding?	Fair condition
Building 708	NRDL Bio-med Facility/animal research; Animal psychology study colony	1953	E	M - orig. doors removed	Fair to good
Building 709	Navy Exchange Gas Station	1952	E	L - glazing/doors removed; equipment stripped	Poor condition - building severely deteriorated
Building 710	Latrine	1948	E	L -windows/doors removed; interior stripped	Poor condition - building severely deteriorated

Hunters Point Shipyard - Integrity Matrix

Building 808	Industrial Storage building	1944	A	H	Good
Building 809	Lumber Storage/Supply Storehouse	1943	E	H	Fair to good
Building 810	Paint & Oil Storage	1943	E	M	Fair to good; adjacent building burned
Building 813	Supply storehouse & office; general Warehouse	1947	A	H	Good
Building 819/823	819: Sewage Dump Station A (1957); 823: Storage Building (1976)	1957/1976	D	L - addition	Fair condition
Other Major Structures:					
Drydocks 5, 6, 7	Ship repair - Submarines	1944	B	L - crane equipment and rail spur connections removed	Unknown

450 Ton Crane	altered	1948		L - altered	Unknown

Appendix K There is no appendix associated with Section III.K

Appendix L ENGEO Preliminary Geotechnical Report Hunters Point Shipyard Phase II and Candlestick Point, May 21, 2009

PRELIMINARY GEOTECHNICAL REPORT

HUNTERS POINT SHIPYARD PHASE II
AND CANDLESTICK POINT

SAN FRANCISCO, CALIFORNIA

SUBMITTED

TO

LENNAR URBAN

SAN FRANCISCO, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 7730.000.001

MAY 21, 2009

Project No.
7730.000.001

May 21, 2009

Mr. Stephen Proud
Lennar Urban
49 Stevenson Street, Suite 600
San Francisco, CA 94105

Subject: Hunters Point Shipyard Phase II and Candlestick Point
San Francisco, California

PRELIMINARY GEOTECHNICAL REPORT

Dear Mr. Proud:

With your authorization, ENGEO is pleased to provide this preliminary geotechnical report for the planned development at Hunters Point Shipyard Phase II and Candlestick Point in San Francisco, California. This report discusses our findings based on the review of previous studies performed at the site and provides preliminary conceptual geotechnical recommendations to address the geologic constraints related to the proposed development. In addition, this report will help support the Environmental Impact Report (EIR) and planning process.

The report describes the geologic conditions based on limited field explorations performed over the past 30 years, identifies the geological and geotechnical concerns at the site, and provides a suite of potential conceptual geotechnical remediation solutions for the proposed development.

We are pleased to provide our services to you on this project and look forward to consulting further with you and your design team.

Very truly yours,

REGISTERED PROFESSIONAL ENGINEER
LEROY CHAN
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Exp. 12/31/2008
CIVIL
STATE OF CALIFORNIA

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Donald E. Bruggers, GE
Principal

TABLE OF CONTENTS

INTRODUCTION

Purpose and Scope

The purpose of this Preliminary Geotechnical Report is to describe subsurface conditions anticipated within the currently planned development areas at Hunters Point Shipyard Phase II and Candlestick Point (Figure 1), identify the geotechnical hazards within the planned development areas, and identify some possible conceptual solutions to the geotechnical constraints associated with the proposed development. We have limited our discussion in this report to focus on the significant geotechnical issues that need to be addressed during the planning process as they relate to the proposed development. This report is intended for preliminary planning purposes only and for providing conceptual-level design recommendations during the EIR phase and initial phases of project planning. Design-level geotechnical studies will be required during development of construction plans.

Our scope of services included research and review of published literature, geologic maps, and previous geotechnical and environmental reports pertinent to the site. At Hunters Point, only limited shallow subsurface data was available, which did not provide sufficient information to accurately characterize the deeper stratigraphy of the site. In addition, geotechnical laboratory data for the site were limited and did not include the necessary data to fully characterize the soil properties. At Candlestick Point, pertinent geotechnical lab data and boring information were available from a limited number of borings based on the previously proposed stadium-mall development. The locations of these data points do not necessarily correspond to the critical areas of the current proposed development plan and additional subsurface exploration is required.

While generalized soil conditions for Parcels D and E at Hunter Point are presented, discussion of conceptual geotechnical solutions are briefly addressed since proposed development for this area may either consist of the 49ers Stadium or commercial development. In addition, we have not included an evaluation of the shoreline, existing bulkhead static or seismic stability at this time due to lack of subsurface information within these areas. Also, the off-site transportation improvements are not covered in the scope of this report and will require separate study.

Due to the limitations of the available data, this report is based primarily on geologic descriptions contained in previous reports and on our experience. We have modeled the available data to interpolate the stratigraphic profile across both sites; however, significant assumptions were made to characterize the subsurface conditions. A considerable amount of additional geotechnical exploration for all portions of the site is required before design-level recommendations can be provided.

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PLANNED DEVELOPMENT

Based on review of the tentative land use plan (Figure 2) prepared by IBI Group and ongoing discussions with Lennar, it is anticipated that development in Phase II of the Hunters Point Shipyard project will consist of 2,100 residential units, 60,000 square feet of neighborhood-serving retail, and 2,000,000 square feet of environmentally-sustainable light industrial and commercial facilities over a total of 495 acres. In addition, there is an NFL football stadium proposed, and the development plan includes preparation of the building pad and supporting utilities for the stadium. At Candlestick Point, the proposed development consists of 6,500 residential units, 585,000 square feet of regional retail, and a small amount of commercial facilities over a total of 276 acres. It is anticipated that building types will be a combination of low-, mid-, and high-rise buildings ranging from 2 to 40 stories for Candlestick Point and 2 to 32 stories for Hunters Point.

Significant public and recreational areas are also proposed in addition to the multi-story residential units and retail parking facilities presented in the tentative land use plan prepared by IBI Group. The development will include extensive infrastructure development including demolition of selected existing improvements, environmental remediation, geotechnical stabilization, site grading, utilities installation, transportation, and street system installation. New utility systems include low-pressure water, fire service, recycled water, sanitary sewer, storm drain, and dry utilities (gas, telephone, and telecommunications). A pedestrian and vehicular bridge is proposed to span over Yosemite Slough to provide connectivity between Hunters Point Shipyard Phase II and Candlestick Park. It is proposed that the deck of the bridge will span at an elevation ranging from approximately 12 feet to 14 feet (CCSF). Additionally, several off-site transportation improvements are not included in the scope of this report.

Development of the project is divided into various Parcels as illustrated in Figure 2. The Hunters Point Shipyard Phase II site will include Parcels 49, B, C, D, and E. Parcel B will consist of low to high-rise residential and mixed-use; Parcel C will consist primarily of mid-rise light industrial uses; development within Parcels D and E is uncertain at the time of this report, it may include a NFL Football stadium with associated parking and recreational open space. The proposed Candlestick Point site will consist of Parcels G, H, J, K, and L. Parcel G will consist of low- to mid-rise residential; Parcel H will consist of low- to high-rise residential and mixed-use; Parcel J will consist of mid- to high-rise residential; Parcel K will consist of low- to mid-rise retail and some commercial; and Parcel L will consist of low- to high-rise residential and mixed use.

At the time of this report, the City and County of San Francisco has just become incorporated into the FEMA program and Flood Insurance Rate Maps (FIRM) are being prepared. Preliminary FIRMs of the project site based on existing site grades were available for us to review. Base Flood Elevation (BFE) as shown on preliminary FEMA flood mapping is between elevation -1.60 and +0.59 feet CCSF datum within site boundaries. Variability in BFE is based on differences in wave setup and wave run-up at each transect as calculated by FEMA. The one percent flood event usually results from a combination of astronomical tides and wave run-up, as opposed to solely a 100-yr tide or a 100-yr storm wave event. Possible impacts of sea level rise were not taken into account in the FEMA study. Based on recommendations provided by Moffatt & Nichol, an additional 36-inches was added to the BFE in establishing proposed finish grades to account for sea level rise.

DATA SOURCE AND PREVIOUS STUDIES

Numerous exploratory investigations and geological mapping were performed by various parties within the project area. Due to the previously mentioned limitations of the available data, this report is based heavily on geologic descriptions contained in the following reports:

Hunters Point

- ENGEO - In a report dated December 31, 2002, ENGEO identified the pertinent subsurface conditions and possible geotechnical constraints based on earlier reports prepared on behalf of the U.S. Navy published by various groups. Additional data relating to the subsurface conditions within the Hunters Point Shipyard Project were gathered from other studies performed at the shipyard.

- ENGEO – Hunters Point Parcel A, a comprehensive geotechnical report prepared for the project area, dated October 2004, was used to prepare the enclosed geotechnical conceptual design.

Candlestick Point

- Treadwell and Rollo – A Geotechnical Investigation Report was prepared dated March 3, 1998. The investigation included drilling 16 test borings, advancing 18 cone penetration tests (CPT), and conducting five profiles of seismic refraction survey between August 5 and September 16, 1997.

- ENGEO 2006 – Various studies related to the proposed development at Candlestick Point.

GEOLOGIC CONDITIONS

The Hunters Point Shipyard Phase II and Candlestick Point project site is situated on the shore of the San Francisco Bay in the northern portion of the San Francisco Peninsula, which is bounded by San Francisco Bay to the east, and the Pacific Ocean to the west. The present day landforms and subsurface environment within the San Francisco Peninsula are primarily the product of tectonic activities associated with the San Andreas fault system and the hydrological setting. A combination of intense erosion and fluctuation of sea level has led to the characteristic deposits of soft and unconsolidated (young Bay Mud) material within the lower-lying areas along the Bay.

The topographic setting within the project boundaries at Hunters Point Shipyard Phase II can be described as relatively level with some minor slopes in the vicinity of Parcel A, located in the center of the Shipyard. Within the lower lying areas, elevations range from sea level to approximately 20 feet. The highest point within the project boundaries is elevation 36 feet on Galvez Avenue in Parcel B. The topographic setting within the project boundaries at Candlestick Point can be described as relatively level with some localized mounding in the park area near the shoreline. There are increasingly steep slopes to the west and a large elevated mound within the area of the Alice Griffith Housing Project within the future Parcel G. Elevations at Candlestick Point vary from sea level to 230 feet at the uppermost boundary of Parcel J. Reported elevations are based on City and County of San Francisco Datum (CCSF).

The site is located within the Coast Ranges geomorphic province of California, a region of northwest-trending, folded and faulted mountain ranges. The site is situated in a portion of the Coast Ranges that is underlain by Jurassic- and Cretaceous-age Franciscan bedrock including serpentinite, greenstone, chert, sandstone, and shale. As indicated on a published geologic map of the site by Bonilla, 1998 (Figure 3), Quaternary slope wash and ravine fill, which has slope stability implications, is mapped in swales along the sloping terrain.

In general, the lower-lying area, where the majority of the proposed development is to be situated, is underlain by a varying combination of five geologic units consisting of (1) artificial fill, (2) young Bay Mud deposits, (3) undifferentiated sedimentary deposits, (4) Old Bay Mud deposits, and (5) Franciscan complex bedrock. Thickness of these units varies widely across the site, but generally increases towards the coastline. The historic mapping depicted on Figure 5 shows the 1903 shoreline and the current shoreline which was established by filling over the years. Based on interpolation of limited data, we estimate that a fill thickness of 0 to 25 feet and Young Bay Mud thickness of 0 to 40 feet should be anticipated in some locations at Hunters Point Shipyard. At Candlestick Point, fill, which typically ranges from about 20 to 30 feet feet below ground surface with localized pockets of fill that extends down to 70 feet below the ground surface. The fill is underlain by young Bay Mud ranging from approximately 0 to 50 feet in thickness. A contour map showing the anticipated relative elevation to bottom of these underlying geologic units and the depths to competent bedrock is provided in Figures 6 and 7. A description of each strata is discussed below. Localized areas of deeper fill may be present throughout the site.

Fill

The fill (Qaf) was placed in conjunction with the land reclamation which began in the mid-1800s. The fill generally includes a mixture of native soil and bedrock-derived material consisting of silty sand with gravels with lenses of gravel and clays. Based on review of the subsurface information provided, the material varies in density from loose to medium dense. In some locations concrete, asphalt, metal objects, and other solid waste can be found. In localized areas along the shoreline, the fill may extend to depths as great as Elevation -70 ft (CCSF) below ground surface (Figure 6). Review of historical aerial photos suggests these locations correspond with areas where historic shoreline failure may have occurred during placement of the fill. Some sand layers within the fill material may be susceptible to liquefaction when subject to cyclic loading. This will be further discussed in subsequent sections of this report.

Young Bay Mud

The majority of the project site is underlain by compressible young Bay Mud beneath the fill (Figure 6). With the exception of the western portion of the site, where shallow bedrock outcrops are present, the Bay Mud thickness generally increases towards the bay. The Bay Mud is normally consolidated to slightly overconsolidated. Post-construction settlement as a result of consolidation of Bay Mud subjected to construction loading may have long-term detrimental effects on buildings and infrastructure within the project area. Further discussion of the effects and mitigation is provided in this report.

Alluvial Soil

Stiff to hard clay referred to as Old Bay Clay typically underlies the young Bay Mud. The Old Bay Clay is interbedded with dense sand, silty sand, or gravel layers.

Slope Wash and Ravine Fill

Bonilla (1971) mapped Quaternary slope wash and ravine fill (Qsr) throughout portions of low-lying areas and swales along the slopes to the west of the project. The approximate limits of slope wash and ravine fill are shown on the Regional Geologic Map, Figure 3. Slope wash and ravine fill are materials transported by erosion from slopes and ridges that are typically deposited in swales. Slope wash and ravine fill in the study area generally consist of sandy clay and clayey sand that are dense and slightly cemented.

Landslides

The slopes at the site vary in steepness from 2:1 (horizontal:vertical) to 1:1. As documented in previous ENGEO studies of the project area, localized areas of slope instabilities are observed within the project area. Many of these are deep-seated landslide complexes that have experienced numerous episodes of movement. Geologic Hazard mapping of the project area (Figure 4) shows that the slopes present at the site are susceptible to earthquake-induced landslides; furthermore, mapping by Bonilla shows areas within the project area to be underlain by landslide deposits. In addition, based on the observed debris at the toe of existing cut slopes, some of the steeper cut slopes, (steeper than 1½:1 horizontal:vertical), have experienced raveling and rock falls over a period of many years.

Bedrock

The site is underlain by Jurassic- and Cretaceous-age Franciscan bedrock, including greenstone, chert, sandstone, and shale, with serpentinite as the predominant rock type. Bedrock exposure can be found to the west of the project where the topographic elevation is higher. The depth from ground surface to bedrock can be over 200 feet towards the coastline (Figure 7).

Serpentinite – Extensive exposures of serpentinite bedrock (sp) are evident on existing cut slopes to the west of the Hunters Point project area as shown on the Regional Geologic Map, Figure 3. The friable to very strong bedrock varies from light green to black in color. Bedrock structure is somewhat chaotic with fractures and foliations in various orientations. Based on previous exploration performed in the area, localized zones of hard calcified bedrock ranging up to about 20 feet in diameter were observed.

Franciscan Sandstone and Shale – Franciscan sandstone and shale (KJs) are mapped at various locations on the western hills of the Candlestick Point and Hunters Point project area (Figure 3). The sandstone units are typically moderately strong to strong, moderately fractured and thickly bedded. The observed shale units are typically friable to weak, highly fractured to crushed, and thinly bedded.

Franciscan Greenstone – Franciscan greenstone (KJg) are mapped in various locations at Candlestick Point and Hunters Point. The greenstone units are typically moderately strong to strong, moderately fractured and thickly bedded.

Groundwater

The groundwater level in the lower-lying areas at Candlestick Point varies between 3 and 14 feet below ground surface, with an elevation of approximately -3 feet to -12 feet (Treadwell and Rollo, 1998). A series of groundwater monitoring wells were installed for environmental purposes within the Hunters Point development. Groundwater levels were reported to be within 3 to 21 feet below ground surface in the low-lying areas. Groundwater conditions are expected to vary depending on factors such as weather conditions, tides, time of year, and irrigation practices.

Data Gaps

Additional geotechnical borings will be needed in order to provide a site-specific mitigation program for the various geotechnical concerns and to develop recommendations for the design of deep and shallow foundations.

Seismic Hazards

The San Francisco Bay Area is a seismically active region; therefore, the site is expected to experience periodic minor earthquakes and a major earthquake on one of the nearby active faults during the service life of the structures. The major active faults in the area are the San Andreas and Hayward faults. For each segment of these faults, the distance from the site and estimated maximum moment magnitude, Mw, [Working Group on California Earthquake Probabilities (WGCEP) (2003) and Cao et al. (2003)] are summarized in the following table.

REGIONAL FAULTS AND SEISMICITY

Fault Segment	Approximate Distance from Site (km)	Direction from Site	Maximum Magnitude
North Hayward	18	East	6.9
Total Hayward	18	East	7.1
South Hayward	21	East	6.9
San Andreas - 1906 Rupture	12	West	7.9
San Andreas - Peninsula	12	West	7.1
San Andreas- North Coast South	22	West	7.6

Numerous earthquakes have been recorded in the San Francisco Bay area in the past. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the San Andreas Fault from Shelter Cove to San Juan Bautista, approximately 470 kilometers in length. It had a maximum intensity of IX, a moment magnitude of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The most recent earthquake to affect the Bay Area was the Loma Prieta Earthquake of 17 October 1989, centered in the Santa Cruz Mountains, which had a moment magnitude of 6.9.

In 2002, the Working Group on California Earthquake Probabilities (WGCEP 2003) at the U.S. Geologic Survey (USGS) predicted a 62 percent probability of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area by the year 2031. More specific estimates of the probabilities for different faults in the Bay Area are presented in the following table.

WGCEP (2003) ESTIMATES OF 30-YEAR PROBABILITY (2002 TO 2031)
OF A MAGNITUDE 6.7 OR GREATER EARTHQUAKE

Fault	Probability (percent)
Hayward-Rodgers Creek	27
San Andreas	21

PRELIMINARY CONCLUSIONS AND CONCEPTUAL DESIGN RECOMMENDATIONS

Based on review of limited geotechnical data, it is our opinion that the proposed development is feasible from a geotechnical perspective provided that sound geotechnical engineering practices are incorporated in the design and construction of the project. Our preliminary conclusions are based on a review of the proposed development plan, which includes specific building types and other site constraints. Mitigation options and foundation systems discussed herein are not limited to the options provided below and may be subject to change based on future exploration and modification of the development plan.

Based on our review of the subsurface conditions and the proposed development, we conclude that the following measures may be required to address the geotechnical constraint at the site: (1) surcharging to pre-consolidate areas underlain by compressible young Bay Mud to mitigate post-construction settlement, (2) over-excavation and compaction of surface fills to create uniform building subgrade conditions for selected building foundations and infrastructure, (3) use of stiffened mat or grade-beam foundations, either with or without geogrid subgrade reinforcement to mitigate the effects of differential settlement, (4) pile-supported structures for areas where alternative methods of site mitigation are either not feasible or cannot achieve desired performance economically, (5) corrective grading in areas where slope stability may be an issue, (6) possibly some ground densification to mitigate localized areas susceptible to liquefaction; however, there is insufficient data to evaluate this risk at this time, and (7) stabilization of the bay shoreline and waterfront retaining structures, as needed. It is anticipated that a combination of the above mitigation solutions will be incorporated in the construction of the various building types and improvements within the proposed development. Remedial grading and foundation alternatives are discussed in detail below. A summary of the geologic conditions and remediation recommendations for each parcel is provided in Appendix A of this report. However, various different types of grading and foundation alternatives may be appropriate for the proposed development. As such, Appendix A may be subject to modification upon completion of further subsurface exploration and geotechnical analyses.

Proposed Building Foundations

Selection of a foundation system for structures is dependent on: (1) the underlying soil and bedrocks ability to support the plan structure under both static and seismic loading conditions, (2) settlement of the foundation under building loads, and (3) aerial settlement due to filling to achieve minimum site finish grades. In areas where the Bay Mud and existing fill are absent or removed by remedial grading, shallow foundations on bedrock, compacted fill and stiff native soils will provide appropriate support to low- to mid-rise buildings. In areas that were reclaimed from the bay, structures that are supported on deep foundations that extend through the existing fill and Bay Mud will settle less than similar structures that are founded on shallow foundations above the Bay Mud. Alternately, ground improvement measures including surcharging and excavation and compaction of fill may be appropriate to mitigate settlement and allow for the use of shallow foundations for lighter structures as discussed below. As a result, the type of foundations to be used should be selected in consideration of the anticipated building load, new fill thicknesses, and the amount of tolerable settlement on a project-specific basis during final design.

Another consideration in the selection of the appropriate foundation system for new building is the potential to excavate and dispose of soil or groundwater that may contain hazardous materials. In addition, ground improvement such as surcharging or densification may temporarily raise groundwater levels, thereby influencing the movement of existing groundwater contaminant plumes. In areas where hazardous materials are suspected, it may be more cost effective to use a driven pile foundation, which generates less excavated soil than a shallow foundation and has less impact on existing contaminant plumes. Deep foundations will also reduce potential liquefaction-related foundation movement. Selection of appropriate foundation types for specific building areas should be conduced in consultation with the environmental remediation team.

For areas of the site closer to the bay waterfront, vertical and lateral deformations due to lateral spreading movements may be anticipated. The magnitude of such movements will be highly dependent on the stability of existing shoreline slopes, waterfront dikes and, in the case on the former Hunters Point Shipyard, on the stability of existing bulkheads and other waterfront retaining structures. Due to the potential for shoreline and bulkhead deformation, buildings adjacent to the shoreline should be supported on deep foundations. Mitigation may include a combination of reinforcing the existing shoreline retaining structures and/or locating improvements a sufficient distance away from the shoreline so that they will not be impacted should lateral spreading occur.

Where Bay mud thicknesses are greater than about 10 feet and where more than a few feet of new fill will be placed to attain new minimum site grades, it is our opinion most future structures that are three stories or more in height should be supported on deep pile foundations that extend through the Bay Mud and derive their support capacity by skin friction in the underlying stiff soils or by end bearing in bedrock. Low-rise buildings can likely be constructed on shallow mat foundations in areas of relatively uniform Bay Mud thickness provided that: (1) settlement due to areal filling is mitigated by surcharging prior to building construction and, (2) the upper portion of the existing fill is recompacted and reinforced with geogrid to created a uniform fill pad which is capable of distributing and attenuating long-term differential settlements.

Foundation alternatives for the different areas within the project are depicted on Figure 8 and summarized in the following table. These options may be subject to change based on data collected from future exploration. A summary of foundation alternatives and proposed geotechnical mitigation methods organized by subparcel area is provided in Appendix A.

AREA	TYPICAL SUBSURFACE CONDITIONS	PLANNED DEVELOPMENT TYPE	OTHER CONSIDERATIONS	SETTLEMENT MITIGATION AND FOUNDATION ALTERNATIVES
Candlestick Point	Existing Hillside, Shallow soil over bedrock, local fill associated with existing improvements	Low-rise residential	Hillside slope stability	Remedial grading to remove and compact exiting fill. Buildings on spread footings supported on compacted fill or bedrock.
Candlestick Point	Transitional area from fill over bedrock to Fill over shallow Bay Mud	Low-rise residential and mixed mid-rise residential and commercial	Surcharge with or without wicks to mitigate aerial settlement effects on foundations and infrastructure	Remedial grading to remove and compact exiting fill. Buildings utilize spread footings supported on compacted fill or bedrock. Heavier buildings on piles.
Candlestick Point	Fill over 5 to 40 feet of Bay Mud	Mid-rise residential and commercial	Need to consider effects of existing stadium foundations	Pile foundations.
Candlestick Point	Fill over 10 to 50 feet of Bay Mud	Mixed low-rise, mid-rise and high-rise residential	Surcharging with or without wicks to mitigate aerial settlement effects on infrastructure and pile downdrag	Low rise utilize mat foundations on geogrid-reinforced fill; mid-rise to high-rise supported on piles.
Candlestick Point	Fill over 10 to 60 feet of Bay Mud	Low-rise residential	Surcharge with or without wicks to mitigate aerial settlement effects on foundations and infrastructure	Low-rise utilize mat foundations on geogrid-reinforced fill, or densified soil.
Hunters Point	Fill over thin Bay mud	Low-rise residential	Excavation and ground improvement possibly limited by environmental contamination concerns	Low-rise on mat foundations on geogrid-reinforced fill, or pile foundations if excavation and ground improvement are restricted.
Hunters Point	Shallow soil over bedrock	Commercial and Research/ Development	Possible environmental contamination concerns	Spread footings on bedrock or compacted fill, possible piles where excavation is restricted
Hunter Point	Fill over thin Bay Mud near shoreline	Low-rise residential , Commercial and Research/ Development	Possible environmental contamination concerns, close proximity to waterfront bulkheads and walls with unknown integrity	Pile foundations, upgrade of waterfront retention

Proposed Bridge Infrastructure Foundations

The location of the proposed Yosemite Slough Bridge alignment is underlain by artificial fill and compressible Young Bay Mud of variable thicknesses. To support the loading conditions of the bridge that spans over the slough, it is anticipated that the bents and abutments be supported on pile foundation deriving support from subsurface material below the Bay Mud. In addition, to minimize the affects of settlement due to new fill loads associated with the road and bridge embankments, ground improvement measures may include surcharging and excavation and compaction of undocumented fills along the alignment. Additionally, soil cement mixed columns or light weight fill may be used at the abutment embankments to mitigate settlement.

Liquefaction

The project site is identified in a zone of high liquefaction risk by the State of California Geologic Survey as shown on Figure 4. Liquefaction occurs when loose to medium-dense, coarse-grained deposits and in some cases fine-grained deposits with low plasticity undergo cyclic loading during a seismic event, causing an increase in pore pressure and a resulting loss of shear strength.

Isolated layers of relatively clean loose sand within the existing fill and some sand layers within the Bay deposits are potentially susceptible to liquefaction and settlement during moderate to large earthquakes. Without ground improvement, these materials may be susceptible to sand boils, fissuring and settlement, resulting in the differential settlement of buildings and improvements (including underground utilities) that achieve bearing on/in these materials. Based on the limited existing data, it appears that settlement of up to 3 to 6 inches may be anticipated as a result of liquefaction of the loose sandy soils within the development areas of the Hunters Point Phase II and Candlestick Point. Differential settlement over a typical building footprint may be on the order of half the total settlement. Mitigation is possible using a variety of options including use of stiffened mat foundations that are designed to span localized zones of differential settlement or possibly by the use of ground improvement to densify susceptible soils beneath shallow foundations. Ground improvement, if required, may include Deep Dynamic Compaction (DDC) or other methods, as appropriate. Other types of ground improvement systems such as, stone columns, vibro-compaction, and ram aggregate piers may also be considered to mitigate susceptibility of structures to liquefaction. Alternatively, structures can derive support on material below the liquefiable material by the use of deep foundations. The need for and scope of liquefaction mitigation should be determined following subsequent investigation and in consultation with the environmental remediation team.

Hillside Stability

Based on geological mapping at a regional scale conducted by Bonilla, there are no mapped landslides within the project boundaries (Figure 3). However, based on our experience at an adjacent development, the slopes in the area are susceptible to deep-seated landsliding. In order to create buildable area for proposed buildings and streets, slopes on the site will be modified during site grading. The grading of proposed cut slopes could create instabilities that do not presently exist on site. In addition, earthquake-induced landsliding may occur as indicated on the USGS Geologic Hazards Map (Figure 4). To evaluate the impact of potentially unstable slopes to the proposed development, additional field mapping should be performed to gather information on the extent of the potential landslide areas. Site exploration to acquire strength characteristics may be necessary to facility slope stability analysis during future design phase studies.

- Corrective grading measures which include removal and recompaction, keying and benching engineered fill into competent materials, and installation of subdrainage.
- Appropriate site planning allowing for setbacks from possible slide areas.
- Construction of soil nail walls and rock bolting in susceptible areas.

- Construction of rockfall catch fences, rockfall mesh netting, or deflection walls.

Areas of seepage should be mitigated with appropriate subdrainage. Where complete removal and replacement of unstable slope materials are planned, the excavations should be observed by a Certified Engineering Geologist to verify removal of disturbed materials. Keyways, subexcavated benches, and locations of subdrainage should be designed in the field based on the slide plane depth and geometry. In general, graded slopes should be constructed at inclinations not exceeding 3:1 (horizontal to vertical). Slopes over 30 feet in height should be designed with intermediate surface terraces and lined v-ditches to control drainage.

Shoreline Stability

The existing shoreline consists of variable fill overlying relatively weak Bay Mud. Failures along various locations of the shoreline were observed during a recent site visit. In many areas there does not appear to be any engineered fill containment structure such as a perimeter dike. It appears that fill was progressively end-dumped or pushed with dozers over the bay deposits. This filling method has likely resulted in statically stable slopes with low factors of safety. Typical of similar fill conditions in the Bay, these bay front slopes will likely be subject to lateral deformation and subsidence during strong earthquake shaking. In many areas, the proposed structures are set back significantly from the bay shore; hence, the risk of significant movements effecting new pile-supported buildings located near the shoreline is low. However, specific geotechnical studies are required to evaluate shoreline stability and assess appropriate setbacks for improvements. Infrastructure and other facilities located along the shoreline will be subject to movement and resulting damage during a large earthquake. Where such movement is considered unacceptable, shoreline stabilization measures may be required.

There are numerous waterfront bulkheads and other retaining structures within the former Hunters Point Shipyard. Some of these structures suffered damage during the 1989 Loma Prieta

Earthquake. It is likely that analysis of the existing shoreline structures will indicate that they are susceptible to damage during future large earthquakes. The stability of the waterfront should be evaluated as part of ongoing geotechnical studies.

Consolidation Settlement of Young Bay Mud

Given the site history, we judge that primary consolidation settlement of the Young Bay Mud under the existing fill loads is essentially complete. Additional fill and/or building loads will result in a new sequence of consolidation settlements that will continue over a period of many years. These consolidation settlements can be mitigated by preloading or surcharging selected development areas. When properly implemented, the surcharge load will cause site settlement to occur prior to building and/or infrastructure construction. Prefabricated wick drains, installed prior to placement of the surcharge fill can be used to facilitate lateral drainage of the young Bay Mud, thereby accelerating the consolidation and decreasing the time required to complete the surcharge program.

Foundations and structures may be designed by the Structural Engineer to accommodate some additional movement as a result of long-term consolidation settlement. For these cases, it may be appropriate to increase surface grades to compensate for anticipated settlements. Similarly, it may be practical to increase design inverts for planned gravity utilities to accommodate potential settlements and maintain positive flow gradients.

Bedrock Rippability and Suitability

Based on field observations at the neighboring project and our experience in the area, it is our opinion in general bedrock should be rippable with conventional heavy construction equipment (such as a Caterpillar D-9). Localized well-cemented beds may be encountered that will require more ripping or rock-breaking effort. Trenching for utilities should be possible with conventional equipment. As noted above, localized well-cemented beds may be encountered that may necessitate use of heavy equipment. If significant areas of hard rock are encountered, rock blasting should be considered as an economical means of improving efficiency of excavation subject to the approval by the San Francisco Department of Public Health.

In general, soil and bedrock materials observed on the site appear suitable for use as engineered fill if properly processed.

Future Geotechnical Studies

As the project proceeds into subsequent phases of development, additional geotechnical studies will be necessary. These studies will include but are not limited to:

1. Preparation of preliminary geotechnical exploration reports. These reports will include an evaluation of:

   a. Physical properties of the typical soil material encountered in the subject area.

   b. Seismic considerations from nearby faults and current CBC seismic design criteria including determination of the Site Class and preparation of a site-specific seismic response analysis, an appropriate.

   c. Discussion of geotechnical constraints such as, compressible, expansive and/or liquefiable soils.

   d. Discussion of ground improvement alternatives (such as surcharging, densification, etc.) to mitigate geotechnical constraints including preliminary cost estimates, as appropriate.

   e. Preliminary fill compaction recommendations and drainage considerations for estimating purposes.

   f. Preliminary analysis of foundation type(s) for the proposed development including preliminary design criteria for project estimating purposes.

g. Preliminary assessment of shoreline stability.

h. Recommendations for further design-level studies.

As land planning progresses into development of a detailed layout, refining geotechnical/geological information by obtaining additional subsurface information will be essential to keep the planning process moving forward and identify impacts and mitigation measures associated with the grading layouts. Additional services will include but are not limited to:

- Preparation of detailed corrective grading and site improvement plans.
- Development of erosion control and storm water pollution prevention plans.
- Preparation or review of construction and permanent dewatering system designs.
- A review of final construction plans and specifications, including grading plans, foundation plans and calculations for conformance with the design level recommendations.
- Geotechnical observation and testing services during construction.
- Special inspection and materials testing services during construction.

These studies are important in expediting approval by governing agencies and achieving cost-effective construction.

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LIST OF FIGURES

EXPLANATION

APPROXIMATE LIMITS OF HUNTERS POINT SHIPYARD PHASE II

APPROXIMATE LIMITS OF CANDLESTICK POINT

APPROXIMATE LIMITS OF YOSEMITE SLOUGH RESTORATION AREA

N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: MS STREETS AND TRIPS

ENGEO Expect Excellence	VICINITY MAP CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II SAN FRANCISCO, CALIFORNIA	PROJECT NO.: 7730.000.001 DATE: MAY 2009 DRAWN BY: RJS CHECKED BY: DB	FIGURE NO. 1

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ORIGINAL FIGURE PRINTED IN COLOR

BASE MAP SOURCE: IBI GROUP, 2009

ENGEO Expect Excellence	PROPOSED DEVELOPMENT PLAN WITH CUT & FILL DEPTHS CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE 2 SAN FRANCISCO, CALIFORNIA	PROJECT NO.: 7730.000.001		FIGURE NO 2
		DATE: MAY 2009		
		DRAWN BY: LC	CHECKED BY: BHJ	

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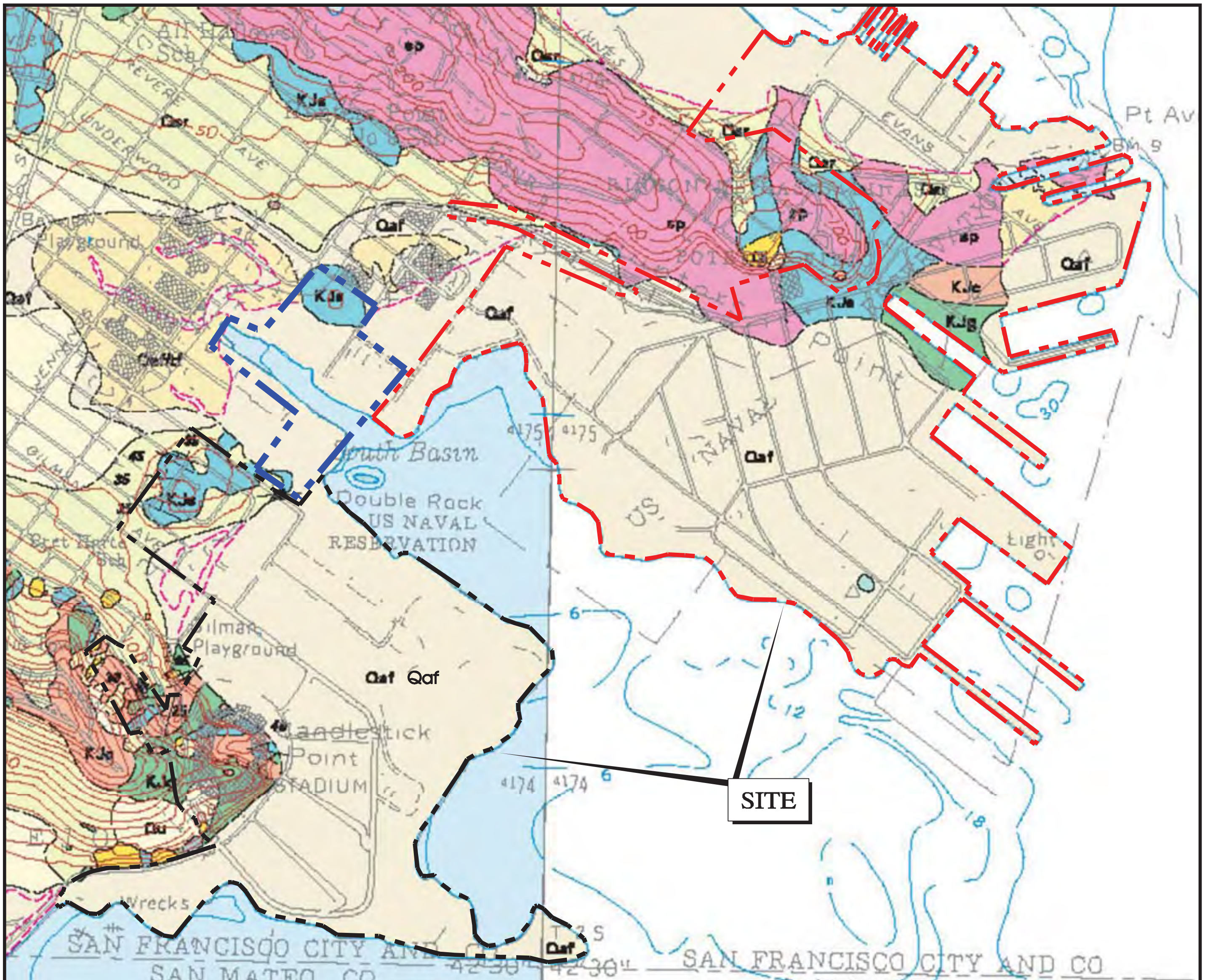

EXPLANATION

Qaf	ARTIFICIAL FILL
Qaf/tf	ARTIFICIAL FILL OVER TIDAL FLAT
Qsr	SLOPE DEBRIS AND RAVINE FILL
Qu	SEDIMENTARY DEPOSITS, UNDIFFERENTIATED
KJs	SANDSTONE AND SHALE
KJc	CHERT
KJg	GREENSTONE
sp	SERPENTINE
———	CONTACT, CERTAIN
— — —	CONTACT, APPROXIMATELY LOCATED

BASE MAP SOURCE: BONILLA, 1998

ENGEO Expect Excellence	REGIONAL GEOLOGIC MAP CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II SAN FRANCISCO, CALIFORNIA	PROJECT NO.: 7730.000.001 DATE: MAY 2009 DRAWN BY: RJS CHECKED BY: DEB	FIGURE NO. 3

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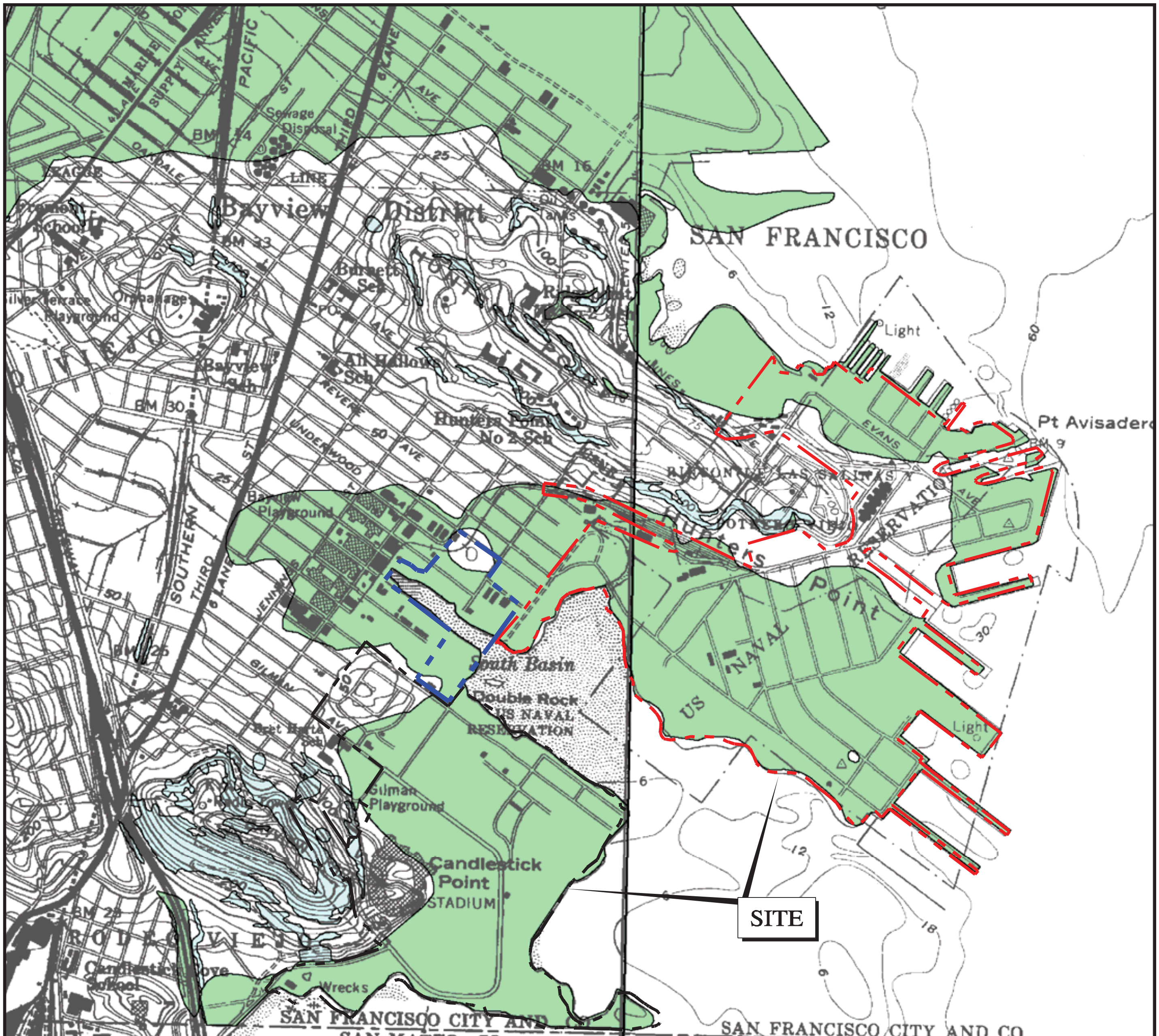


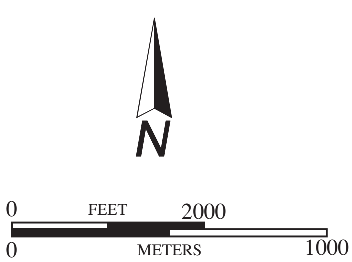
EXPLANATION

Liquefaction

Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides

Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.



BASE MAP SOURCE: DAVIS, 2001

ENGEO Expect Excellence	GEOLOGIC HAZARD MAP CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II SAN FRANCISCO, CALIFORNIA	PROJECT NO.: 7730.000.001 DATE: MAY 2009 DRAWN BY: RJS CHECKED BY: DEB	FIGURE NO. 4

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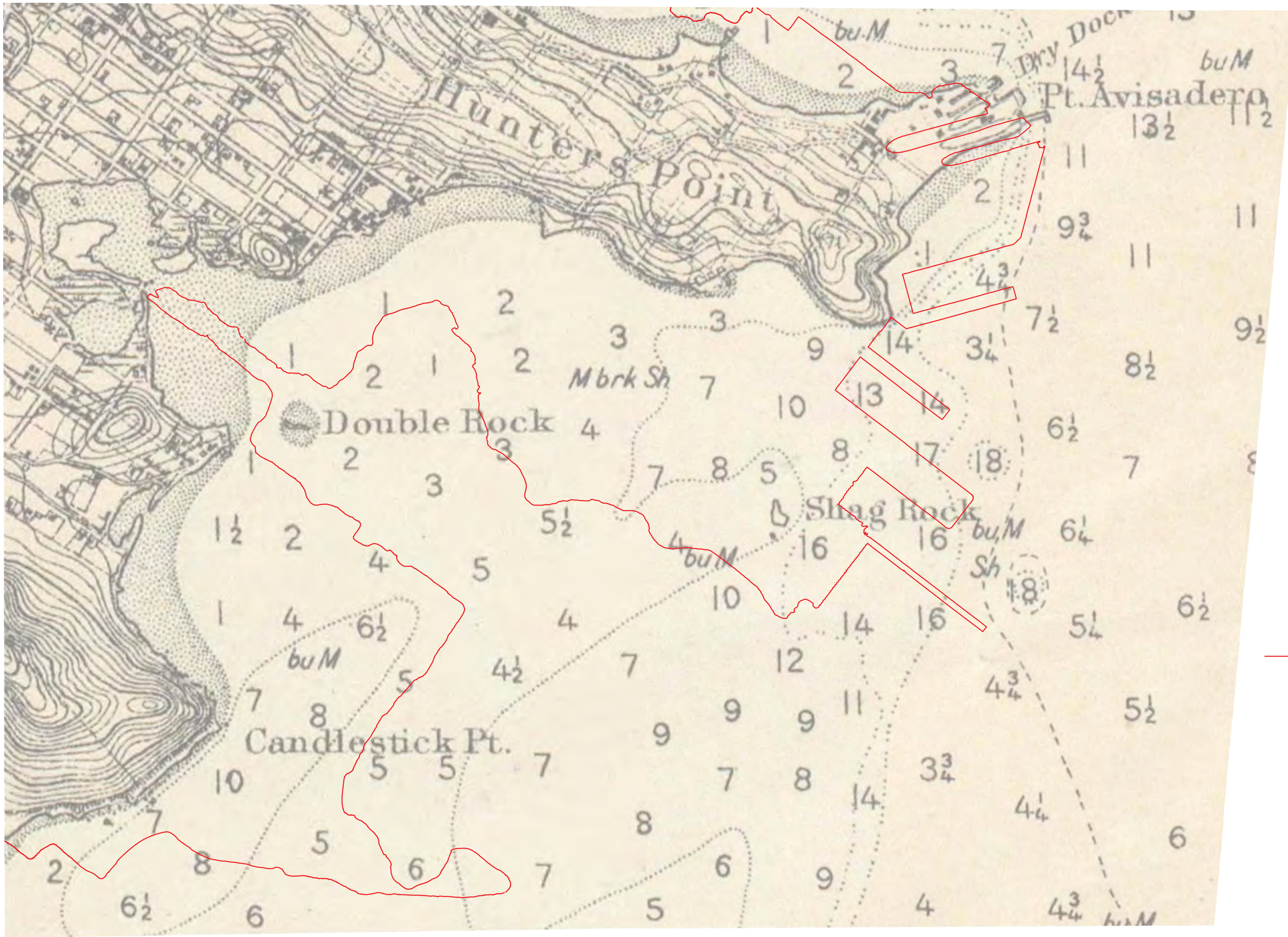

EXPLANATION

6 ORIGINAL WATER DEPTHS(IN FATHOMS)
1 FATHOM = 6 FEET

APPROXIMATE LIMIT OF EXISTING SHORELINE

N

0 FEET 1000
0 METERS 500

BASE MAP SOURCE: US COAST AND GEODETIC SURVEY, 1903

ENGEO — Expect Excellence	HISTORIC MAPPING WITH EXISTING SHORELINE CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II SAN FRANCISCO, CALIFORNIA	PROJECT NO.: 7730.000.001 DATE: MAY 2009 DRAWN BY: PC CHECKED BY: DEB	FIGURE NO. 5

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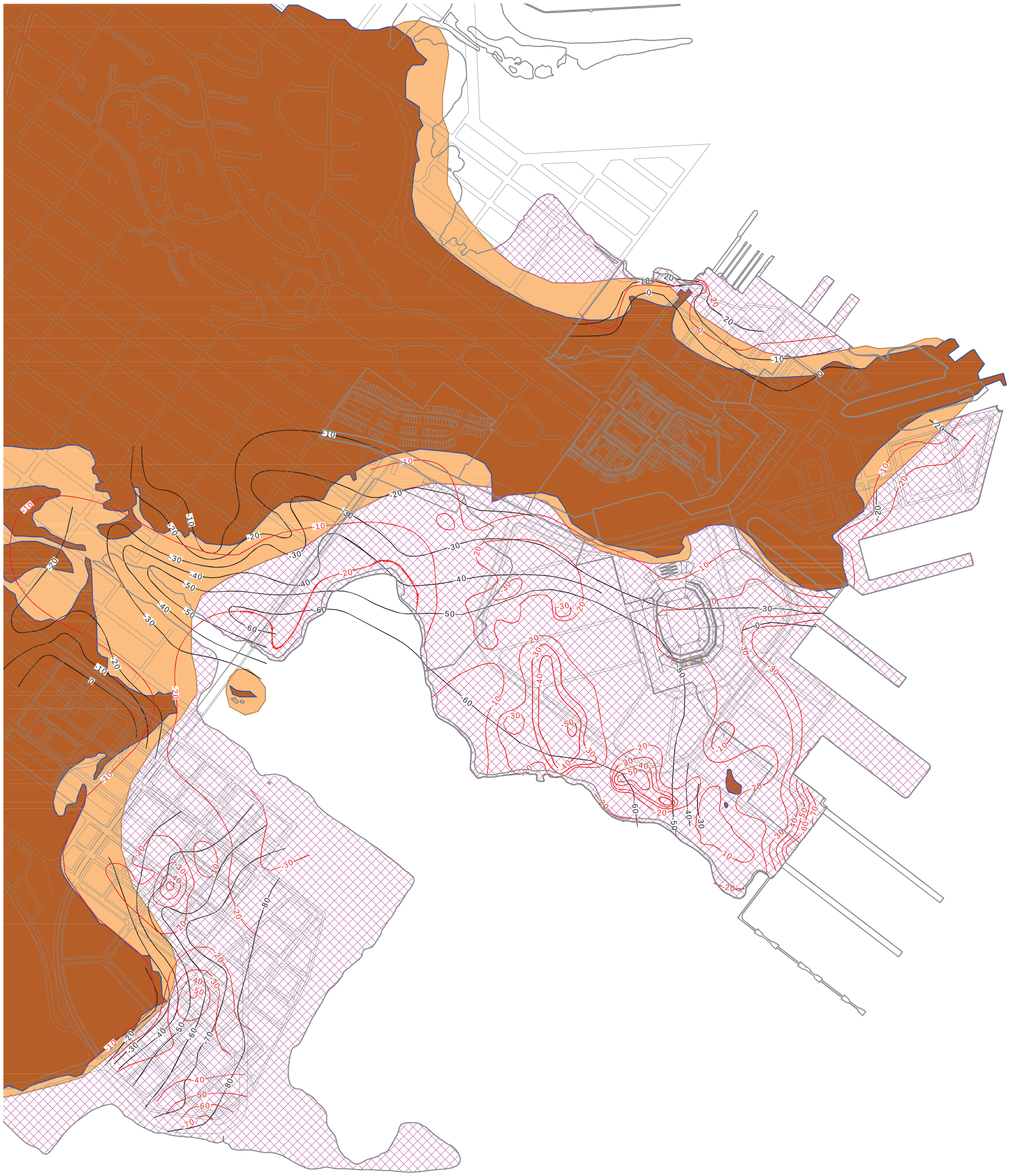

EXPLANATION

SHORELINE FROM 1903 MAPPING

INTERTIDAL LIMIT FROM 1903 MAPPING

-70 CONTOURS ON THE BASE OF BAY FILL DEPOSITS*

-80 CONTOURS ON THE BASE OF THE YOUNGER BAY MUD*

APPROXIMATE AREA OF RECLAIMED LAND

ONSHORE AREAS, 1903

INTERTIDAL ZONE, 1903

N

0 FEET 1000

0 METERS 500

ELEVATIONS BASED ON CCSF (CITY AND COUNTY OF SAN FRANCISCO DATUM)

BASE MAP SOURCE: IBI GROUP

ENGEO
Expect Excellence

CONTOUR OF BASE OF FILL AND BASE OF YOUNG BAY MUD
CANDLESTICK POINT AND HUNTERSPOINT SHIPYARD PHASE II
SAN FRANCISCO, CALIFORNIA

PROJECT NO.: 7730.000.001
DATE: MAY 2009
DRAWN BY: LC
CHECKED BY: DB
FIGURE NO. 6

ORIGINAL FIGURE PRINTED IN COLOR

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EXPLANATION

SHORELINE FROM 1903 MAPPING

INTERTIDAL LIMIT FROM 1903 MAPPING

-70 BEDROCK CONTOUR*

APPROXIMATE LIMITS OF EXISTING SHORELINE

APPROXIMATE AREA OF RECLAIMED LAND

ONSHORE AREAS, 1903

INTERTIDAL ZONE, 1903

N

0 FEET 1000

0 METERS 500

ELEVATIONS BASED ON CCSF (CITY AND COUNTY OF SAN FRANCISCO DATUM)

BASE MAP SOURCE: IBI GROUPS

ENGEO Expect Excellence	BEDROCK CONTOUR MAP CANDLESTICK AND HUNTERS POINT SHIPYARD PHASE II SAN FRANCISCO, CALIFORNIA	PROJECT NO.: 7730.000.001 DATE: MAY 2009 DRAWN BY: LC CHECKED BY: DB	FIGURE NO. 7

ORIGINAL FIGURE PRINTED IN COLOR

BASE MAP SOURCE: IBI GROUP, 2009

ENGEO Expect Excellence	PRELIMINARY SITE MITIGATION AND FOUNDATION TYPES CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE 2 SAN FRANCISCO, CALIFORNIA	PROJECT NO.: 7730.000.001 DATE: MAY 2009 DRAWN BY: LC CHECKED BY: BHJ	FIGURE NO 8

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ORIGINAL FIGURE PRINTED IN COLOR

APPENDIX 1

Conceptual Geotechnical Design Summary

BASE MAP SOURCE: IBI GROUP, 2009

EXPLANATION

APPROXIMATE LIMITS OF GEOTECHNICAL SITE MITIGATION AND FOUNDATION OPTION PARCEL

N

0 FEET 1000
0 METERS 500

ENGEO Expect Excellence	CONCEPTUAL GEOTECHNICAL DESIGN PLAN CANDLESTICK POINT AND HUNTERS POINT SHIPYARD PHASE II SAN FRANCISCO, CALIFORNIA	PROJECT NO.: 7730.000.001 DATE: MAY 2009 DRAWN BY: LC CHECKED BY: BHJ	FIGURE NO. 1

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ORIGINAL FIGURE PRINTED IN COLOR

Parcel	**L_1**
Area	Building Area 43.7 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +5 to -5 ft (CCSF) Final grades vary from +2.5 to +5.0 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 30 ft to up to 70 feet. Bottom of Artificial Fill ranges from Elevation -30 ft to up to -70 (CCSF) ft in some isolated locations • Thickness of Young Bay Mud ranges from 10 ft to up to 60 feet. Bottom of Young Bay Mud ranges from Elevation -20 ft to -80 ft (CCSF) • Bedrock located at Elevation -70 ft to -220 ft (CCSF) • Groundwater Elevation between -6 ft to -9 ft (CCSF)
Proposed Development Type	Low-rise residential with ½ basement (5 ft deep) parking level. Anticipated 3 to 4 stories in building height. One high-rise building is anticipated to be located in block L6A with height of up to 38 stories.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Surcharging to mitigate bay mud settlement due to new fill loads associated with proposed grades.
Expected Utilities Performance	• Surcharging will mitigate majority of long-term settlement and some secondary settlement • Minor settlement due to liquefaction and on-going long-term settlement may be expected • Some differential settlement of utilities between pile supported structure and external utilities may be expected • Flexible utilities connection for external utilities into pile supported structures • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	• Surcharging may be employed to mitigate bay mud settlement due to new building loads, design grade and secondary compression. For a duration of one year, assume surcharge of 5 ft above final grade in areas of cut and 15 ft above final grade in areas receiving fill The structures may either be supported on mat foundation underlain by over-excavated and recompacted existing fill for uniform support or on pile foundations. Foundation type will depend on surcharge effectiveness, bay mud thickness, and building loads. Assume a minimum overexcavation of 5 feet below basement slab. Building pad area utilizing shallow foundations may require reinforcement with 2 layers of geogrid. Remedial grading within building pad areas will be performed on a pad-by-pad basis and conducted during vertical construction. High-rise towers will be supported on deep foundations founded on competent material. Depth of foundation should be determined during design-level study.
Expected Geotechnical Performance	• Structures supported on mat foundations underlain by a layer of reinforced recompacted fill will experience acceptable amount of total and differential settlement due to on going bay mud consolidation, secondary compression and small amounts of possible seismic settlement. • Settlement of pile supported structures is not anticipated.
Other Considerations	• Previous exploration data shows concrete rubble maybe present within the artificial fill material. This rubble may need to be crushed on-site during grading operation if encountered within building envelopes. • Due to presences of shallow groundwater level, subgrade stabilization maybe required during excavation. Contingency to cost estimate should be applied to account for stabilization measures (i.e. dewatering, bridging).

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	L_2
Area	Building Area 2.9 acres (90% building pad; 10% streets and parks)
Grades	Existing grades vary from -2 ft to +6 ft (CCSF) Final grades vary from +3.5 ft to +5.0 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 20 ft to up to 40 feet. Bottom of Artificial Fill ranges from Elevation -20 ft to -40 ft (CCSF); • Thickness of Young Bay Mud can be up to 10 feet. Bottom of Young Bay Mud ranges from Elevation -20 ft to -40 ft (CCSF); • Bedrock located at Elevation -30 ft to -70 ft (CCSF); • Groundwater Elevation between -6 ft to -7ft (CCSF)
Proposed Development Type	Mid-rise mix-use structures constructed on-grade. Anticipated 6 to 12 stories in building height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial grading is anticipated.
Expected Utilities Performance	• Settlement will occur rapidly. Post-construction settlement minimal. • Flexible utilities connection required
Probable Remedial Grading Related to Foundation/Vertical Construction*	Structures can be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study.
Expected Geotechnical Performance	• Settlement of pile supported structures is not anticipated • Some differential settlement between structures and external utilities may be expected.
Other Considerations	No other considerations.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	K_1
Area	Building Area 7.5 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +4 ft to +50 ft (CCSF) Final grades vary from +5 ft to +25 ft (CCSF)
Soil and Groundwater Condition	Majority of the parcel underlain by Bedrock located at Elevation +10 ft to the northeast to +50 ft to the southwest (CCSF); Groundwater not anticipated.
Proposed Development Type	Mid-rise commercial structures constructed on-grade. Anticipated building heights are 2 to 6 stories.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	No settlement is expected.
Probable Remedial Grading Related to Foundation/Vertical Construction*	• Structures may be supported on mat or spread footing foundations. Remedial grading within building pad areas will be investigated and selection of appropriate foundation approach on a pad-by-pad basis will be conducted during vertical construction. • Slope stability along steep slopes may require corrective grading or implementation of slope protection systems
Expected Geotechnical Performance	Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill)
Other Considerations	• Rippability of bedrock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	K_2
Area	Building Area 15 acres (80% building pad; 20% streets and parks)
Grades	Existing grades vary from +1 to +25 ft (CCSF) Final grades vary from +3 to +18 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 40 feet. Bottom of Artificial Fill extends to Elevation -40 ft (CCSF); • Thickness of Young Bay Mud up to 20 feet. Bottom of Bay Mud extends to Elevation -55 ft (CCSF); • Bedrock located at Elevation 0 ft to -100 ft (CCSF); • Groundwater Elevation between -6 ft to -8 ft (CCSF)
Development Type	Mid-rise commercial structures constructed on-grade. Anticipated 6 to 12 stories in building height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	• Some differential settlement between pile supported structures and external utilities. • Settlement will occur rapidly. Post-construction settlement minimal.
Probable Remedial Grading Related to Foundation/Vertical Construction*	• This is a transitional soil area. Foundation will vary from shallow to deep foundations. Remedial grading within building pad areas will be investigated and selection of appropriate foundation approach on a pad-by-pad basis will be conducted during vertical construction. • Proposed development may require modification of current slope configuration. Depending on the proposed grading, slope rebuilt with buttress or stabilization via retaining structures may be needed.
Expected Geotechnical Performance	• Settlement will vary based on selected foundation systems • Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill) • Settlement of pile supported structures is not anticipated
Other Considerations	Rippability of bedrock may require heavy equipment or blasting. In location currently occupied by the existing stadium, overexcavation maybe required to completely remove foundation elements.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	J
Area	Building Area 4 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +113 ft to +150 ft (CCSF) Final grades vary from +100 ft to +135 ft (CCSF)
Soil and Groundwater Condition	Majority of the parcel underlain by Bedrock located at Elevation +100 ft to the northeast to +150 ft to the southwest (CCSF); Groundwater not anticipated.
Proposed Development Type	Mid-rise residential structures constructed on-grade. Anticipated building heights are 6 to 18 stories.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	No settlement is expected.
Probable Remedial Grading Related to Foundation/Vertical Construction*	• Structures may be supported on mat or spread footing foundations. Remedial grading within building pad areas will be investigated and selection of appropriate foundation approach on a pad-by-pad basis will be conducted during vertical construction. • Slope stability along steep slopes may require corrective grading or implementation of slope protection systems
Expected Geotechnical Performance	Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill)
Other Considerations	• Rippability of rock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	H
Area	Building Area 56 acres (60% building pad; 40% streets and parks)
Grades	Existing grades vary from -5 ft to +7 ft (CCSF) Final grades vary from +3 ft to +5.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 20 ft to up to 40 feet. Bottom of Artificial Fill ranges from Elevation -20 ft to -40 ft (CCSF); • Thickness of Young Bay Mud ranges from 10 ft to up to 50 feet. Bottom of Bay Mud ranges from Elevation -15 ft to -70 ft (CCSF); • Bedrock located at Elevation -50 ft to -220 ft (CCSF); • Groundwater Elevation between -6 ft to -9 ft (CCSF)
Proposed Development Type	Low-rise residential structures with basement parking level (10ft deep). Anticipated 3 to 4 stories in building height. Mid-rise and High-rise towers on podium with basement (10ft deep). Anticipated 6 to 12 stories in height for mid-rise buildings and up to 38 stories in height for high-rise towers. Basement under full blocks. Fill required locally within street footprint.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	• In general no remedial measures are required for infrastructure and utilities • May consider some surcharging or placement of lightweight fill in local deep mud areas where 3 or more feet of new fill is proposed
Expected Utilities Performance	• Minor settlement due to liquefaction and on-going long-term settlement may be expected • Accommodate utility and infrastructure settlement in as-built design grades • Some differential settlement between structure supported on pile foundation and external utilities • Flexible utility connections may be required • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	• In general no remedial measures are required for structures • Structures will be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study.
Expected Geotechnical Performance	Structures will be supported on pile foundations. Settlement of the structures is not anticipated. Some differential settlement between structure and external utilities may be expected
Other Considerations	• Previous exploration data shows concrete rubble maybe present within the artificial fill material. Rubble may need to be crushed on-site or off-hauled during grading operation if encountered within building envelopes. • Due to presences of shallow groundwater level, subgrade stabilization maybe required during excavation. Contingency to cost estimate should be applied to account for stabilization measures (i.e. dewatering, bridging).

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	G_1
Area	Building Area 11.6 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +0 to +15 ft (CCSF) Final grades vary from +5 to +16 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 10 ft to up to 20 feet. Bottom of Artificial Fill ranges from Elevation -10 to -20 ft (CCSF); • Thickness of Young Bay Mud up to 10 feet. Bottom of Bay Mud extends to Elevation -20 ft (CCSF); • Bedrock located at Elevation -25 ft to -50 ft (CCSF); • Groundwater Elevation between -6 to -7 ft (CCSF)
Proposed Development Type	Low-rise residential structures constructed on-grade. Anticipated 3 to 4 stories in building height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	• Some differential settlement between structures and external utilities is expected • Settlement will occur rapidly. Post-construction settlement minimal. • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	This is a transitional soil area. Foundation will vary from shallow to deep foundations. Remedial grading within building pad areas will be investigated. Selection of appropriate foundation approach will be conducted on a pad-by-pad basis during vertical construction design phase.
Expected Geotechnical Performance	• Settlement will vary based on selected foundation systems • Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill)
Other Considerations	• Existing pile supported utility requires special consideration. Civil designers should consider minimizing fill proposed in proximity of existing utility. • Reconditioning of bay mud required for reuse. • Rippability of rock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	G_2
Area	Building Area 25.6 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from +10 to the east and +45 ft to the west(CCSF) Final grades vary from +16 to the east and +45 ft to the west (CCSF)
Soil and Groundwater Condition	• Majority of site consists of thin fill over bedrock. Lower portion of site consists of Artificial Fill underlain by Young Bay Mud over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 10 feet. Bottom of Artificial Fill extends to Elevation -10 ft (CCSF)Minimal Bay Mud up to 5 feet thick is expected Bedrock located at Elevation +45 ft to -10 ft (CCSF)
Proposed Development Type	Low-rise residential structures constructed on-grade. Anticipated 3 to 4 stories in building height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	Minimal infrastructure settlement
Probable Remedial Grading Related to Foundation/Vertical Construction*	Structures may be supported on spread footing or mat foundations on compacted fill. Remedial grading within building pad areas will be investigated. Selection of appropriate foundation approach will be conducted on a pad-by-pad basis during vertical construction design phase.
Expected Geotechnical Performance	Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform building material (i.e. recompacted engineered fill)
Other Considerations	Rippability of bedrock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	B_1
Area	Building Area 36 acres (70% building pad; 30% streets and parks)
Grades	Existing grades vary from 0 to +5 ft (CCSF) over majority of the site; increases to 35 ft (CCSF) along the southwestern boundary. Final grades vary from +3.5 to +7.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 10 feet. Bottom of Artificial extends to Elevation -10 ft (CCSF); • Thickness of Young Bay Mud up to 5 feet. Bottom of Bay Mud extends to Elevation -20 ft (CCSF); • Bedrock located at Elevation 0 to -50 ft (CCSF) • Groundwater Elevation between -3 to -7 ft (CCSF)
Proposed Development Type	Low-rise and mid-rise residential and mid-rise mix-use structures constructed on-grade. Anticipated 3 to 4 stories for low-rise and 6 to 8 stories for mid-rise.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Some differential settlement between structure on piles and external utilities may be expected • Flexible utility connections required • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	• Low-rise structures can be supported on mat. Remedial grading within building pad areas will be investigated. Selection of appropriate foundation approach will be conducted on a pad-by-pad basis during vertical construction design phase. • Mid-rise structures can be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study. • Proposed development may require modification of current slope configuration. Depending on the proposed grading, slope rebuilt with buttress or stabilization via retaining structures may be needed.
Expected Geotechnical Performance	• Structure on mat foundation will experience acceptable amount of total and differential settlement due to on-going bay mud consolidation, secondary compression and small amounts of possible seismic settlement. • Settlement of the structure supported on pile foundation is not anticipated.
Other Considerations	• Due to environmental constraints, overexcavation in this area may not be feasible. Consider pile foundation as an alternative to overexcavation • Rippability of bedrock may require heavy equipment or blasting.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	B_2
Area	Building Area 8 acres (80% building pad; 20% streets and parks)
Grades	Existing grades vary from 0 to +3 ft (CCSF) Final grades vary from +2.0 to +3.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 10 feet. Bottom of Artificial Fill extends to Elevation -10 ft (CCSF); • Thickness of Young Bay Mud up to 20 feet. Bottom of Bay Mud extends to Elevation -30 ft (CCSF); • Bedrock located at Elevation of -25 to -100 ft (CCSF); • Groundwater Elevation between -3 to -8 ft (CCSF)
Proposed Development Type	Low-rise and one high-rise building at the east corner constructed on-grade. Anticipated 3 to 4 stories for low-rise and 20 to 60 stories for high-rise.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Some differential settlement between structure and external utilities may be expected • Flexible utilities connection may be required for external utilities into pile supported structures • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	Structures will be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study.
Expected Geotechnical Performance	Settlement of the structure is not anticipated.
Other Considerations	No other considerations.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	B_3
Area	Building Area 11 acres (100% streets and parks)
Grades	Existing grades vary from +1.5 to +20 ft (CCSF) Final grades will be result of minor cut and fill to achieve drainage
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 20 feet. Bottom of Artificial Fill extends to Elevation -20 ft (CCSF); • Thickness of Young Bay Mud up to 10 feet. Bottom of Bay Mud extends to Elevation -20 ft (CCSF); Bedrock located at Elevation of 0 to -50 ft (CCSF) Groundwater Elevation between -3 to -8 ft (CCSF)
Proposed Development Type	Openspace and supporting facilities constructed on-grade.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Expect minor settlement due to on-going long term settlement from design fill load, liquefaction, secondary compression, and small amounts of possible seismic settlement. • Flexible utility connections required.
Probable Remedial Grading Related to Foundation/Vertical Construction*	No structures are planned for this area.
Expected Geotechnical Performance	N/A
Other Considerations	RAD impact area may restrict construction activities

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	C_1
Area	Building Area 13.6 acres (80% building pad; 20% streets and parks)
Grades	Existing grades vary from 0 to +3 ft (CCSF) Final grades vary from +1.5 to +4.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 10 feet. Bottom of Artificial Fill extends to Elevation -10 ft (CCSF); • Thickness of Young Bay Mud up to 10 feet. Bottom of Bay Mud extends to Elevation -10 ft (CCSF); • Bedrock located at Elevation ranging from 0 to -15 ft (CCSF); • Groundwater Elevation between -1 to -9ft (CCSF)
Proposed Development Type	Mid-rise commercial structures constructed on-grade approximately 6 to 8 stories in height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	• Some differential settlement between structures and external utilities is expected. • Settlement will occur rapidly. Post-construction settlement minimal. • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	This is a highly transitional soil area. Foundation will vary from shallow to deep foundations. Remedial grading within building pad areas will be investigated. Selection of appropriate foundation approach will be conducted on a pad-by-pad basis during vertical construction design phase.
Expected Geotechnical Performance	• Settlement will vary based on selected foundation systems. • Structures supported on shallow foundation should expect minimal differential settlement if it is underlain by uniform backfill material (i.e. recompacted engineered fill)
Other Considerations	• Due to presences of shallow groundwater level, subgrade stability maybe required during excavation. Contingency to cost estimate should be applied to account for stabilization measures (i.e. dewatering, shoring). • Environmental impacted zones located within this area. Environmental remediation of subsurface soils maybe required or alternatively buildings may be founded on deep foundations to avoid soil disturbance. • Reconditioning of bay mud required for reuse.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	C_2
Area	Building Area 25.8 acres (80% building pad; 20% streets and parks)
Grades	Existing grades vary from -1 to +2 ft (CCSF) Final grades vary from 0 to +2.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 0 ft to up to 20 feet. Bottom of Artificial Fill extends to Elevation -20 ft (CCSF); • Thickness of Young Bay Mud up to 20 feet. Bottom of Bay Mud extends beyond Elevation -20 ft (CCSF); • Bedrock located at Elevation ranging from -15 to -60 ft (CCSF) • Groundwater Elevation between -6 to -10 ft (CCSF)
Proposed Development Type	Mid-rise commercial structures constructed on-grade approximately 6 to 8 stories in height.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Settlement in areas of new fill will occur rapidly. Post-construction settlement minimal • Some differential settlement between structure and external utilities may be expected • Flexible utilities connection may be required for external utilities into pile supported structures • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	Structures may be supported on pile foundations founded on competent material. Depth of foundation will be determined during design-level study.
Expected Geotechnical Performance	Settlement of the structure is not anticipated.
Other Considerations	Environmental impacted zones located within this area, environmental remediation of subsurface soils maybe required or alternatively buildings may be founded on deep foundations to avoid soil disturbance.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	**49 Stadium**
Area	Building Area 33 acres (100% stadium)
Grades	Existing grades vary from -2.5 to +1.5 ft (CCSF) Final grades vary from +3.5 to +7.5 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 10 ft to up to 30 feet. Bottom of Artificial Fill ranges from Elevation -10 to -30 ft (CCSF); • Thickness of Young Bay Mud up to 30 feet. Bottom of Bay Mud ranges from Elevation -30 to -50 ft (CCSF); • Bedrock located at Elevations of -15 to -125 ft (CCSF) • Groundwater Elevation between -5 to -10 ft (CCSF)
Proposed Development Type	Professional level sport facility with playing field.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Minor settlement due to liquefaction and on-going long-term settlement may be expected • Some differential settlement between stadium on piles and external utilities may be expected • Flexible utilities connection may be required for external utilities into pile supported structures • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	Foundation design and criteria to be provide by others. Assume structure and playing field supported on deep foundations.
Expected Geotechnical Performance	Settlement on the orders of 6 inches is anticipated due to new design fill loads. This amount of settlement should be accounted for when selecting construction grades.
Other Considerations	• For purpose of construction estimate, assume stadium graded as relatively level building pad suitable to support temporary construction equipment and drain surface water. • Site grade needs to be adjusted to compensate for long-term settlement.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	49 Parking
Area	Building Area 87 acres (100% streets and parking)
Grades	Existing grades vary from 0 to +3.0 ft (CCSF) Final grades vary from +2.0 to +9.0 ft (CCSF)
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 10 ft to up to 50 feet. Bottom of Artificial Fill ranges from Elevation -10 to -50 ft (CCSF); • Thickness of Bay Mud ranges up to 40 feet. Bottom of Bay Mud extends to elevation -55 ft (CCSF); • Bedrock located at Elevation of -20 ft to -200 ft (CCSF) • Groundwater Elevation between -5 to -10 ft (CCSF)
Proposed Development Type	Turf and/or permeable pavement area for stadium parking with dual-use recreational and sports fields.
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	No remedial measures are required for infrastructure and utilities.
Expected Utilities Performance	• Minor settlement due to liquefaction and on-going long-term settlement may be expected • Flexible utilities connection may be required for external utilities that enter stadium from transition area • On-going long-term settlement of Bay Mud may require utilities to maintain positive gradient by increase in design inverts
Probable Remedial Grading Related to Foundation/Vertical Construction*	No remedial measures are required for the parking area.
Expected Geotechnical Performance	Settlement on the order of 8 inches is anticipated due to new design fill loads. This amount of settlement should be accounted for when selecting construction grades.
Other Considerations	• For purpose of construction estimate, assume parking area graded at relatively level building pad suitable to support temporary construction equipment and drain surface water. • Site grade needs to be adjusted to compensate for long-term settlement.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	UC_1
Area	Building Area 6 acres (100% streets)
Grades	Existing grades vary from 0 to +3 ft (CCSF) Final grades vary from +5.0 to +10.0 ft (CCSF)
Soil and Groundwater Condition	• Thickness of Artificial Fill up to 10 feet. Bottom of Artificial Fill extends to Elevation -10 ft (CCSF); • Bedrock located at Elevation of -10 to -30 ft (CCSF) • Groundwater Elevation between -10 to -15 ft (CCSF)
Proposed Development Type	Utility Corridor
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	• Minor settlement due to liquefaction and on-going long-term settlement may be expected • Flexible utilities connection may be required for external utilities that transition to any pile supported structures
Probable Remedial Grading Related to Foundation/Vertical Construction*	No remedial grading planned for this area.
Expected Geotechnical Performance	N/A
Other Considerations	No other considerations

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	UC_2
Area	Building Area 7 acres (100% streets and parks)
Grades	Existing grades vary from 0 to +50 ft (CCSF) Final grades vary from +5.0 to +50 ft (CCSF)
Soil and Groundwater Condition	• Thickness of Artificial Fill may range up to 5 feet. Bottom of Artificial Fill extends to Elevation -5 ft (CCSF) • Bedrock located at Elevation of at least 0 to +50 ft (CCSF) • Groundwater Elevation between -3 to -8 ft (CCSF)
Proposed Development Type	Utility Corridor
Probable Remedial Grading Related to Infrastructure and Utilities Phase*	Local overexcavation of bedrock to a depth of 10 feet below finished grade for utilities is anticipated.
Expected Utilities Performance	No settlement is anticipated
Probable Remedial Grading Related to Foundation/Vertical Construction*	No remedial grading planned for this area.
Expected Geotechnical Performance	N/A
Other Considerations	• Rippability of rock may require heavy equipment. • Presence of Serpentinite may require air quality monitoring during grading.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Parcel	YB
Area	Building Area 7 acres (100% bridge and street)
Grades	Existing grades vary from -3.0 to +5.5 ft (CCSF) Final grades a result of minor cuts and fills of up to 5 feet to achieve grades for drainage.
Soil and Groundwater Condition	• Site consists of Artificial Fill underlain by Young Bay Mud over Older Alluvium/Stiff Bay Clay over Bedrock. • Thickness of Artificial Fill ranges from 10 ft to up to 20 feet. Bottom of Artificial Fill ranges from Elevation -10 ft to -20 ft (CCSF) • Thickness of Artificial Fill ranges from 10 ft to up to 40 feet. Bottom of Bay Mud ranges from Elevation -20 ft to -60 ft (CCSF); • Bedrock located at Elevation of at least -50 to -150 ft (CCSF) • Groundwater Elevation between -3 to -8 ft (CCSF)
Proposed Development Type	Bridge and roadway corridor

Probable Remedial Grading Related to Infrastructure and Utilities Phase*	• Surcharging may be employed to mitigate bay mud settlement due to new fill loads associated with proposed grades.
	• Bridge abutments and bents may be supported on pile foundations
	• Abutment embankment stability and settlement will need to be addressed,
	  ○ Possible use of cement deep mixed columns to stabilize abutment embankment foundation soils
	  ○ Possible use of light weight fill to mitigate settlement
	  ○ Possible use of surcharge and wick drains to mitigate embankment settlement

Expected Utilities Performance	• Some on-going settlement expected on the approaches and abutments • Differential settlement between utilities and pile supported bridge deck on-grade bridge abutment embankments need will require flexible utility connections
Probable Remedial Grading Related to Foundation/Vertical Construction*	No remedial grading for pile supported structures is planned for this area.
Expected Geotechnical Performance of Foundations	Pile supported bridge structure will have limited settlement. Bridge approach and embankment may experience tolerable amounts of differential settlement.
Other Considerations	No other considerations.

**Note: Recommendations provided are based on our understanding of the site condition and the most conventional remedial approach in practice within the San Francisco Bay Area. Alternate remedial options are available and will is assessed during design-level study.*

Appendix M1 PBS&J and Baseline Stormwater Runoff Calculations, November 2009

Appendix M1: Stormwater Runoff Calculations

RUNOFF QUANTITY

Stormwater Runoff

Runoff is affected by physical characteristics such as the amount of impervious area, roughness of land surface, routing of flows, distance for flow to travel, and amount/intensity of precipitation. Runoff is typically calculated based on the Rational Method:

Flow Rate:

$Q = CiA$, where [1]

Q = the runoff rate (cubic feet per second, cfs)

C = the runoff coefficient

i = the rainfall intensity (inches per hour)

A = the drainage area (acres)

Runoff Coefficient

The runoff coefficient, C, is a factor representing the fraction of rainfall falling on the drainage area that will contribute to stormwater runoff instead of on-site storage or infiltration. It is directly related to the amount of impervious surface and can be calculated based on[1]:

$C = 0.05+0.9Ia$, where [2]

Ia = Impervious fraction (proportion of the drainage area that is impervious)

The runoff coefficient can also be determined from technical references for typical runoff coefficients based on land use types and characteristics. Runoff coefficients used in this report are based on both standard engineering references for land use types, as reported by Winzler and Kelly, and Equation 2, based on GIS estimates of impervious area. Winzler and Kelly values were used where possible and GIS impervious areas and Equation 2 were used only if necessary to characterize the drainage area.

For this analysis, the more detailed land use categories were combined into general categories as depicted in Table M1 (Land Use Categories Consolidation for Water Quality Analysis).

[1] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm. Accessed September 26, 2009

Table M1 Land Use Categories Consolidation for Water Quality Analysis

Existing Conditions	*Project*
Residential	Residential
■ RV Park	■ Residential Density I
■ Residential	■ Residential Density II
Commercial	■ Residential Density III
■ Artist Community	■ Residential Density IV
■ Public Institution	Commercial
■ Candlestick Park	■ Regional Retail
■ Parking	■ Neighborhood Retail
■ Transportation	■ Office
Open Space	■ Hotel
■ Open Space	■ Stadium
Industrial	■ Arena
■ Former Naval facilities	■ Parking
■	■ Community Facility
	■ Hotel / Parking
	■ Office / Regional Retail
	■ Arena / Regional Retail
	■ Community Facility / Neighborhood Retail
	■ Residential Density I / Neighborhood Retail
	■ Residential Density I / Parking
	■ Residential Density I / Regional Retail
	■ Residential Density II / Neighborhood Retail
	■ Residential Density II / Research & Development
	■ Residential Density III / Neighborhood Retail
	■ Residential Density IV / Neighborhood Retail
	Industrial
	■ Research & Development
	Open Space
	■ Parks & Open Space

SOURCE: PBS&J 2009 and Winzler & Kelly 2009

Table M2 (Estimated Project Site Characteristics for Runoff Calculations) lists the estimated existing and Project general land use, runoff coefficients, and drainage areas used in this analysis. Land use areas draining to the combined sewer and separate sewer systems were derived from GIS overlays of Figure III.M-1 (Combined and Separate Storm Sewer System and Receiving Water Bodies) of this EIR, aerial photographs, and Figure III.G-1 from the Candlestick Point Stadium and Retail/Entertainment Center EIR, prepared by ESA, Clement Designs, and Orion Environmental Associates.

Table M2 Estimated Project Site Characteristics for Runoff Calculations

		Existing		Project	
Drainage	*Land Use*	*Area (acres)[a]*	*Runoff Coefficient*	*Area (acres)[h]*	*Runoff Coefficient*
Candlestick Park					
Combined Sewer	Residential	28	0.70[b]		
	Commercial	42	0.90[d]		
	Open Space	28	0.20[b]		
	Total	***98***	***0.64***	***0***	
Separate Sewer	Commercial	114	0.90[c]	26	0.70[h]
	Residential	3	0.85[d]	84	0.77[h]
	Open Space	8[e]	0.20[c]	107	0.20[h]
	Total	***183***	***0.68***	***217***	***0.48***
Sheet Flow to Bay	Open Space	58[c]	0.30[c]	50[h]	0.20[h]
Hunters Point Shipyard					
Separate Sewer	Industrial	358	0.79[d]	27	0.75[h]
	Commercial	28	0.74[d]	56	0.77[h]
	Residential	0[f]		61	0.70[h]
	Subtotal	*421*	*0.79*	*257*	*0.53*
	Off-site Residential[g]	75	0.70[b]	75	0.70[h]
	Total	***496***	***0.73***	***332***	***0.57***
Sheet Flow to Bay	Open Space	35[i]	0.30[i]	164	0.20[h]

SOURCE: PBS&J 2009 and Winzler & Kelly 2009

a. PBS&J GIS estimated area
b. Winzler & Kelly, HPS_CP_subarea_runoff.xlsx; runoff coefficients for land use
c. Winzler & Kelly, flow calculations for existing conditions HPS_CP_runoff_existing.xlsx
d. PBS&J GIS estimated based on estimated impervious area and C=0.05+0.9*Ia
e. Existing sheet flow to Lower Bay about 58 acres
f. Artist community and police facility were included in the "Commercial" fraction
g. Runoff calculations include off-site residential, Parcel A
h. Winzler & Kelly, HPS_CP_subarea_runoff.xlsx; areas and weighted average runoff coefficients for land use
i. Estimates of sheet flow directly to the Lower Bay are about 10 percent of the HPS Phase II site. This area has not been delineated and cannot be exactly determined. Therefore, the open space area was assumed to be the fraction contributing to sheet flow to the Lower Bay to provide a reasonable estimate since the sheet flow area is primarily the existing open space area. The same runoff coefficient for the HPS Phase II sheet flow area was assumed to be the same as for the Candlestick Point sheet flow area as determined by Winzler & Kelly 2009

Rainfall Intensity

Rainfall intensities during storm events vary with time since the beginning of the rainfall event and how big of a storm it is. The rainfall intensity (i) to use in calculations is typically derived from Intensity/Duration/Frequency (IDF) curves for rainfall events in the geographical region of interest. These IDF curves describe the rainfall intensity for various lengths of time in a storm event (e.g., 5 minutes, 15 minutes, 1 hour, and others), for specific design storm events (e.g., the 2-year storm event, 10-year storm event, and others); a different curve is used for the different design storm events. The length of time (duration) to use is the is usually equivalent to the "time of concentration" (t_c) for the drainage area; the t_c is the time it takes a drop of water at the top of the drainage area to make its way down to the bottom outlet.

Winzler and Kelly analyzed rainfall data from the Department of Water Resources gage #E70 7772 00 to determine the coefficients to describe the IDF curve to be used at the Project site. The rainfall intensity is therefore determined by:

$i = B / (D+t_c)^C$, where [3]

i = the intensity (inches per hour)

B, C, and D are coefficients fitted to monitoring data (see Table M3, below)

t_c = the time of concentration (minutes)

These values for the fitted coefficients identified by Winzler and Kelly are presented in Table M3 (Intensity/Duration/Frequency Curve Coefficients).

Table M3 Intensity/Duration/Frequency Curve Coefficients

	IDF Coefficient		
Design Storm	*B*	*D*	*E*
2 yr*	6.109	0.8	0.54174
5 yr	8.025	1.1	0.5637
10 yr	8.527	0.5	0.548078
100 yr	13.217	1	0.567912

SOURCE: Winzler & Kelly 2009

* Adjusted for partial duration series (see Handbook of Applied Hydrology , Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44).

The time of concentration, used in Equation 4, was estimated for each drainage area based on best professional judgment by Winzler & Kelly and listed in Table M4 (Overall Estimated Time of Concentration).

Table M4 Overall Estimated Time of Concentration

Drainage Area	*Existing (minutes)*	*Project (minutes)*
Candlestick Point		
Combined Sewer	10	--
Separate Storm	7	9.4[a]
Sheet Flow	8	6
Hunters Point Shipyard		
Separate Storm	15	11.4[a]
Sheet flow	8[b]	8
Offsite Residential	10	10

SOURCE: Winzler & Kelly 2009

a. Area weighted-average of Winzler & Kelly selected values

b. Sheet flow time of concentration estimated as same as for Candlestick Point existing conditions

\- = not applicable

Runoff Volume

Calculation of storm runoff volume is similar to calculation of flow rate, except the entire storm depth is used instead of a rainfall intensity:

$V = CAd$, where [5]

V = Volume of water (acre-feet)

A = drainage area (acres)

C = composite runoff coefficient for drainage area

d = design rainfall depth (feet)

The design rainfall depth for the storm events evaluated is listed in Table M5 (Design Storm Rainfall Depths).

Table M5 Design Storm Rainfall Depths

Storm Event	*Design Rainfall Depth (inches)*
2-year	2.09
5-year	2.94
10-year	3.6
100-year	5.23
Annual Average	20.0[a]

SOURCE: Winzler & Kelly 2009

a. Western Regional Climate Center. No date, San Francisco WSO AP, California (047769) Period of Record Monthly Climate Summary Period of Record : 7/ 1/1948 to 4/30/2009, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7769, Accessed September 26, 2009

RESULTS

Table M6 lists the estimated Project site flow rates calculated using Equations 1, 2, and 3 and data in Table M1 through Table M4. For Hunters Point Shipyard, flow rates in Table M6 (Estimated Peak Flow Rates for Existing and Project Conditions) do not include off-site flow from Parcel A (hilltop). The City has required the HPS Phase II development to treat and convey the 5-year storm event from Parcel A in the Project storm drain system, or 108 cfs of flow (5-year storm event) in addition to Project flows. However, the Parcel A flows are existing flows, currently draining to the separate storm system. Therefore, although the offsite flows (108 cfs) must be accounted for in the Project storm drain infrastructure design and must be treated as required, they are not included in this Table M6 because they are not Project site flows and are not affected by development of the Project.

Table M6	Estimated Peak Flow Rates for Existing and Project Conditions		
	Peak Flow Rate		
Storm Event	*Existing (cfs)*	*Project (cfs)*	*Project Increase (cfs [%])*[a]
Candlestick Point			
5-Year	477 (130)[c]	249 (0)[c]	-228 (-48%)
10-Year	545	284	-261 (-48%)
100-Year	783	408	-375 (-48%)
Hunters Point Shipyard[b]			
5-Year	644	448	-196 (-30%)
10-Year	730	509	-221 (-30%)
100-Year	1052	733	-319 (-30%)
Total[c]			
5-Year	1121	697	-424 (-38%)
10-Year	1275	793	-482 (-38%)
100-Year	1835	1141	-694 (-38%)

SOURCE: PBS&J 2009 and Winzler & Kelly 2009

a. A negative increase denotes a reduction in flow
b. Off-site flow from Parcel A is not included in these runoff calculations. Required Parcel A diversions into the HPS Phase II separate storm drain system would be 108 cfs.
c. Values in parenthesis denote the amount of total Candlestick Point site runoff flowing to the combined sewer system.

Table M7 (Estimated Storm Flow Volumes for Existing and Project Conditions) lists the storm flow volumes based on Equation 5 and Table M1, Table M2, and Table M5. Although the offsite flows (15.4 acre-feet) must be accounted for in the Project storm drain infrastructure design and must be treated as required, they are not included in this Table M7 because they are not Project site flows and are not affected by development of the Project.

LEED® Credit Flows

LEED® Credit 6.1. In accordance with LEED® Credit 6.1, the Project must reduce the 2-year 24-hour flow volume by 25 percent compared to existing conditions. As can be seen in Table M7, the Project would reduce the 2-year 24-hour storm volume by 41 percent. Although these calculations are based on estimated site characteristics, it is not likely that more detailed data would indicate a substantially lower reduction in 2-year 24-hour storm event flows. Therefore, it is expected that the Project would meet LEED® Credit 6.1 requirements.

LEED® Credit 6.2. In accordance with LEED® Credit 6.2, the Project must implement water quality BMPs to treat runoff from 0.75 inch of rainfall, or a rainfall intensity of 0.2 inch per hour, depending upon whether a volume-based treatment BMPs is used or a flow-rate-based treatment BMP is used.

Table M7 — Estimated Storm Flow Volumes for Existing and Project Conditions

	Flow Volume		
Storm Event	*Existing (acre-feet)*	*Project (acre-feet)*	*Project Increase (acre-feet [%])[a]*
Candlestick Point			
2-year	36	20	-16 (-44%)
5-Year	50	28	-22 (-44%)
10-Year	61	34	-27 (-44%)
100-Year	89	50	-39 (-44%)
Hunters Point Shipyard[b]			
2-year	64	39	-25 (-39%)
5-Year	90	54	-36 (-40%)
10-Year	110	66	-44 (-40%)
100-Year	160	97	-63 (-39%)
Total			
2-year	100	59	-41 (-41%)
5-Year	140	82	-58 (-41%)
10-Year	171	100	-71 (-42%)
100-Year	249	147	-102 (-41%)

SOURCE: PBS&J 2009 and Winzler & Kelly 2009

a. A negative number denotes a reduction in flow; slight differences (1 %) in percent reductions for different storm events for each site are because of rounding factors

b. Off-site flow from Parcel A is not included in these runoff calculations. Required Parcel A diversions into the HPS Phase II separate storm drain system would be 108 cfs.

Volume-based BMP design standards apply to BMPs whose primary mode of pollutant removal depends on the volumetric capacity of the BMP. Examples of BMPs in this category include detention basins, retention basins, and infiltration. Flow-based BMP design standards apply to BMPs whose primary mode of pollutant removal depends on the rate of flow of runoff through the BMP. Examples of BMPs in this category include swales, sand filters, screening devices, and many proprietary products.

For volume-based BMPs, the volume requirement for capturing and treating a 0.75-inch design storm is calculated by the using the Equation 5 and using 0.75 inch for the design rainfall depth.

For flow-based BMPs, the required flow rate BMPs must be designed to treat is runoff from a rain event equal to an intensity of 0.2 inch per hour of rainfall. The Rational Method (Equation 1 and Table 1 and Table 2) is used to determine the treatment flow rate, with the rainfall intensity of 0.2 inch per hour.

As such, if volume-based treatment BMPs are used, they must be designed to treat at least:

- 7 acre-feet from Candlestick Park, and
- 11 acre-feet from HPS Phase II
- 4 acre-feet from off-site area (Parcel A)

If flow rate BMPs are used, they must be designed to treat at least:

- 23 cfs from Candlestick Park, and
- 34 cfs from HPS Phase II
- 10 cfs from off-site area (Parcel A)

It should be noted that although the City requires conveyance of the 5-year storm event runoff from the off-site from Parcel A and treatment to LEED® Credit 6.2 requirements, this off-site area is not affected by the Project and would not included in the impacts analysis because this area is not part of the Project.

CSOs

Development of the Project would reduce the amount of stormwater runoff to the combined sewer system by diverting the 5-year storm event runoff from the portion of Candlestick Point flowing to the combined sewer system to a separate sewer system (130 cfs or 58,348 gallons per minute [gpm]) (Table M6). CSO events occur when the instantaneous flow rate in the combined sewer system exceeds 110 million gallons per day (mgd) with about 94 percent consisting of stormwater flows (refer to Section III.Q [Utilities] of this EIR). Eliminating the 5-year storm event flow, from the area draining to the combined sewer system, from combined sewer system flows would therefore reduce the potential for CSO events in the combined sewer system because CSOs occur primarily as a result of stormwater runoff. Development of the Project would also increase peak sewage flows to the combined system by up to 1,479 gpm from Candlestick Point and 979 gpm from HPS Phase II for a total of 2,458 gpm (Table III.Q-7 [Sewer Trunk Capacity and Project Maximum Peak Flows]). Therefore, even with the increased peak sewage flows with development of the Project, the Project would result in a net reduction of 55,890 gpm of flow to the combined sewer system during storm events. Given this large reduction in flow during the critical times when CSOs may occur (storm events), there would be no impact from Project sewage discharges to the combined sewer system CSOs and violation of the Wastewater Discharge Permit.

WATER QUALITY

In order to evaluate the Project effect on stormwater quality, annual pollutant loads were estimated for existing and Project conditions. The amount of runoff, along with the expected pollutant concentrations in stormwater runoff, as related to land use, can be used provide a relative measure of Project effects on stormwater pollutants following conversion from one land use type to another. Different land uses will have different average pollutant concentrations in stormwater runoff, along with a different amount runoff each year. For instance, according to the national median total suspended solids concentration in runoff from residential lands is 49 mg/L and the median concentration in industrial runoff is 81 mg/L.[2] In general, the annual amount of runoff can be calculated or modeled based on simple site characteristics. Pollutant concentrations in stormwater runoff are required for each land use category to provide the relative comparison criteria.

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[2] Maester, A. and R. Pitt. 2005. The National Stormwater Quality Database, Version 1.1 A Compilation and Analysis of NPDES Stormwater Monitoring Information. Prepared for the U.S. EPA Office of Water, Septebmer 4, 2005. p. 7-12

Land use pollutant concentrations will vary, depending upon local or regional conditions and the precipitation regime.[3] Therefore, using a national average (e.g., NSQD v. 1.1) or many other reported values would not be appropriate for local/regional scale analyses because the Project area is in a semi-arid/Mediterranean climate regime. Unfortunately, stormwater monitoring studies typically do not measure or report stormwater runoff pollutant concentrations by land use and data is very limited. While the limited data can be used to address ***relative*** changes in land use (Project) effects on annual pollutant loads, it would not be suitable to use these values to identify specific effects on pollutant concentrations. Consequently, this analysis does not address potential land use change effects on pollutant concentrations but makes use of literature values for stormwater pollutant concentrations to estimate the ***relative*** effect on pollutant loads; it would not be suitable to use generalized numbers to estimate effects on concentrations that water quality objectives are based on.

The Simple Method

Stormwater pollutant loads are calculated based on the Simple Method.[4] The Simple Method was developed based on empirical relationships observed in data collected in the Washington, D.C. area for the Nationwide Urban Runoff Program (NURP) studies published by U.S. EPA in 1983. The Simple Method estimates pollutant loads for chemical constituents as a product of the annual runoff volume and pollutant concentration, as[5]:

$L = 0.226 * R * C * A$, where [5]

L = Annual load (pounds [lbs])

R = Annual runoff (inches [in])

C = Pollutant concentration (milligrams per liter [mg/L])

A = Area (acres)

0.226 = Unit conversion factor

For bacteria, the equation is slightly different, to account for the differences in units. The modified equation for bacteria is[6]:

$L = 1.03 * 10\text{-}3 * R * C * A$, where [6]

L = Annual load (Billion Colonies)

R = Annual runoff (in)

C = Bacteria concentration (#/100 ml)

A = Area (acres)

[3] Maester, A. and R. Pitt. 2005. The National Stormwater Quality Database, Version 1.1 A Compilation and Analysis of NPDES Stormwater Monitoring Information. Prepared for the U.S. EPA Office of Water, Septebmer 4, 2005. p. 34

[4] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm (accessed September 26, 2009)

[5] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm (accessed September 26, 2009)

[6] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm (accessed September 26, 2009)

1.03 * 10-3 = Unit conversion factor

The Simple Method calculates annual runoff as a product of annual runoff volume, and a runoff coefficient (Rv). Runoff volume is calculated as[7]:

R = P * Pj * Rv, where [7]

R = Annual runoff (inches)

P = Annual rainfall depth (inches)

Pj = Fraction of annual rainfall events that produce runoff (usually 0.9)

Rv = Runoff coefficient (identified as 'C' in Equations 1 and 2)

The annual precipitation at the Project site is 20.0 inches per year.[8] The runoff coefficient can be estimated from look-up tables or based on the amount of impervious surface using Equation 2 (identified as "C" in Equations 1 and 2). Areas and runoff coefficients for each drainage area and land use type analyzed are presented in Table M2.

Pollutant Concentrations

Pollutant concentrations used in this analysis were derived from a combination of Los Angeles County Department of Public Works (LACDPW) monitoring data and Bay Area Stormwater Management Agencies Association (BASMAA) data; the best available data for the area. As mentioned above, stormwater pollutant concentrations can vary as a function of climate regime and local/regional conditions. Therefore, it is important to use data that was generated from a study geographically close to the site of interest or otherwise similar in Project site/pollutant concentration site characteristics. The BASMAA data includes measurements from Alameda and Santa Clara County (Alameda County data were used for this assessment). However, this data is limited to only a few constituents. The LACDPW data includes more parameters to compare, but is not as geographically similar to the Project site. The National Stormwater Quality Database v. 1.1 was mined to see if sufficient data was available in EPA Rain Zone 6, the rain zone California is in, which could provide a more robust dataset that was not too limited by coming from a very different precipitation regime. However, this data was not used because insufficient information was available for the 'Open Space' land use category in U.S. EPA Rain Zone 6 (the U.S. EPR Rain Zone for California). For each parameter assessed, the same data set (either LACDPW or BASMAA) was used for all land use categories for that parameter. Therefore, even though the absolute pollutant loads may not be reflective of Project site conditions, the relative differences caused by changes in land use should reasonably reflect the Project changes in land use effect on stormwater quality. Table M8 (Pollutant Event Mean Concentrations in Stormwater Runoff by Land Use) lists the pollutant concentrations and data sources used in this analysis. It should be noted that not all constituents of concern were analyzed because of insufficient data (e.g., pesticides, inorganic

[7] Center for Watershed Protection. No Date. The Simple Method to Calculate Urban Stormwater Loads http://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm. Accessed September 26, 2009

[8] Western Regional Climate Center. No date, San Francisco WSO AP, California (047769) Period of Record Monthly Climate Summary Period of Record : 7/ 1/1948 to 4/30/2009, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7769, Accessed September 26, 2009.

compounds, trash and debris, oil and gas, and PCBs). However, reasonable data was available to assess sediment, nutrients, metals, and bacteria (pathogens) pollution potential.

Table M8 Pollutant Event Mean Concentrations in Stormwater Runoff by Land Use

Pollutant	Data Source	Units[a]	Industrial	Commercial	High Density Single Family Residential	Open Space
Sediment						
Total Suspended Solids	LACDPW	mg/L	229.4	67.4	104.6	164.7
Nutrients						
Ammonia	LACDPW	mg/L	0.48	0.09	0.36	0.08
Nitrate+Nitrite as N	LACDPW	mg/L	0.95	0.72	1.13	1.16
Total Kjeldahl Nitrogen	LACDPW	mg/L	3.07	0.81	2.08	0.81
Total Nitrogen	LACDPW	mg/L	4.02	1.53	3.21	1.97
Dissolved Phosphorous	LACDPW	mg/L	0.28	0.3	0.29	0.006
Total Phosphorous	LACDPW	mg/L	0.44	0.41	0.39	0.11
Metals						
Total Cadmium	BASMAA	ug/L	1.4	0.85	0.85	0.15
Total Chromium	BASMAA	ug/L	20	14	14	1.8
Total Copper	LACDPW	ug/L	31	34.8	15.3	3.4
Total Lead	BASMAA	ug/L	77	73	73	3.5
Total Nickel	LACDPW	ug/L	13	20	20	0.65
Total Zinc	BASMAA	ug/L	358	397	188	34
Pathogens						
Fecal Coliforms	LACDPW	MPN/100mL	653070	1071656	1085354	2175

SOURCE: Los Angeles County Department of Public Works (LACDPW), Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report, Table 4-9. Cumulative Event Mean Concentrations 1994-2000 Storm Season, http://dpw.lacounty.gov/wmd/NPDES/Int_report/Tables/Table_4-9.pdf , Accessed September 25, 2009; Woodward-Clyde Consultants, 1996, Monitoring Data Analysis Draft Final Report, prepared for the Bay Area Stormwater Management Agencies Association (BASMAA)

a. Where mg/L = milligrams per liter, ug/L = micrograms per liter, and MPN/100mL = most probable number (of colonies) per 100 milliliters.

ANNUAL POLLUTANT LOADS

Using Equations 5, 6, and 7 and data in Table M2 and Table M8, annual pollutant load from the Project site under existing land use conditions and Project conditions were calculated.

Candlestick Point

Table M9 (Potential Project Effect on Annual Pollutant Load from Candlestick Point) lists the Project effects on pollutants in stormwater runoff from Candlestick Point and annual runoff volume to each system. Runoff to the separate sewer system in Table M9 includes sheet flow runoff to the Bay.

Table M9 Potential Project Effect on Annual Pollutant Load from Candlestick Point

	Existing			*Project*		
					Overall Difference from Existing[a]	
Pollutant	*Combined (lbs)*	*Separate (lbs)*	*Total (lbs)*	*Total (lbs)*	*(lbs)*	*(%)*
Total Suspended Solids	*24,951*	*42,289*	67,240	59,500	-7,740	-12%
Ammonia	*49.5*	*51.1*	101	124	23.5	23%
Nitrate+Nitrite as N	*252*	*416*	669	554	-114	-17%
Total Kjeldahl Nitrogen	*343*	*448*	791	790	-1.42	0%
Total Nitrogen	*596*	*864*	1,460	1,344	-116	-8%
Dissovled Phosphorous	*77.1*	*143*	220	110	-110	-50%
Total Phosphorous	*107*	*201*	309	163	-145	-47%
Total Cadmium	*0.224*	*0.413*	0.637	0.340	-0.298	-47%
Total Chromium	*3.68*	*6.76*	10.4	5.50	-4.94	-47%
Total Copper	*7.38*	*16.50*	23.9	7.82	-16.1	-67%
Total Lead	*19.0*	*34.9*	53.9	27.8	-26.1	-48%
Total Nickel	*5.21*	*9.54*	14.7	7.58	-7.17	-49%
Total Zinc	*85.3*	*188*	274	92.4	-181	-66%
Fecal Coliforms (billions of colonies)	*1,272,951*	*2,322,614*	3,595,565	1,849,326	-1,746,238	-49%
Stormwater Volume (acre-feet)	94.5	177.5	272.0	171.4	-100.6	-37%

SOURCE: PBS&J 2009

a. The 'Difference' columns denote the difference between Project and Existing annual pollutant loads; a negative number indicates that pollutant loads are lower with development of the Project compared to existing conditions.

Overall, except for ammonia, development of Candlestick Point, without considering BMP effects or removal of pollutants by the combined sewer system, would result in a reduction in annual stormwater pollutant load. However, because a portion of existing runoff flows to the water treatment plant (SWPCP), this portion of existing flows are treated prior to discharge to the Lower Bay. Comparison of Candlestick Point pollutant loads and existing pollutant loads from only the areas currently not receiving any treatment (flow to the separate sewer system and sheet flow to the Lower Bay) provides a better indication of potential Candlestick Point 'worst case' effects on water quality. Table M10 (Annual Pollutant Loads Piped and Sheet Flow Direct to the Lower Bay from Candlestick) lists these potential 'worst case' effects by comparing only those flows that currently receiving no treatment.

Table M10 Annual Pollutant Loads Piped and Sheet Flow Direct to the Lower Bay from Candlestick

Pollutant	Existing (lbs)	Project (lbs)	Project Difference from Existing (lbs)	Project Difference from Existing (%)
Total Suspended Solids	42,289	59,500	17,211	41%
Ammonia	51.1	124	73.0	143%
Nitrate+Nitrite as N	416	554	138	33%
Total Kjeldahl Nitrogen	448	790	342	76%
Total Nitrogen	864	1,344	480	56%
Dissolved Phosphorous	143	110	-32.5	-23%
Total Phosphorous	201	163	-37.8	-19%
Total Cadmium	0.413	0.340	-0.073	-18%
Total Chromium	6.76	5.50	-1.26	-19%
Total Copper	16.5	7.82	-8.69	-53%
Total Lead	34.9	27.8	-7.06	-20%
Total Nickel	9.54	7.58	-1.96	-21%
Total Zinc	188	92.4	-95.9	-51%
Fecal Coliforms (billions of colonies)	2,322,614	1,849,326	-473,288	-20%
Stormwater Volume (acre-feet)	177.5	171.4	-6.1	-3

SOURCE: PBS&J 2009
Loads directly to the Lower Bay

Therefore, considering just the Project effect on pollutants being discharged to a separate storm drain system or sheet flow to the Lower Bay, development at Candlestick Point, without BMPs, would increase the pollutant load for several pollutants including total suspended solids (+41 percent), ammonia (+143 percent), nitrate + nitrite (+33 percent), and total nitrogen (+56 percent) (Table M10). If BMPs are incorporated, they could further reduce stormwater pollutants. There is no information on BMP effectiveness for removing ammonia, however, several BMPs are effective at removing nitrogen sources. Table M11 (Expected BMP Pollutant Removal Rates) lists potential BMP pollution removal effectiveness for some potential Project BMPs

This increase is partially because the total amount of stormwater currently diverted to the combined system would be diverted to the storm drain system or sheet flow to the Lower Bay with development at Candlestick Point, resulting in about the same amount of runoff directly to the Lower Bay but with higher total suspended solids and total kjeldahl nitrogen (organic nitrogen) concentrations from the increased amount of open space land and higher nitrogen concentrations from the increased amount residential lands with development of Candlestick Point, compared to the mostly commercial land under existing conditions.

Unlike the HPS Phase II site, which is greatly constrained for use of infiltration BMPs because of shallow depth to groundwater, existing groundwater plumes, and extensive fill material, infiltration BMPs may be possible at the Candlestick Point site. Infiltration BMP effectiveness depends on many factors including the soil characteristics and type of infiltration BMP used and should not be used in areas where the depth to shallow groundwater is within 10 feet of the bottom of the infiltration device[9] or where infiltration rates are to low (not enough infiltration) or too fast (not enough filtration before reaching groundwater).

Even though the overall Candlestick development reduces total suspended solids (TSS) loads by about 12 percent without BMPs, in order to meet LEED® Credit 6.2 (80 percent TSS annual load removal) the Project would still have to implement additional BMPs that would further reduce annual pollutant loading by reducing TSS concentrations or decreasing runoff volumes via infiltration and/or evapotranspiration. In other words, Lennar Urban would still have to treat 7 acre-feet (or 23 cfs) of runoff with BMPs that can provide 80 percent TSS annual load removal at Candlestick Point. This could be met a variety of BMPs including vegetated swales or BMPs that use infiltration (where infiltration is not constrained by site characteristics).

Some of the types of BMPs being considered for implementation at the Project site include:

- **Dry Detention Ponds/Dry Ponds.** Dry detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain stormwater runoff for some minimum time (e.g., 24 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool of water. However, they are often designed with small pools at the inlet and outlet of the basin. They can also be used to provide flood control by including additional flood detention storage.
- **Infiltration Basin.** An infiltration basin is a shallow impoundment which is designed to infiltrate stormwater into the soil and use soils on the site as a filter media. Such a system collects the stormwater and allows it to percolate through the soils and back into the groundwater This practice is believed to have a high pollutant removal efficiency and can also help recharge the ground water. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices. Because it depends on the native soils to filter and discharge the water, an infiltration system is not feasible for every site. The soil types, underlying geology, slopes, and hydrology of the site must be considered when designing an infiltration system.
- **Wetland Basins.** Stormwater wetlands (a.k.a. constructed wetlands) are structural practices similar to wet ponds that incorporate wetland plants into the design. As stormwater runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake within the practice. Wetlands are among the most effective stormwater practices in terms of pollutant removal and they also offer aesthetic and habitat value. Although natural wetlands can sometimes be used to treat stormwater runoff that has been properly pretreated, stormwater wetlands are fundamentally different from natural wetland systems. Stormwater wetlands are designed specifically for the purpose of treating stormwater runoff, and typically have less biodiversity than natural wetlands in terms of both plant and animal life. Several design variations of the stormwater wetland exist, each design differing in the relative amounts of shallow and deep water, and dry storage above the wetland.

[9] SWRCB, 2003, Water Quality Order No. 2003-0005-DWQ, National Pollutant Discharge Elimination system (NPDES) General Permit No. CAS000004, Waste Discharge Requirements (WDRs) for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (General Permit), Attachment 4, p 10.

- **Biofilter.** Bioswales, vegetative buffers, constructed wetlands, bioretention devices and other types of stormwater filters that use biological components to treat and filter pollutants in stormwater runoff.
- **Vegetated Filter Strips.** Vegetated filter strips (grassed filter strips, filter strips, and grassed filters) are a type of biofilter. They consist of vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities and filtering out sediment and other pollutants, and by providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice, and have more recently evolved into an urban practice. With proper design and maintenance, filter strips can provide relatively high pollutant removal. One challenge associated with filter strips, however, is that it is difficult to maintain sheet flow, so the practice may be "short circuited" by concentrated flows, receiving little or no treatment.
- **Grassed Channels.** Grassed channels are a type of biofilter. Grassed channels are the most similar to a conventional drainage ditch, with the major differences being flatter side slopes and longitudinal slopes, and a slower design velocity for water quality treatment of small storm events. Of all of the options, grassed channels are the least expensive but also provide the least reliable pollutant removal. An excellent application of a grassed channel is as pretreatment to other structural stormwater practices. A major difference between the grassed channel and many other structural practices is the method used to size the practice. Most stormwater management water quality practices are sized by volume. This method sets the volume available in the practice equal to the water quality volume, or the volume of water to be treated in the practice. However, the grassed channel, is a flow-rate-based design. Based on the peak flow from the water quality storm, the channel should be designed so that runoff takes, on average, 10 minutes to flow from the top to the bottom of the channel.
- **Bioretention.** Bioretention devices are a type of biofilter. Bioretention areas are landscaping features adapted to provide on-site treatment of stormwater runoff. They are commonly located in parking lot islands or within small pockets of residential land uses. Surface runoff is directed into shallow, landscaped depressions. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. During storms, runoff ponds above the mulch and soil in the system. Runoff from larger storms is generally diverted past the facility to the storm drain system. The remaining runoff filters through the mulch and prepared soil mix. The filtered runoff can be collected in a perforated underdrain and returned to the storm drain system
- **Dry Swales.** Dry swales are a type of biofilter Dry swales are similar in design to bioretention areas. These designs incorporate a fabricated soil bed into their design. The native soil is replaced with a sand/soil mix that meets minimum permeability requirements. An underdrain system is installed at the bottom of the soil bed. This underdrain is a gravel layer that encases a perforated pipe. Stormwater treated in the soil bed flows into the underdrain, which routes this treated stormwater to the storm drain system or receiving waters. Dry swales are a relatively new design, but studies of swales with a native soil similar to the man-made soil bed of dry swales suggest high pollutant removal.
- **Media Filters.** Stormwater filters collect the water and pass it through a bed of sand or other media to remove contaminants from the water. Media filter devices typically include a sedimentation chamber and a filtering chamber containing the filter media. The media is housed in cartridge filters enclosed in concrete vaults, or in fixed beds such as sand filters. An assortment of filter media are available, including leaf compost, pleated fabric, activated charcoal, perlite,

amended sand and perlite, and zeolite. The most common type of stormwater filter is a sand filter, which may be constructed in a concrete structure or designed into a small detention area. The system functions by routing the stormwater through the filtering or sorbing medium, which traps particulates and/or soluble pollutants. While they are capable of excellent pollutant removal, filters are also susceptible to clogging and are costly to maintain.

- **Hydrodynamic Separators.** Hydrodynamic separators are structures designed to remove suspended sediments, oils, and floatable debris by physical processes. Usually installed as an underground structure, a hydrodynamic separator is most often used on sites with large paved areas where space is at a premium. This type of installation relies on sedimentation and flotation to remove and retain pollutants, and often includes proprietary flow controls and pollutant removal effectiveness is highly dependent upon the stormwater flow rate being similar to the device design treatment flow rate.
- **Pervious Pavement.** Permeable pavement is open graded asphalt or concrete with reduced fines and a special binder that allows for the rapid flow of water. Water is able to pass through the pavement by flowing through voids between the aggregate. Another way to construct a permeable paving surface is to use paver blocks. The paver blocks themselves are not permeable, but are installed with gaps between the pavers to allow stormwater to penetrate into the subsurface. The gap is integrated into the interlocking design of the paver blocks. Grid systems made of plastic grids filled with soil or aggregate are also used.

  Beneath the porous surface is an aggregate subbase underlain with geotextile fabric. The aggregate subbase is typically divided into an upper filter course comprised of fine aggregate, and a lower reservoir course comprised of larger aggregate. The geotextile fabric provides separation between the aggregate and soil beneath and structural stability. Stormwater runoff from the paved surface and adjacent impervious areas passes through the porous pavement to the aggregate reservoir where it is filtered and stored. The aggregate also serves as the road or parking area's support base and must be sufficiently thick to support traffic loads. Permeable pavement decreases runoff volume and peak discharge, filters pollutants, and may be used to recharge groundwater. Porous pavements reduce stormwater runoff volume and peak discharge by providing a storage reservoir and an opportunity for subsurface infiltration.

Table M11 lists pollutant removal rates by these various BMPs that are being considered for implementation.

Removal rates were calculated based on the difference between the median influent and effluent concentrations as reported in the International Stormwater Best Management Practices (BMP) Database, except where noted. It should be noted that these values are reported by general category of BMP. Exact type of BMP within each category, influent concentration, BMP sizing, and BMP siting will make a difference in actual BMP performance. However, from Table M11 it can be seen that implementation of BMPs or a suite of BMPs would be effective at removing pollutants in stormwater runoff sufficient to meet LEED® Credit 6.2 requirements. However, some BMPs that may be effective at removing TSS may actually increase other constituents of concern, such as nitrogen.

Table M11 Expected BMP Pollutant Removal Rates

Pollutant	*Detention Pond (%)*	*Dry Pond (%)*	*Infiltration Basina (%)*	*Wetland Basin (%)*	*Biofilter (%)*	*Vegetated Filter Strip (75 feet)a (%)*	*Grassed Channel[a] (%)*	*Bioretention[a] (%)*	*Dry Swale[a] (%)*	*Media Filter (%)*	*Hydrodynamic Device (%)*	*Pervious Pavement[a] (%)*
Total Suspended Solids	57	47–61[c]	75	53	54	75	60–83	NA	80–99	63	5	71–99
Total Nitrogen	-118	25–31[c]	55–60	46	17	NA	NA	49	84–99	42	-61	83[b]
Nitrate-Nitrogen	17	3.5–39[c]	NA	41	-2	-27	-25–31.4	15–16	45–99	-95	-25	67
Total Kjeldahl Nitrogen	-30	NA	NA	9	16	NA	32[b]	52–67	70[b]	3	-36	35–53
Dissolved Phosphorous	-33	NA	NA	-70	-389	NA	4.5–45	NA	83[b]	0	-50	10 b
Total Phosphorous	0	19[a]	60–70	48	-36	NA	NA	65–87	18–99	30	-8	42–65
Total Cadmium	34	NA	NA	33	44	NA	NA	NA	NA	24	23	NA
Total Copper	40	26[b]	NA	25	67	NA	42[b]	43–97	NA	30	8	13–79
Total Chromium	57	NA	NA	NA	18	NA	NA	NA	70b	32	14	NA
Total Lead	37	NA	NA	29	66	-16	NA	70–95	NA	62	82	NA
Total Zinc	46	26[b]	NA	35	77	NA	45[b]	64–95	86[b]	59	33	72–99
Ammonia	NA	NA	NA	NA	NA	47	NA	92	NA	NA	NA	72
General Metals	NA	26–54[a]	85–90	NA	NA	NA	2–73	NA	37–90	NA	NA	NA
Bacteria	NA	NA	90	NA	NA	NA	-25–100	NA	NA	NA	NA	NA

SOURCE: Except where noted, PBS&J and Geosyntec Consultants and Wright Water Engineers, Inc., June 2008, Overview of Performance by BMP Category and Common Pollutant Type, International Stormwater Best Management Practices (BMP) Database Overview of Performance by BMP Category and Common Pollutant Type [1999-2008], Prepared for: Water Environment Research Foundation, American Society of Civil Engineers (Environmental and Water Resources Institute/Urban Water Resources Research Council), U.S. Environmental Protection Agency, Federal Highway Administration, American Public Works Association

NA = not available

a. U.S. EPA, National Pollutant Discharge Elimination System (NPDES) Menu of Stormwater BMPs. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=137&minmeasure=5, updated May 24, 2006 except for Pervious Pavement, updated September 10, 2009 (accessed October 1, 2009).

b. U.S. EPA Office of Water , November 2005, National Management Measures to Control Nonpoint Source Pollution from Urban Areas EPA-841-B-05-004, Table 5.8: Effectiveness of management practices for runoff control p 5-59

c. Combination of sources a and b

HPS Phase II

Table M12 (Potential Project Effect on Annual Pollutant Load From HPS Phase II) lists the effect of development at HPS Phase II on pollutants in stormwater runoff to the Lower Bay and annual runoff volumes. At HPS Phase II, all stormwater is currently discharged to the storm drain system and does not receive treatment prior to discharge.

Table M12 Potential Project Effect on Annual Pollutant Load From HPS Phase II

Pollutant	*Existing (lbs)*	*Project (lbs)*	*Project Difference from Existing (%)*	*Off-site Residential (lbs)*
Total Suspended Solids	304,776	113,803	-63%	*24,822*
Ammonia	625	160	-74%	*85.4*
Nitrate+Nitrite as N	1,319	864	-34%	*268*
Total Kjeldahl Nitrogen	4,026	1,133	-72%	*494*
Total Nitrogen	5,345	1,997	-63%	*762*
Dissovled Phosphorous	386	142	-63%	*68.8*
Total Phosphorous	604	235	-61%	*92.5*
Total Cadmium	1.87	0.512	-73%	*0.202*
Total Chromium	26.9	7.91	-71%	*3.32*
Total Copper	43.0	13.8	-68%	*3.63*
Total Lead	105	36.6	-65%	*17.3*
Total Nickel	18.5	9.18	-50%	*4.75*
Total Zinc	496	159	-68%	*44.6*
Fecal Coliforms (billions of colonies)	4,262,577	2,182,629	-49%	*1,173,810*
Stormwater Volume (acre-feet)	465.8	229.8	-40%	*78.7*

SOURCE: PBS&J 2009

Development of HPS Phase II would substantially reduce the amount of stormwater runoff and pollution from the HPS Phase II site, for the parameters listed (assuming no residual contamination from prior Navy operations). Overall, development of HPS Phase II would reduce pollutants in stormwater runoff and impacts on water quality would not be substantial.

Additionally, Lennar Urban would have to divert stormwater runoff (up to the peak 5-year storm event) from the off-site Parcel A area through the Project storm drain system (Off-site Residential column in Table M12) and treat in accordance with LEED® Credit 6.2 requirements. Consequently, the Project storm drain system would have to be designed to convey and treat flow from this off-site area, which would improve stormwater quality conditions not associated with development of the project. The last column in Table M12 listed the current annual pollutant load from this off-site area. Any treatment of these flows would be a beneficial effect of the Project.

Even though the HPS Phase II reduces TSS by about 63 percent without BMPs, in order to meet LEED® Credit 6.2 (80 percent TSS annual load removal) development at HPS Phase II would still have to implement additional BMPs that would further reduce annual pollutant loading by reducing TSS concentrations or decreasing runoff volumes via infiltration and/or evapotranspiration. In other words, Lennar Urban would have to treat 11 acre-feet (or 34 cfs) of runoff with BMPs that can provide 80 percent TSS annual load removal at HPS Phase II. Additionally, in accordance with City requirements, the Project would have to treat 4 acre-feet (10 cfs) of off-site flows from Parcel A with BMPs that can provide 80 percent TSS annual load removal at HPS Phase II. This could be met a variety of BMPs, however, infiltration BMPs will likely be constrained over the majority of the HPS Phase II site.

Project

Table M13 (Potential Project Effect on Annual Stormwater Pollutant Load) lists the overall effect of development at the Project site on pollutants in stormwater runoff and annual runoff (combination of Table M9 and Table M12).

Table M13 Potential Project Effect on Annual Stormwater Pollutant Load

Pollutant	Existing (lbs)	Project (lbs)	Project Difference From Existing (lbs)	(%)
Total Suspended Solids	372,017	173,303	-198,714	-53%
Ammonia	725	284	-441	-61%
Nitrate+Nitrite as N	1987	1419	-569	-29%
Total Kjeldahl Nitrogen	4817	1923	-2,895	-60%
Total Nitrogen	6,804	3,341	-3,463	-51%
Dissovled Phosphorous	606	253	-354	-58%
Total Phosphorous	913	399	-514	-56%
Total Cadmium	2.128	0.824	-1.30	-61%
Total Chromium	37.4	13.4	-24.0	-64%
Total Copper	66.9	21.6	-45.3	-68%
Total Lead	159.3	64.5	-94.8	-60%
Total Nickel	33.3	16.8	-16.5	-50%
Total Zinc	770	251	-518	-67%
Fecal Coliforms (billions of colonies)	7,858,141	4,031,956	-3,826,186	-49%
Stormwater Volume (acre-feet)	737.8	450.3	-287.4	-39%

SOURCE: PBS&J 2009

Development of Project would substantially reduce the amount of stormwater runoff and pollution from the Project site for the parameters listed (assuming no residual contamination from prior Navy operations). However, because a portion of existing runoff from Candlestick Point flows to the water treatment plant (SWPCP), this portion of existing flows are treated prior to discharge to the Lower Bay. Comparison of Project pollutant loads and existing pollutant loads from only the areas currently not receiving any treatment (flow to the separate sewer system and sheet flow to the Lower Bay) provides a better indication of potential Project 'worst case' effects on water quality. Table M14 (Annual Pollutant

Loads Piped and Sheet Flow Direct to the Lower Bay From the Project) lists these potential 'worst case' effects by comparing only those flows that currently receiving no treatment.

Table M14 Annual Pollutant Loads Piped and Sheet Flow Direct to the Lower Bay From the Project

			Project Difference from Existing	
Pollutant	*Existing (cfs)*	*Project (cfs)*	*(cfs)*	*(%)*
Total Suspended Solids	347,065	173,303	-173,762	-50%
Ammonia	676	284	-392	-58%
Nitrate+Nitrite as N	1,735	1,419	-316	-18%
Total Kjeldahl Nitrogen	4,474	1,923	-2,551	-57%
Total Nitrogen	6,209	3,341	-2,868	-46%
Dissovled Phosphorous	529	253	-276	-52%
Total Phosphorous	806	399	-407	-51%
Total Cadmium	2.29	0.85	-1.44	-63%
Total Chromium	33.7	13.4	-20.3	-60%
Total Copper	59.5	21.6	-37.9	-64%
Total Lead	140	64	-75.8	-54%
Total Nickel	28.1	16.8	-11.3	-40%
Total Zinc	684	251	-433	-63%
Fecal Coliforms (billions of colonies)	6,585,191	4,031,956	-2,553,235	-39%
Stormwater Volume (acre-feet)	643	450	-193	-30%

SOURCE: PBS&J 2009

From Table M14, it can be seen that even when considering just the Project effect on pollutants being discharged to a separate storm drain system or sheet flow to the Lower Bay, development of the Project, without BMPs, would reduce pollutant loads for all assessed parameters and impacts on water quality would not be substantial. If BMPs are incorporated, they could further reduce stormwater pollutants. Table M11 lists potential BMP pollution removal effectiveness for some potential Project BMPs.

Even though the Project reduces TSS by about 50 percent without BMPs, in order to meet LEED® Credit 6.2 (80 percent TSS annual load removal) the Project would still have to implement additional BMPs that would further reduce annual pollutant loading by reducing TSS concentrations or decreasing runoff volumes via infiltration and/or evapotranspiration. In other words, Lennar Urban would have to treat 30 acre-feet (or 45 cfs) of runoff with BMPs that can provide 80 percent TSS annual load removal at HPS Phase II. Additionally, in accordance with City requirements, the Project would have to treat 4 acre-feet (10 cfs) of off-site flows from Parcel A with BMPs that can provide 80 percent TSS annual load removal at HPS Phase II. This could be met a variety of BMPs, however, infiltration BMPs will likely be constrained over the majority of the HPS Phase II site. As noted above, some BMPs that may be effective at meeting the LEED® Credit 6.2 requirements may also result in higher discharges of other constituents of concern, such as nitrogen. Care must be taken to select BMPs that maximize pollutant removal of TSS and minimize increases in loads of other pollutants.

RECOMENDATIONS

Incorporate stormwater quality BMPs into the Storm Water Quality Management Plan to achieve 80 percent TSS annual load reduction from the 0.75 inch (or 0.2 inch per hour) runoff from the Project and off-site Parcel A, without increasing loads of nitrogen, metals, or bacteria compared to existing loads to the separate sewer system and sheet flow to the Lower Bay. Document that the selected BMPs, do not increase nitrogen, metals, or bacteria loads compared to existing loads to the separate sewer system and sheet flow to the Lower Bay (including off-site Parcel A). Calculations can be performed by modeling water quality runoff concentrations as affected by BMPs using the International Stormwater Best Management Practices (BMP) Database data, or by performing load calculations as presented in this document and BMP removal rates in Table M11. Additional BMPs and BMP removal rates can be used where supported by effectiveness studies as approved by the City.

Limit use of infiltration BMPs on the HPS Phase II site to areas where groundwater constraints are minimal and areas without fill material.

ATTACHMENT A1

WINZLER & KELLY 2009 RUNOFF CALCULATIONS (PBS&J Revised areas and C-factors)

	Area (acres)	Flows to	Composite C factor	Time of Concentration Tc (minutes)	Peak 5yr Q (cfs)	5yr Volume (AF/yr)	Peak 10yr Q (cfs)	10yr Volume (AF/yr)	Peak 100yr Q (cfs)	100yr Volume (AF/yr)	LEED (2-year 24-hr) Peak (cfs)	LEED (2-year 24-hr) Volume (AF)	BMPs Flow-based (cfs)	BMPs Volume-based (AF)	Load Calcs Annual Runoff (AF)
CANDLESTICK															
	98	Combined Sewer	0.64	10	130	15.4	147	18.8	212	27	105.56	10.9	12.5	3.9	105
	183	Separate Storm	0.68	7	307	30.5	352	37.3	505	54	250	21.7	24.9	7.8	207
	58	Sheet Flow	0.30	8	40	4.3	46	5.2	66	8	33	3.0	3.5	1.1	29
TOTAL	281				477	50	545	61	783	89	388	36	41	13	341
HUNTERS POINT															
	386	Separate Storm	0.79	15.0	511	74.7	579	91	835	133	418	53.1	61.0	19.1	508
	35	Sheet flow	0.30	8.0	24	2.6	28	3	40	5	20	1.8	2.1	0.7	18
	75	Offsite	0.70	10.0	108	12.9	123	16	178	23	88	9.1	10.5	3.3	88
TOTAL	386				644	90	730	110	1052	160	526	64	74	23	613

RAINFALL INPUT: (DWR gage #E70 7772 00)

IDF curve cnstants

	B	D	E	depth (24 hour)
2 yr*	6.109	0.8	0.54174	2.09 inches
5 yr	8.025	1.1	0.5637	2.94 inches
10 yr	8.527	0.5	0.548078	3.6 inches
100 yr	13.217	1	0.567912	5.23 inches
average annual rainfall				20 inches

* adjusted for partial duration series (see Handbook of Applied Hydrology
Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

Values in yellow cell blocks equal corrected areas and C factors based on PBS&J GIS analysis and weighted average runoff coefficient

Values in pink cells denote estimated sheet flow characteristics; GIS measured open space areas, using the same runoff coefficient and time of concentration identified for Candlestick Point sheet flow areas by Winzler & Kell

ATTACHMENT A2

WINZLER & KELLY 2009 RUNOFF CALCULATIONS (PBS&J Re-summarized)

	Area (acres)	Flows to	Composite C factor	Time of Concentration Tc (minutes)	Peak 5yr Q (cfs)	5yr Volume (AF/yr)	Peak 10yr Q (cfs)	10yr Volume (AF/yr)	Peak 100yr Q (cfs)	100yr Volume (AF/yr)	LEED (2-year 24-hr) Peak (cfs)	LEED (2-year 24-hr) Volume (AF)	BMPs Flow-based (cfs)	BMPs Volume-based (AF)	Load Calcs Annual Runoff (AF)
CANDLESTICK															
Separate Storm	217.0	Bay	0.48	9.4	222	25.5	253	31.2	364	45.4	181	18.1	20.8	6.5	173.6
open space (sheet flow)	50.3	Bay	0.20	6	27	2.5	31	3.0	44	4.4	22	1.8	2.0	0.6	17
TOTAL	267				249	28	284	34	408	50	203	20	23	7	190
HUNTERS POINT															
Separate Storm	257.0	Bay	0.53	11.4	263	33.4	299	40.9	431	59.4	215	23.7	27.2	8.5	227.0
Off-site	75.0	Bay	0.70	10.0	108	12.9	123	15.8	178	22.9	88	9.1	10.5	3.3	87.5
open space (sheet flow)	164	Bay	0.20	8.0	76	8.0	87	10	125	14	62	6	7	2.1	55
TOTAL	496				448	54	509	66	733	97	365	39	44	14	369
without off-site flows					*339*		*385*		*555*		*276*		*34*	*11*	*282*

RAINFALL INPUT: (DWR gage #E70 7772 00)

IDF curve cnstants

	B	D	E	depth (24 hour)	
2 yr*	6.109	0.8	0.54174	2.09	inches
5 yr	8.025	1.1	0.5637	2.94	inches
10 yr	8.527	0.5	0.548078	3.6	inches
100 yr	13.217	1	0.567912	5.23	inches
average annual rainfall				20	inches

* adjusted for partial duration series (see Handbook of Applied Hydrology, Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

Values in yellow cell blocks equal PBS&J summaries from Winzler & Kelly HPS_CP_subarea_runoff.xlsx

Values in blue cell blocks equal area-weighted average time of concentration from Winzler & Kelly HPS_CP_subarea_runoff.xlsx

ATTACHMENT B1

WINZLER & KELLY 2009 RUNOFF CALCULATIONS:

	Area (acres)	Flows to	Composite C factor	Time of Concentration Tc (minutes)	Peak 5yr Q (cfs)	5yr Volume (AF/yr)	Peak 10yr Q (cfs)	10yr Volume (AF/yr)	Peak 100yr Q (cfs)	100yr Volume (AF/yr)	LEED (2-year 24-hr) Peak (cfs)	LEED (2-year 24-hr) Volume (AF)	BMPs Flow-based (cfs)	BMPs Volume-based (AF)	Load Calcs Annual Runoff (AF)
CANDLESTICK															
	162	Combined Sewer	0.74	10	248	20.9	282	36.0	406	52	201.77	20.9	24.0	7.5	213
	47	Separate Storm	0.90	7	104	7.4	120	12.7	172	18	85	7.4	8.5	2.6	75
	58	Sheet Flow	0.30	8	40	3.0	46	5.2	66	7.6	33	3.0	3.5	1.1	31
TOTAL	267				392	31	447	54	644	78	319	31	36	11	319
HUNTERS POINT															
	496	Separate Storm	0.85	15.0	706	73.4	800	126	1154	184	577	73.4	84.3	26.4	748
TOTAL	496				706	73	800	126	1154	184	577	73	84	26	748

RAINFALL INPUT: (DWR gage #E70 7772 00)

IDF curve cnstants

	B	D	E	depth (24 hour)
2 yr*	6.109	0.8	0.54174	2.09 inches
5 yr	8.025	1.1	0.5637	2.94 inches
10 yr	8.527	0.5	0.548078	3.6 inches
100 yr	13.217	1	0.567912	5.23 inches
average annual rainfall				21.3 inches

* adjusted for partial duration series (see Handbook of Applied Hydrology
Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

ATTACHMENT B2.1

WINZLER & KELLY 2009 RUNOFF CALCULATIONS:

	Area (acres)	Flows to	Composite C factor	Time of Concentration Tc (minutes)	Peak 5yr Q (cfs)	5yr Volume (AF/yr)	Peak 10yr Q (cfs)	10yr Volume (AF/yr)	Peak 100yr Q (cfs)	100yr Volume (AF/yr)	LEED (2-year 24-hr) Peak (cfs)	LEED (2-year 24-hr) Volume (AF)	BMPs Flow-based (cfs)	BMPs Volume-based (AF)	Load Calcs Annual Runoff (AF)
CANDLESTICK															
1	45.1	Bay	0.54	10	51	4.3	57	7.3	83	11	41.17	4.3	4.9	1.5	43
2	37.0	Bay	0.31	7	28	2.0	32	3.4	46	5	23	2.0	2.3	0.7	20
3	13.9	Bay	0.52	8	17	1.2	19	2.2	27	3.1	13	1.2	1.4	0.4	13
4	18.7	Bay	0.40	8	17	1.3	20	2.2	28	3.3	14	1.3	1.5	0.5	13
5	35.1	Bay	0.48	10	35	2.9	40	5.0	57	7.3	28	2.9	3.4	1.1	30
6	51.4	Bay	0.48	12	47	4.3	53	7.5	76	10.8	38	4.3	5.0	1.6	44
7	6.2	Bay	0.47	6	8	0.5	9	0.9	13	1.3	6	0.5	0.6	0.2	5.1
11	4.8	Bay	0.49	5	7	0.4	8	0.7	11	1.0	6	0.4	0.5	0.1	4.1
21	4.5	Bay	0.56	6	7	0.4	8	0.8	11	1.1	5	0.4	0.5	0.2	4.5
open space (sheet flow)	50.3	Bay	0.20	6	27	1.8	31	3.0	44	4.4	22	1.8	2.0	0.6	18
TOTAL	267				242	19	276	33	397	48	197	19	22	7	195
HUNTERS POINT															
8	89.8	Bay	0.26	15.0	39	4.1	45	7	64	10	32	4.1	4.7	1.5	42
9	45.0	Bay	0.64	10.0	60	5.0	68	9	98	13	49	5.0	5.8	1.8	51
10	13.4	Bay	0.20	8.0	6	0.5	7	0.8	10	1.2	5	0.5	0.5	0.2	4.7
12	23.8	Bay	0.54	10.0	27	2.2	30	3.9	44	5.6	22	2.2	2.6	0.8	23
13	8.5	Bay	0.51	5.0	13	0.8	15	1.3	21	1.9	10	0.8	0.9	0.3	7.7
14	30.2	Bay	0.57	12.0	32	3.0	37	5.1	53	7.5	26	3.0	3.4	1.1	30
15 (Hilltop)	75.0	???	0.70	10.0	108	9.1	123	15.8	178	23	88	9.1	10.5	3.3	93
16	5.5	Bay	0.57	6.0	8	0.5	10	0.9	14	1.4	7	0.5	0.6	0.2	5.6
17	12.7	Bay	0.51	8.0	15	1.1	17	1.9	24	2.8	12	1.1	1.3	0.4	11
18	13.4	Bay	0.56	8.0	17	1.3	20	2.3	29	3.3	14	1.3	1.5	0.5	13
19	8.4	Bay	0.48	7.0	10	0.7	11	1.2	16	1.7	8	0.7	0.8	0.2	7.1
22	6.3	Bay	0.20	10.0	3	0.2	3	0.4	4	0.5	2	0.2	0.3	0.1	2.2
open space (sheet flow)	164	Bay	0.20	8.0	76	6	87	10	125	14	62	6	7	2.1	58
TOTAL	496				414	34	472	59	679	86	337	34	39	12	350

RAINFALL INPUT: (DWR gage #E70 7772 00)

	IDF curve cnstants B	D	E	depth (24 hour)
2 yr*	6.109	0.8	0.54174	2.09 inches
5 yr	8.025	1.1	0.5637	2.94 inches
10 yr	8.527	0.5	0.548078	3.6 inches
100 yr	13.217	1	0.567912	5.23 inches
average annual rainfall				21.3 inches

* adjusted for partial duration series (see Handbook of Applied Hydrology
Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs--Proposed

Drainage Area[1]	Sumary of SW Management Approach[1]	Total Area (acres)	Residential Density I	Residential Density II	Residential Density III	Residential Density IV	Regional Retail	Neighborhood Retail	Office	Research & Development	Hotel	Stadium	Arena	Parking	Community Facility	Arena / Regional Retail	Community Facility / Neighborhood Retail	Hotel / Parking
CANDLESTICK																		
1	onstreet BMPs, treated stormdrains, large open space BMP (vegetated swale), ouftall to Bay with high flow channel	45.1	4.1	5.1		5.5	3.4							3.3		1.0		
2	untreated stormdrains, wetland/wetpond, sheet flow to Bay	37.0	3.3	4.0										0.4				
3	onstreet BMPs, small open space BMPs, some sheet flow to Bay, some outfall to Bay	13.9	3.2	0.3	3.4	1.8												
4	onstreet BMPs, large openspace BMPs, larege swales and naturalized channel to wetlands	18.7			3.4	0.2										0.6		
5	onstreet BMPs, treated stormdrains and swales/filterstrips, 2 outfalls and 2 high flow channels to Bay	35.1	4.6	8.0	6.4													
6	onstreet BMPs, large ope sapce BMP (lined natural channel), WQ event pump discharges to end of pipe BMP or wetland	51.4	4.8	15.6	0.2		1.9							1.8	1.0		0.3	0.7
7	onstreet BMPs, large open space BMP (lined natural channel), WQ event pump discharges to end of pipe BMP or wetland	6.2		3.3														
11	on street BMPs, drains offsite	4.8		2.8														
21	onstreet BMPs, swales/filterstrips, sheet flow to Bay with high flow channel	4.5	3.3															
	OPEN SPACE (not delineated)	50.3																
	TOTAL	**267.0**	**23.3**	**39.2**	**13.5**	**7.5**	**5.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.5**	**1.0**	**1.6**	**0.3**	**0.7**
HUNTERS POINT																		
8	swales and treated stormdrains, outfall to Bay with high flow channel	89.8										6.1			3.8			
9	swales and treated stormdrains, outfall to Bay with high flow channel	45.0										33.3						
10	swales and treated stormdrains, outfall to Bay, high flow sheet flow to bay	13.4																
12	on street BMPs, treated stormdrain, outfall to Bay	23.8						5.6		6.5		0.5			1.1			

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs--Proposed

Drainage Area[1]	Sumary of SW Management Approach[1]	Total Area (acres)	Residential Density I	Residential Density II	Residential Density III	Residential Density IV	Regional Retail	Neighborhood Retail	Office	Research & Development	Hotel	Stadium	Arena	Parking	Community Facility	Arena / Regional Retail	Community Facility / Neighborhood Retail	Hotel / Parking
13	swales/filterstrips, outfall to Bay, high flow sheet flow to Bay	8.5	0.2							4.6								
14	onstreet BMPs, treated stormdrains, large open space BMP (vegetated swale), cistern/underground detention, outfall to Bay	30.2	0.2	1.3				0.7		16.1								
15 (Hilltop)	to City system???	75			75.0													
16	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay with high flow channel	5.5	1.5	1.2	0.1	0.6												
17	onstreet BMPs , treated stormdrain, naturalized channel, swale/filterstrip, outfall to Bay with high flow channel	12.7	2.3	3.3	2.1			0.1										
18	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay with high flow channel, high flow sheet flow to Bay	13.4	4.0	5.5	0.2													
19	onstreet BMPs , treated stormdrain, outfall to Bay with high flow channel	8.4	1.1	3.5														
22	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay, high flow sheet flow to Bay	6.3																
	OPEN SPACE (not delineated)	164.1																
	TOTAL	496.0	9.3	14.9	77.3	0.6	0.0	6.4	0.0	27.3	0.0	39.9	0.0	0.0	5.0	0.0	0.0	0.0

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs-

Drainage Area[1]	Sumary of SW Management Approach[1]	Office / Regional Retail	Residential Density I / Neighborhood Retail	Residential Density I / Parking	Residential Density I / Regional Retail	Residential Density II / Neighborhood Retail	Residential Density II / Research & Development	Residential Density III / Neighborhood Retail	Residential Density IV / Neighborhood Retail	Parks & Open Space	Composite C Factor
CANDLESTICK											
1	onstreet BMPs, treated stormdrains, large open space BMP (vegetated swale), ouftall to Bay with high flow channel	2.6		0.4	1.4	2.0				16.4	0.54
2	untreated stormdrains, wetland/wetpond, sheet flow to Bay			0.1	0.0	0.1				29.0	0.31
3	onstreet BMPs, small open space BMPs, some sheet flow to Bay, some outfall to Bay									5.1	0.52
4	onstreet BMPs, large openspace BMPs, larege swales and naturalized channel to wetlands	2.5				0.1		0.4		11.3	0.40
5	onstreet BMPs, treated stormdrains and swales/filterstrips, 2 outfalls and 2 high flow channels to Bay					0.6		0.0		15.5	0.48
6	onstreet BMPs, large ope sapce BMP (lined natural channel), WQ event pump discharges to end of pipe BMP or wetland				1.4	0.1				23.5	0.48
7	onstreet BMPs, large open space BMP (lined natural channel), WQ event pump discharges to end of pipe BMP or wetland									2.9	0.47
11	on street BMPs, drains offsite									2.1	0.49
21	onstreet BMPs, swales/filterstrips, sheet flow to Bay with high flow channel									1.3	0.56
	OPEN SPACE (not delineated)									50.3	0.20
	TOTAL	**5.1**	**0.0**	**0.5**	**2.8**	**2.8**	**0.0**	**0.4**	**0.0**	**157.4**	
HUNTERS POINT											
8	swales and treated stormdrains, outfall to Bay with high flow channel									79.8	0.26
9	swales and treated stormdrains, outfall to Bay with high flow channel									11.7	0.64
10	swales and treated stormdrains, outfall to Bay, high flow sheet flow to bay									13.4	0.20
12	on street BMPs, treated stormdrain, outfall to Bay		1.8							8.2	0.54

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs-

Drainage Area[1]	Sumary of SW Management Approach[1]	Office / Regional Retail	Residential Density I / Neighborhood Retail	Residential Density I / Parking	Residential Density I / Regional Retail	Residential Density II / Neighborhood Retail	Residential Density II / Research & Development	Residential Density III / Neighborhood Retail	Residential Density IV / Neighborhood Retail	Parks & Open Space	Composite C Factor
13	swales/filterstrips, outfall to Bay, high flow sheet flow to Bay									3.7	0.51
14	onstreet BMPs, treated stormdrains, large open space BMP (vegetated swale), cistern/underground detention, outfall to Bay		1.0			0.8	0.3			9.7	0.57
15 (Hilltop)	to City system???									0.0	0.70
16	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay with high flow channel					0.1			0.6	1.4	0.57
17	onstreet BMPs , treated stormdrain, naturalized channel, swale/filterstrip, outfall to Bay with high flow channel									4.9	0.51
18	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay with high flow channel, high flow sheet flow to Bay									3.8	0.56
19	onstreet BMPs , treated stormdrain, outfall to Bay with high flow channel									3.7	0.48
22	onstreet BMPs , treated stormdrain, swale/filterstrip, outfall to Bay, high flow sheet flow to Bay									6.3	0.20
	OPEN SPACE (not delineated)									164.1	0.20
	TOTAL	0.0	2.8	0.0	0.0	0.9	0.3	0.0	0.6	310.8	

ATTACHMENT B2.2
WINZLER & KELLY 2009 Composite C Factor Calcs--Proposed

Drainage Area[1]	Sumary of SW Management Approach[1]	Total Area (acres)	Residential Density I	Residential Density II	Residential Density III

ATTACHMENT B2.3
WINZLER & KELLY 2009 Composite C Factor Calcs--Proposed
Assumptions:

Land Use	Cfactor
Residential Density I	0.70
Residential Density II	0.70
Residential Density III	0.70
Residential Density IV	0.70
Regional Retail	0.75
Neighborhood Retail	0.70
Office	0.70
Research & Development	0.75
Hotel	0.85
Stadium	0.80
Arena	0.90
Parking	0.90
Community Facility	0.70
Arena / Regional Retail	0.83
Community Facility / Neighborhood Retail	0.70
Hotel / Parking	0.88
Office / Regional Retail	0.70
Residential Density I / Neighborhood Retail	0.70
Residential Density I / Parking	0.80
Residential Density I / Regional Retail	0.73
Residential Density II / Neighborhood Retail	0.70
Residential Density II / Research & Development	0.73
Residential Density III / Neighborhood Retail	0.70
Residential Density IV / Neighborhood Retail	0.70
Parks & Open Space	0.20

References:

1 Arup, LID Stormwater Opportunities Study, Figures 15 &16
Subarea land use breakdown from W&K GIS analysis

RAINFALL INPUT: (DWR gage #E70 7772 00)

	5-minute peak intensity		depth (24 hour)	
2 yr*	2.35	inches/hour	2.09	inches
5 yr	2.90	inches/hour	2.94	inches
10 yr	3.32	inches/hour	3.6	inches
100 yr	4.83	inches/hour	5.23	inches
average annual rainfall			21.3	inches

* adjusted for partial duration series (see Handbook of Applied Hydrology
Ven Te Chow 1964, Figure 8-I-5 and Equation 8-I-44)

Appendix M2 BASELINE Water Quality Data Analysis, November 2009

Appendix M2 Water Quality Data Analysis

This Appendix is an evaluation of in-Bay pathogen indicator[1] quality data collected in the vicinity of the Project site as part of the City's Beach Water Quality Monitoring Program, and stormwater runoff data collected by the Navy and its tenants at the Hunters Point Shipyard in accordance with the requirements of the Industrial General Permit.

Beach Water Quality

Table M-1 through Table M-3 summarize the shoreline beach water quality monitoring data collected by the San Francisco Public Utilities Commission (SFPUC) and San Francisco Department of Public Health for the Beach Water Quality Monitoring Program[2] in the vicinity of the Project site. BASELINE obtained the data for this analysis from the SFPUC. The three sampling locations discussed in this Appendix are Jack Rabbit Beach (Station No. 301.2), Windsurfer Circle (Station No. 301.1), and Sunnydale Cove (Station No. 300.1). The sampling locations are shown on Figure III M-1. The sampling locations are in the proximity of combined sewer overflow outfall 043 (Candlestick Cove) and are south of outfall 042 (South Basin) (see Figure III.M-2).

Table M-1 through Table M-3 summarize the pathogen indicator data collected from 2004-2008 for total coliform, *Escherichia* coli (E. coli), and enterococcus bacteria. For this analysis, BASELINE separated the data into wet and dry weather samples, with wet weather samples defined as samples collected when the sum of the daily and 24-hour antecedent rainfall depths was greater than or equal to 0.1 inch (because generally smaller rain events are not likely to produce stormwater runoff). Dry weather samples represent data collected when the sum of the daily and 24-hour antecedent rainfall depths was less than 0.1 inch. Each table shows the number of samples, the number of non-detect results, the number of samples that exceeded the quantification range of the analysis (and were not diluted and reanalyzed; therefore the reported values are lower than actual concentrations and give the results a low bias), the average and median concentrations, and the coefficient of variation (CV) (i.e., the standard deviation divided by the average concentration; the CV provides an indication of data variability).

Generally among the three sampling locations, Jack Rabbit Beach has the lowest total coliform, E. coli, and enterococcus bacteria concentrations for both wet and dry weather, and Windsurfer Circle has the highest pathogen concentrations. Generally pathogen indicator concentrations are significantly higher in wet weather than in dry weather for all three stations.

The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) includes water quality objectives for total coliform (and fecal coliform, which was not monitored as part of the Beach Water Quality Monitoring Program), but not for E. coli or enterococcus bacteria. For total coliform, the Basin

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1 Although they are not generally harmful themselves, pathogen indicators indicate the possible presence of disease-causing bacteria, viruses, and protozoa.

2 San Francisco Public Utilities Commission, website: http://sfwater.org/detail.cfm/MC_ID/20/MSC_ID/198/MTO_ID/515/C_ID/3554, accessed August 3, 2009.

Plan objective states that the median concentration should be less than 240 Most Probable Number [MPN] per 100 milliliters [mL]. The wet weather median concentrations for total coliform at all three stations exceeded the Basin Plan objective; however the dry weather median concentrations did not exceed the objective. The Basin Plan also has a single sample objective, which is that no sample should exceed 10,000 MPN/100 mL. As indicated in Table M-1, 20 wet weather samples exceeded the Basin Plan objective for total coliform at Sunnydale Cove, 42 wet weather samples exceeded at Windsurfer Circle, and no wet weather samples exceeded the Basin Plan single sample objective at Jack Rabbit Beach. Eleven dry weather samples exceeded the single sample standard at Windsurfer Circle, two dry weather samples exceeded at Jack Rabbit Beach, and no dry weather samples exceeded the Basin Plan single sample standard for total coliform at Sunnydale Cove.

TABLE M-1
SUMMARY OF TOTAL COLIFORM DATA FOR SOUTH BASIN/CANDLESTICK POINT
2004-2008

Sample Location	Sunnydale Cove (Station No. 300.1)		Windsurfer Circle (Station No. 301.1)		Jack Rabbit Beach (Station No. 301.2)	
	Dry	Wet	Dry	Wet	Dry	Wet
No. Samples	231	95	250	108	223	71
No. Non-Detects	8	1	10	0	18	1
No. Samples that Exceeded Quantification Range of the Analysis(1)	0	11	5	30	1	0
Average [MPN/100 mL]	413	5,772	1,729	10,010	350	947
Coefficient of Variation (CV)(2)	2.1	1.5	2.7	1.0	5.1	1.4
Median [MPN/100 mL] (Basin Plan Standard median < 240)(3)	134	1,296	193	5,794	63	345
No. samples > 10,000 MPN/100 mL (Basin Plan Standard)(4)	0	20	11	42	2	0

Source: Statistical data analysis performed by BASELINE using analytical data provided by the San Francisco Public Utilities Commission.

Notes:

MPN = Most Probable Number as quantified by multiple-tube fermentation.

"Wet" and "Dry" samples were defined based on rainfall amounts. A "Wet "sample is defined as a sample collected when the sum of the daily and 24-hour antecedent rainfall depth was ≥ 0.1 inch. A "Dry" sample is defined as a sample collected when the rainfall depth was < 0.1 inch.

The sample detection limit was used to calculate statistics for non-detect concentrations. When a result was reported as > X MPN/100 mL, X was used to calculate statistics (see also Note 1).

(1) The sample result was reported as greater than the reported concentration because the result exceeded the quantification range of the analysis, and a dilution and reanalysis of the sample was not performed. Consequently, these results have a low bias.

(2) The Coefficient of Variation (CV) is the ratio of the standard deviation and the average concentration. A CV greater than 1.0 generally indicates high variability in the data.

(3) The Basin Plan objective is based on a minimum of five consecutive samples equally spaced over a 30-day period. This analysis compares the objective to the median of all data collected from 2004-2008.

(4) The Basin Plan objective states that no single sample should exceed 10,000 MPN/ml.

TABLE M-2
SUMMARY OF E. COLI DATA FOR SOUTH BASIN/CANDLESTICK POINT
2004-2008

Sample Location	Sunnydale Cove (Station No. 300.1)		Windsurfer Circle (Station No. 301.1)		Jack Rabbit Beach (Station No. 301.2)	
	Dry	Wet	Dry	Wet	Dry	Wet
No. Samples	231	95	250	108	223	71
No. Non-Detects	71	8	58	4	76	13
No. Samples that Exceeded Quantification Range of the Analysis(1)	0	3	0	2	0	0
Average [MPN/mL]	96	1,649	137	2,215	77	147
Median [MPN/mL]	20	121	20	245	10	41
Coefficient of Variation (CV)(2)	2.9	3.0	5.3	2.1	3.4	1.7

Source: Statistical data analysis performed by BASELINE using analytical data provided by the San Francisco Public Utilities Commission

Notes:

MPN = Most Probable Number as quantified by multiple-tube fermentation.

“Wet” and “Dry” samples were defined based on rainfall amounts. A “Wet “sample is defined as a sample collected when the sum of the daily and 24-hour antecedent rainfall depth was ≥ 0.1 inch. A “Dry” sample is defined as a sample collected when the rainfall depth was < 0.1 inch.

The sample detection limit was used to calculate statistics for non-detect concentrations. When a result was reported as > X MPN/100 mL, X was used to calculate statistics (see also Note 1).

The Basin Plan does not include water quality objectives for E. Coli.

(1) The sample result was reported as greater than the reported concentration because the result exceeded the quantification range of the analysis, and a dilution and reanalysis was not performed. Consequently, these results have a low bias.

(2) The Coefficient of Variation (CV) is the ratio of the standard deviation and the average concentration. A CV greater than 1.0 generally indicates high variability in the data.

TABLE M-3
SUMMARY OF ENTEROCOCCUS DATA FOR SOUTH BASIN/CANDLESTICK POINT
2004-2008

Sample Location	Sunnydale Cove (Station No. 300.1)		Windsurfer Circle (Station No. 301.1)		Jack Rabbit Beach (Station No. 301.2)	
	Dry	Wet	Dry	Wet	Dry	Wet
No. Samples	231	95	250	108	223	71
No. Non-Detects	107	12	100	9	131	15
No. Samples that Exceeded Quantification Range of the Analysis(1)	0	2	0	2	0	0
Average [MPN/mL]	55	1,352	80	1,672	24	152
Median [MPN/mL]	10	98	10	217	10	31
Coefficient of Variation (CV)(2)	2.7	3.2	4.7	2.6	1.9	2.3

Source: Statistical data analysis performed by BASELINE using analytical data provided by the San Francisco Public Utilities Commission

Notes:

MPN = Most Probable Number as quantified by multiple-tube fermentation.

“Wet” and “Dry” samples were defined based on rainfall amounts. A “Wet “sample is defined as a sample collected when the sum of the daily and 24-hour antecedent rainfall depth was ≥ 1.0 inch. A “Dry” sample is defined as a sample collected when the rainfall depth was < 0.1 inch.

The sample detection limit was used to calculate statistics for non-detect concentrations. When a result was reported as > X MPN/100 mL, X was used to calculate statistics (see also Note 1).

The Basin Plan does not include water quality objectives for Enterococcus bacteria.

(1) The sample result was reported as greater than the reported concentration because the result exceeded the quantification range of the analysis, and a dilution and reanalysis was not performed. Consequently, these results have a low bias.

(2) The Coefficient of Variation (CV) is the ratio of the standard deviation and the average concentration. A CV greater than 1.0 generally indicates high variability in the data.

Hunters Point Shipyard Industrial Stormwater Discharge Quality

The Navy and tenants at the Hunters Point Shipyard (HPS) collect stormwater runoff water quality data in accordance with the Industrial General Permit (Water Quality Order No. 97-03-DWQ, NPDES General Permit No. CAS000001). The Industrial General Permit requires implementation of a stormwater monitoring program. In accordance with the General Permit, the discharger must:

- Collect samples from two storm events per year including the first storm of the wet season (from all outfalls producing a discharge), and any additional storm event (in the case of a deviation, the discharger must report why the first qualifying storm was not sampled and/or why a second storm was not sampled). Stormwater runoff samples must be collected within the first hour of discharge, and "qualifying" events must be preceded by three working days with no precipitation that causes a discharge.
- Analyze samples for total suspended solids (TSS), pH, conductivity, and total organic carbon (TOC); oil and grease may be substituted for TOC. Additional parameters, which are identified in Table D of the Industrial General Permit, may be required based on the facility's Standard Industrial Classification (SIC).
- Document and report the monitoring data in the Annual Report for Storm Water Discharges Associated with Industrial Activities, which must be submitted to the State Water Resources Control Board (if submitting electronically) or San Francisco Regional Water Quality Control Board (SFRWQCB) (if submitting a hardcopy report) by July 1 of each year.

The Draft Final 2005 Industrial General Permit (Draft Final Permit) contains parameter benchmark concentrations for certain constituents, which are derived from US EPA's Multi-Sector General Permit[3]. For this analysis, US EPA benchmarks[4] are compared to the HPS stormwater monitoring data to evaluate the magnitude of the concentrations, and average concentrations above benchmarks are considered to be elevated. However, the benchmarks will not take effect until Draft Final Permit is adopted.

Six Annual Reports for Storm Water Discharges Associated with Industrial Activity[5,6,7,8,9,10] representing the 2002-2003 through 2007-2008 reporting periods were available at the SFRWQCB for

3 The Multi-Sector General Permit is the industrial stormwater permit in areas where US EPA is the NPDES permit authority.

4 The Draft Final 2005 Industrial General Permit contains parameter benchmark concentrations for certain constituents that are derived from US EPA's Multi-Sector General Permit. The benchmarks will take effect when the Draft Final Permit is adopted. The benchmarks are not numeric discharge limits, but are used to assess if site Best Management Practices (BMPs) are effective for reducing concentrations of pollutants of concern. The Draft Permit requires that if runoff concentrations are above one or more benchmarks, the discharger must revise its Storm Water Pollution Prevention Plan (SWPPP) to include more effective BMPs, and collect samples from the next two consecutive qualifying storms.

5 Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

6 Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

7 Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

review (including the inactive industrial landfill). The HPS includes many parcels that are leased to other entities and the Annual Reports identify the industrial tenants associated with each outfall. The industrial facilities have various SICs; therefore, the list of additional parameters monitored at each outfall depends on the SIC of the facilities discharging to the outfall. Table M-4 summarizes the eleven discharge locations sampled at the HPS and identifies which discharge locations are associated with the industrial landfill.

Stormwater runoff data from each outfall are summarized in Table A.M-5 through Table III.M-15. The tables include the number of samples collected, the number of non-detects, the average concentration, and the parameter benchmark from the 2005 Draft Final Permit. Data from one or more outfalls exceeded parameter benchmarks for conductivity, TSS, total copper, total zinc, and total lead. The benchmarks for conductivity and TSS were exceeded most frequently.

[8] Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

[9] Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

[10] Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

TABLE M-4
SUMMARY OF DISCHARGE LOCATIONS SAMPLED AT THE HPS FOR THE INDUSTIRAL GENERAL PERMIT

Outfall	Location
1	39-inch diameter pipe located east of Building 144 and west of Building 145. In 2007-02008, the location was changed to a gravel swale east of Building 144 and north of Building 146. The drainage area and associated industrial activities did not change.
7	33-inch diameter pipe east of Building 130 and northwest of Building 133, near Berth 55
16	30-inch diameter pipe east of Building 236 and west of the North Berthing Slip
19	24-inch diameter pipe southeast of Building 368, at Berth 14
20	42-inch diameter pipe southeast of Building 306, at Berth 15
33	72-inch diameter pipe west of the base of Pier 3
OLF1	Overland flow from parking lot west of Building 916 and the unpaved area north of Building 916
OF101/OLF101	Swale by entrance of wetland west of landfill cap (associated with Parcel E-2 and Landfill)
DP1	Catch basin downstream of UCSF Compound pipe inlet to the underground storm drain (associated with Parcel E-2 and Landfill)
DP2	Catch basin north of landfill cap and east of USCF Compound (associated with Parcel E-2 and Landfill)
DP4	18-inch diameter pipe south of landfill cap (associated with Parcel E-2 and Landfill)

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

TABLE M-5
STORMWATER RUNOFF DATA FROM HPS OUTFALL 1

Parameter	No. Samples	No. NDs(1)	Average	Parameter Benchmark(2)
Conductivity [µmhos/cm]	9	0	12,057	200
Total Suspended Solids [mg/L]	9	0	433	100
Oil & Grease [mg/L]	9	6	5.2	15
pH [Standard Units]	9	0	7.5	6.0 – 9.0
Total Organic Carbon [mg/L]	9	0	7.7	110
Total Arsenic [µg/L]	0	NA	NA	168.54
Total Cadmium [µg/L]	0	NA	NA	15.9
Total Chromium [µg/L]	0	NA	NA	None
Total Copper [µg/L]	0	NA	NA	63.6
Total Lead [µg/L]	0	NA	NA	81.6
Total Mercury [µg/L]	0	NA	NA	2.4
Total Nickel [µg/L]	0	NA	NA	1,417
Total Selenium [µg/L]	0	NA	NA	238.5
Total Zinc [µg/L]	0	NA	NA	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West, *2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-6
STORMWATER RUNOFF DATA FROM HPS OUTFALL 7

Parameter	No. Samples	No. NDs(1)	Average	Parameter Benchmark(2)
Conductivity [µmhos/cm]	2	0	9,295	200
Total Suspended Solids [mg/L]	2	0	41	100
Oil & Grease [mg/L]	2	2	5.0	15
pH [Standard Units]	2	0	7.6	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	0	NA	NA	168.54
Total Cadmium [µg/L]	0	NA	NA	15.9
Total Chromium [µg/L]	0	NA	NA	None
Total Copper [µg/L]	0	NA	NA	63.6
Total Lead [µg/L]	0	NA	NA	81.6
Total Mercury [µg/L]	0	NA	NA	2.4
Total Nickel [µg/L]	0	NA	NA	1,417
Total Selenium [µg/L]	0	NA	NA	238.5
Total Zinc [µg/L]	0	NA	NA	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West, *2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-7
STORMWATER RUNOFF DATA FROM HPS OUTFALL 16

Parameter	No. Samples	No. NDs(1)	Average	Parameter Benchmark(2)
Conductivity [µmhos/cm]	8	0	8,993	200

TABLE M-7
STORMWATER RUNOFF DATA FROM HPS OUTFALL 16

Parameter	No. Samples	No. NDs(1)	Average	Parameter Benchmark(2)
Total Suspended Solids [mg/L]	8	0	154	100
Oil & Grease [mg/L]	8	7	4.9	15
pH [Standard Units]	8	0	7.5	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	2	0	3.3	168.54
Total Cadmium [µg/L]	2	2	1.0	15.9
Total Chromium [µg/L]	2	0	4.5	None
Total Copper [µg/L]	8	0	72	63.6
Total Lead [µg/L]	2	0	21	81.6
Total Mercury [µg/L]	2	2	0.2	2.4
Total Nickel [µg/L]	2	0	6.8	1,417
Total Selenium [µg/L]	2	0	6.3	238.5
Total Zinc [µg/L]	8	0	267	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source: Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-8
STORMWATER RUNOFF DATA FROM HPS OUTFALL 19

Parameter	No. Samples	No. NDs(1)	Average	Parameter Benchmark(2)
Conductivity [µmhos/cm]	8	0	976	200
Total Suspended Solids [mg/L]	8	1	65	100
Oil & Grease [mg/L]	8	5	5.0	15
pH [Standard Units]	8	0	6.0	6.0 – 9.0
Total Organic Carbon [mg/L]	2	0	13.2	110
Total Arsenic [µg/L]	2	0	1.3	168.54
Total Cadmium [µg/L]	2	1	1.4	15.9
Total Chromium [µg/L]	2	0	7.7	None
Total Copper [µg/L]	8	0	66	63.6
Total Lead [µg/L]	2	0	73	81.6
Total Mercury [µg/L]	2	2	0.20	2.4
Total Nickel [µg/L]	2	0	8.2	1,417
Total Selenium [µg/L]	2	2	1.0	238.5
Total Zinc [µg/L]	8	0	188	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West, *2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOC/PAH = Semi-volatile organic compound/polynuclear aromatic hydrocarbon

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-9
STORMWATER RUNOFF DATA FROM HPS OUTFALL 20

Parameter	No. Samples	No. NDs[1]	Average	Parameter Benchmark[2]
Conductivity [μmhos/cm]	8	0	2,600	200
Total Suspended Solids [mg/L]	7	0	97	100
Oil & Grease [mg/L]	8	5	5.3	15
pH [Standard Units]	8	0	6.2	6.0 – 9.0
Total Organic Carbon [mg/L]	8	0	13.7	110
Total Arsenic [μg/L]	2	1	1.1	168.54
Total Cadmium [μg/L]	2	1	1.1	15.9
Total Chromium [μg/L]	2	0	14.8	None
Total Copper [μg/L]	8	0	43	63.6
Total Lead [μg/L]	2	0	130	81.6
Total Mercury [μg/L]	2	2	0.20	2.4
Total Nickel [μg/L]	2	0	11.7	1,417
Total Selenium [μg/L]	2	2	1.0	238.5
Total Zinc [μg/L]	2	0	195	117
PCB Aroclors [μg/L]	0	NA	NA	None
SVOCs/PAHs [μg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West, *2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the mean concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-10
STORMWATER RUNOFF DATA FROM HPS OUTFALL 33

Parameter	No. Samples	No. NDs(1)	Mean	Parameter Benchmark(2)
Conductivity [μmhos/cm]	10	0	920	200
Total Suspended Solids [mg/L]	9	0	620	100
Oil & Grease [mg/L]	10	6	5.5	15
pH [Standard Units]	10	0	7.3	6.0 – 9.0
Total Organic Carbon [mg/L]	7	0	25.3	110
Total Arsenic [μg/L]	2	0	2.2	168.54
Total Cadmium [μg/L]	2	2	1.0	15.9
Total Chromium [μg/L]	2	0	3.2	None
Total Copper [μg/L]	9	0	148	63.6
Total Lead [μg/L]	2	0	15	81.6
Total Mercury [μg/L]	2	1	0.25	2.4
Total Nickel [μg/L]	2	0	6.8	1,417
Total Selenium [μg/L]	2	2	1.0	238.5
Total Zinc [μg/L]	2	0	61	117
PCB Aroclors [μg/L]	0	NA	NA	None
SVOCs/PAHs [μg/L]	0	NA	NA	None

Source: Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE M-11
STORMWATER RUNOFF DATA FROM HPS OUTFALL OLF1

Parameter	No. Samples	No. NDs[(1)]	Average	Parameter Benchmark[(2)]
Conductivity [µmhos/cm]	2	0	435	200
Total Suspended Solids [mg/L]	2	0	357	100
Oil & Grease [mg/L]	2	1	5.4	15
pH [Standard Units]	2	0	7.6	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	0	NA	NA	168.54
Total Cadmium [µg/L]	0	NA	NA	15.9
Total Chromium [µg/L]	0	NA	NA	None
Total Copper [µg/L]	0	NA	NA	63.6
Total Lead [µg/L]	0	NA	NA	81.6
Total Mercury [µg/L]	0	NA	NA	2.4
Total Nickel [µg/L]	0	NA	NA	1,417
Total Selenium [µg/L]	0	NA	NA	238.5
Total Zinc [µg/L]	0	NA	NA	117
PCB Aroclors [µg/L]	0	NA	NA	None
SVOCs/PAHs [µg/L]	0	NA	NA	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

TABLE A. M-12
STORMWATER RUNOFF DATA FROM HPS OUTFALL DP1

Parameter	No. Samples	No. NDs(1)	Average	Parameter Benchmark(2)
Conductivity [μmhos/cm]	5	0	248	200
Total Suspended Solids [mg/L]	5	0	149	100
Oil & Grease [mg/L]	5	2	4.3	15
pH [Standard Units]	5	0	7.7	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [μg/L]	5	3	6.1	168.54
Total Cadmium [μg/L]	5	4	4.1	15.9
Total Chromium [μg/L]	5	2	39.7	None
Total Copper [μg/L]	5	0	158	63.6
Total Lead [μg/L]	5	1	45	81.6
Total Mercury [μg/L]	5	3	0.63	2.4
Total Nickel [μg/L]	5	1	74.1	1,417
Total Selenium [μg/L]	5	4	6.0	238.5
Total Zinc [μg/L]	5	0	314	117
PCB Aroclors [μg/L]	3	3	Note (3)	None
SVOCs/PAHs [μg/L]	4	Note (4)	Note (4)	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

(3) All results were ND and ranged from < 0.3 - < 1.3 μg/L.

(4) Three parameters were detected just above the Practical Quantitation Limit for one sampling event. All other results were ND and ranged from < 9.4 - < 49 μg/L.

TABLE M-13
STORMWATER RUNOFF DATA FROM HPS OUTFALL DP2

Parameter	No. Samples	No. NDs(1)	Average	Parameter Benchmark(2)
Conductivity [μmhos/cm]	4	0	160	200
Total Suspended Solids [mg/L]	4	0	138	100
Oil & Grease [mg/L]	4	2	4.8	15
pH [Standard Units]	4	0	7.3	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [μg/L]	4	4	6.2	168.54
Total Cadmium [μg/L]	4	4	5.0	15.9
Total Chromium [μg/L]	4	2	30.1	None
Total Copper [μg/L]	4	0	222	63.6
Total Lead [μg/L]	4	3	53	81.6
Total Mercury [μg/L]	4	4	0.98	2.4
Total Nickel [μg/L]	4	1	58.2	1,417
Total Selenium [μg/L]	4	2	7.5	238.5
Total Zinc [μg/L]	4	3	339	117
PCB Aroclors [μg/L]	2	Note (3)	Note (3)	None
SVOCs/PAHs [μg/L]	4	4	Note (4)	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

(3) All Aroclors were detected in the first sampling event at concentrations ranging from 0.57 – 1.10 μg/L. Only Aroclor 1221 was detected in the second sampling event at 0.94 μg/L.

(4) All results were ND and ranged from < 9.4 - < 50 μg/L.

TABLE M-15
STORMWATER RUNOFF DATA FROM HPS OUTFALL OF101/OLF101

Parameter	No. Samples	No. NDs(1)	Average	Parameter Benchmark(2)
Conductivity [µmhos/cm]	4	0	1,340	200
Total Suspended Solids [mg/L]	4	0	6	100
Oil & Grease [mg/L]	4	2	4.8	15
pH [Standard Units]	4	0	7.8	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	NA	110
Total Arsenic [µg/L]	4	4	16.3	168.54
Total Cadmium [µg/L]	4	4	5.0	15.9
Total Chromium [µg/L]	4	2	8.2	None
Total Copper [µg/L]	4	0	71	63.6
Total Lead [µg/L]	4	3	5	81.6
Total Mercury [µg/L]	4	4	0.20	2.4
Total Nickel [µg/L]	4	1	15.6	1,417
Total Selenium [µg/L]	4	2	10.0	238.5
Total Zinc [µg/L]	4	3	31	117
PCB Aroclors [µg/L]	2	2	Note (3)	None
SVOCs/PAHs [µg/L]	4	Note (4)	Note (4)	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West, *2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and Mactec Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) The analytical Practical Quantitation Limit was used as the concentration for non-detect (ND) values when calculating the average concentration.

(2) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

(3) All results were ND and ranged from < 0.5 - < 0.99 µg/L.

(4) Only one parameter was detected just above the Practical Quantitation Limit for one sampling event. The other results were ND and ranged from < 9.4 - < 50 µg/L.

TABLE M-15
STORMWATER RUNOFF DATA FROM HPS OUTFALL DP4

Parameter	No. Samples	No. NDs	Result	Parameter Benchmark[1]
Conductivity [μmhos/cm]	1	0	590	200
Total Suspended Solids [mg/L]	1	0	73	100
Oil & Grease [mg/L]	1	0	5	15
pH [Standard Units]	1	0	7	6.0 – 9.0
Total Organic Carbon [mg/L]	0	NA	0	110
Total Arsenic [μg/L]	1	1	< 5	168.54
Total Cadmium [μg/L]	1	1	< 5	15.9
Total Chromium [μg/L]	1	0	8	None
Total Copper [μg/L]	1	0	39	63.6
Total Lead [μg/L]	1	0	20	81.6
Total Mercury [μg/L]	1	1	< 0.2	2.4
Total Nickel [μg/L]	1	0	14	1,417
Total Selenium [μg/L]	1	1	< 10	238.5
Total Zinc [μg/L]	1	0	46	117
PCB Aroclors [μg/L]	1	1	< 0.49 - < 0.98	None
SVOCs/PAHs [μg/L]	1	1	< 9.9 - < 50	None

Source:

Department of the Navy Base Realignment and Closure Program Management Office West, 2002/2003 *Annual Report for Storm Water Discharges Associated with Industrial Activities at Hunters Point Shipyard, San Francisco, California*, No date.

Department of the Navy Base Realignment and Closure Program Management Office West, 2004-2005 *Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, June 30, 2005. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2005-2006 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, June 2006.

Department of the Navy Base Realignment and Closure Program Management Office West*, 2006/2007 Storm Water Monitoring Report, Hunters Point Shipyard, San Francisco, California*, 2007.

Department of the Navy Base Realignment and Closure Program Management Office West, *2004-2005 Annual Report for Storm Water Discharge Management IR-01/21, Industrial Landfill, Parcel E-2, Hunters Point Shipyard, San Francisco, California*, July 31, 2007. Prepared by AFA Construction Group/EEC.

Department of the Navy Base Realignment and Closure Program Management Office West, *2007/2008 Annual Report for Storm Water Discharges Associated with Industrial Activities, Hunters Point Shipyard, San Francisco, California*, June 2008. Prepared by Marrs Services, Inc. and MACTEC Engineering & Consulting, Inc.

Notes:

NA The parameter was not analyzed.

PCB = Polychlorinated biphenyl

SVOCs/PAHs = Semi-volatile organic compounds/polynuclear aromatic hydrocarbons

(1) Parameter Benchmarks are from the 2005 Draft Final Industrial General Permit. Permittees are currently not subject to these benchmarks.

Appendix N1 PBS&J Candlestick Point/Hunters Point Shipyard Project Biological Resources Technical Report, December 2008, Updated November 2009

Candlestick Point/
Hunters Point Shipyard Project
Biological Technical Report

San Francisco County, California

Prepared for:

San Francisco Redevelopment Agency
San Francisco Planning Department

Prepared by:

PBS&J

December 11, 2008

(Updated November 2, 2009)

Candlestick Point/Hunters Point Shipyard Project
Biological Technical Report

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EXECUTIVE SUMMARY

The Candlestick Point–Hunters Point Shipyard Phase II (CPHPS) Development Plan (Project) is located on approximately 702-acre area east of US 101 in the southeast area of the City and County of San Francisco (City). It occupies the waterfront area from south of India Basin to Candlestick Cove. The Project proposed by Lennar Urban includes a mixed-use community with a wide range of residential, retail, office, research and development, civic and community uses, and parks and recreational open space. A major component would be a new stadium for the San Francisco 49ers National Football League (NFL) team. Additionally, new transportation and utility infrastructure would serve the Project including a bridge across Yosemite Slough. The description of the Project is organized under two major sub-components: Candlestick Point and Hunters Point Shipyard (HPS) Phase II.

For the purpose of this biological study, PBS&J reviewed conditions in the Project Site, as shown in Figure 1, Study Area. In addition, the study includes a more general review of conditions and in aquatic areas adjacent to the Project Site shoreline. The Project Site and the aquatic areas, including Yosemite Slough, are referred to as the "Study Area" in this report. PBS&J completed a biological study of the Project during the summer of 2007 and during 2008. This study included a field survey of the parcels, documenting existing habitats, the plants and animals occurring in those habitats, and any significant habitat types that may be protected by state and federal law. Additional studies reviewed by PBS&J for this project included a delineation of wetlands and other waters of the U.S. and a tree survey prepared by H. T. Harvey & Associates, and information on biological resources of the area described in other reports.

As shown in Figure 2, the Study Area supports six vegetation communities, in addition to urban/developed areas:

1. landscaped areas/ornamental plants;
2. non-native grassland;
3. freshwater wetland;
4. tidal salt marsh
5. nontidal salt marsh; and
6. mudflats/open water.

Landscaped/ornamental and non-native annual grassland habitats occupy much of Candlestick Point, while HPS Phase II and much of Candlestick Point consist largely of urban/developed areas. Small areas of freshwater wetlands and nontidal salt marsh are present on HPS Phase II, and narrow strips of tidal salt marsh are present along the shoreline at scattered places on Candlestick Point and portions of HPS Phase II.

Although the vegetation of the Project area is largely dominated by non-native plants, native plants and a number of native wildlife species are present on the site. No special-status plants have been recorded, and none are expected to occur, on the site, although several species of special-status animals are present.

Jurisdictional wetlands and other waters of the U.S./State are present on the site, including the tidal and non-tidal wetlands and the aquatic habitats that surround the site. Eelgrass beds and Essential Fish Habitat, both sensitive biological habitats, are also present on/adjacent to the site.

INTRODUCTION

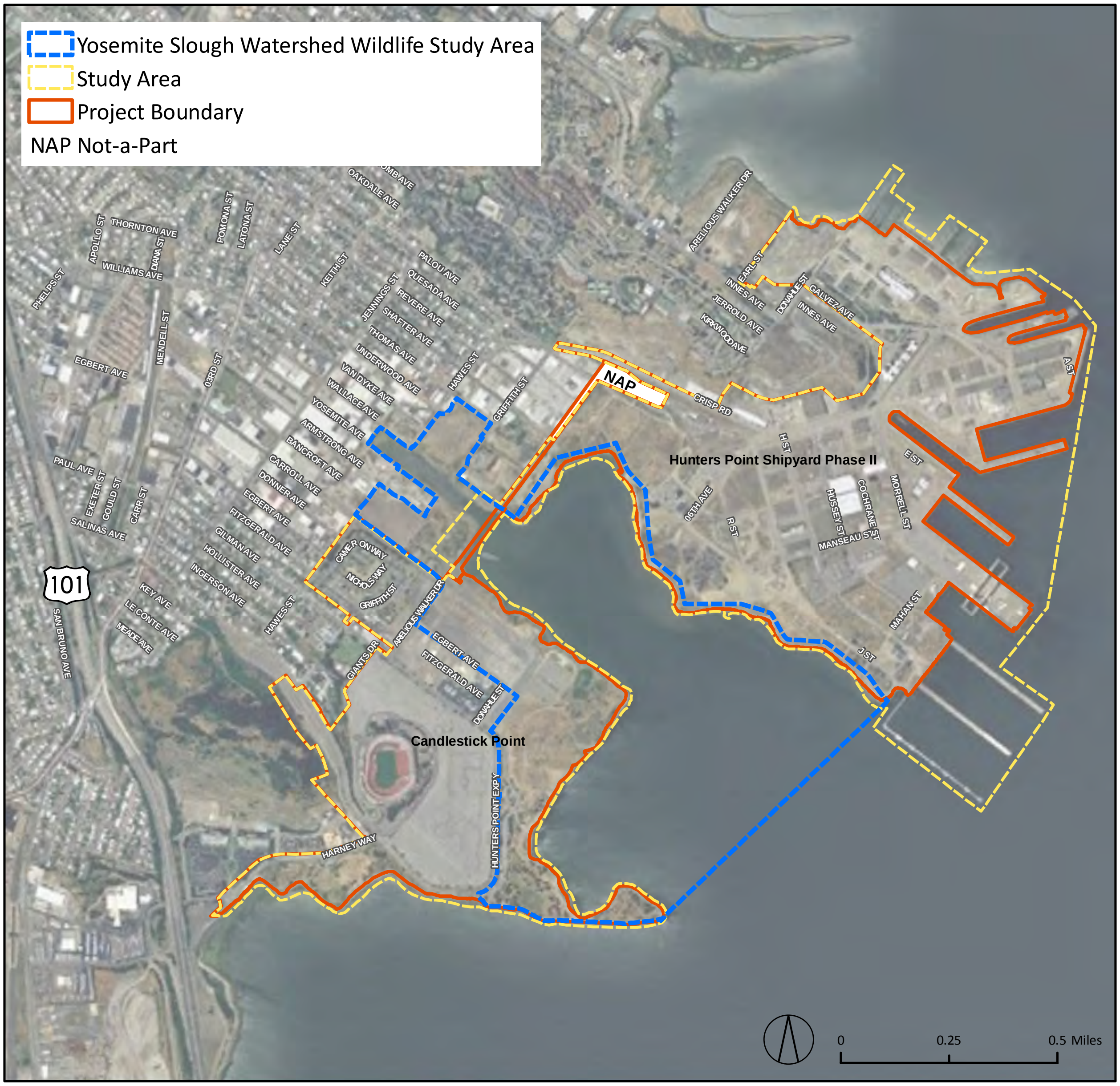
The Candlestick Point–Hunters Point Shipyard Phase II (CPHPS) Development Plan (Project) is located on approximately 702-acre area east of US 101 in the southeast area of the City and County of San Francisco (City; see Figure 1). It occupies the waterfront area from south of India Basin to Candlestick Cove. The Project proposed by Lennar Urban includes a mixed-use community with a wide range of residential, retail, office, research and development, civic and community uses, and parks and recreational open space. A major component would be a new stadium for the San Francisco 49ers National Football League (NFL) team. Additionally, new transportation and utility infrastructure would serve the Project including a bridge across Yosemite Slough. The description of the Project is organized under two major sub-components: Candlestick Point and Hunters Point Shipyard (HPS) Phase II.

This report discusses biological resources present on and potentially affected by the proposed Project. Biological resources surveys were conducted to identify existing biological resources present on the site and to determine if habitats present on the site could support any special-status plant or wildlife species present in the region, and to document any occurrences of those species, if observed during the field survey. In addition, this report includes a summary of the applicable laws and regulations related to biological resources and the resource agencies responsible for their implementation.

METHODOLOGY

BIOLOGICAL RESOURCES STUDY

In order to assess existing conditions and potential Project-related impacts, PBS&J staff biologists conducted reconnaissance-level surveys of the Project site on August 9, 2007, May 5, 2008, and July 8, 2008. The Study Area for this biological resources analysis includes both developed and undeveloped portions of HPS Phase II and Candlestick Point, including the entire Candlestick Point State Recreation Area (CPSRA), as well as off-site open waters adjacent to the Project site that could be impacted by Project components (Figures 1 and 2). The off-site aquatic resources discussed include Yosemite Slough, the open water area between Candlestick Point and HPS Phase II (known as South Basin), and adjacent open waters that could be impacted by Project components. For purposes of the evaluation of sensitive species, the Study Area is defined as the Project site and a radius of up to 5 miles beyond the Project site. Surveys of Candlestick Point included the Candlestick Park stadium, Alice Griffith housing, the Candlestick Park State Recreation Area (including Yosemite Slough), Jamestown Avenue, and 16 acres near Gilman Avenue and Aurelious Walker Drive. Surveys of HPS Phase II included the Hunters Point Shipyard (Parcels A-E).



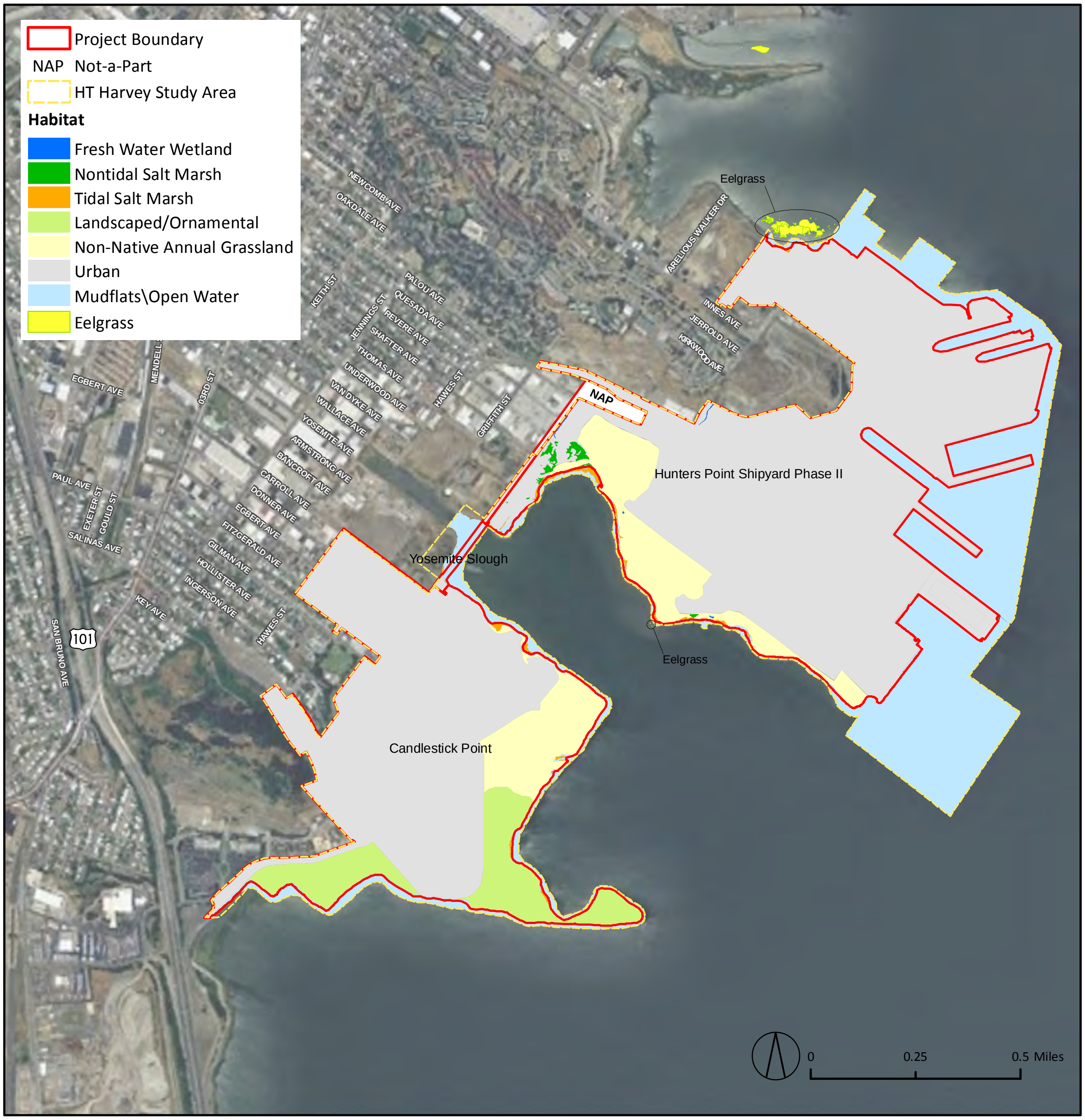
HT Harvey, 2009; LSA Associates, 2004.

PBS&J 10.27.09

FIGURE 1

Candlestick Point - Hunters Point Shipyard Phase II EIR

BIOLOGICAL RESOURCES STUDY AREA



SOURCE: Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007. Golden Gate Audubon Society, Final Report Yosemite Slough Watershed Wildlife Survey, H.T. Harvey & Associates, Hunters Point Shipyard and Candlestick Point State Recreation Areas Final Delineation of Wetlands and other Waters, February 2009 and revised July and October 2009. LSA, July 2004, PBS&J Field Survey, August 2007 and May 2008, Merkel and Associates, 2003 SF Bay eelgrass survey.

PBS&J 10.19.09

FIGURE 2

Candlestick Point - Hunters Point Shipyard Phase II EIR

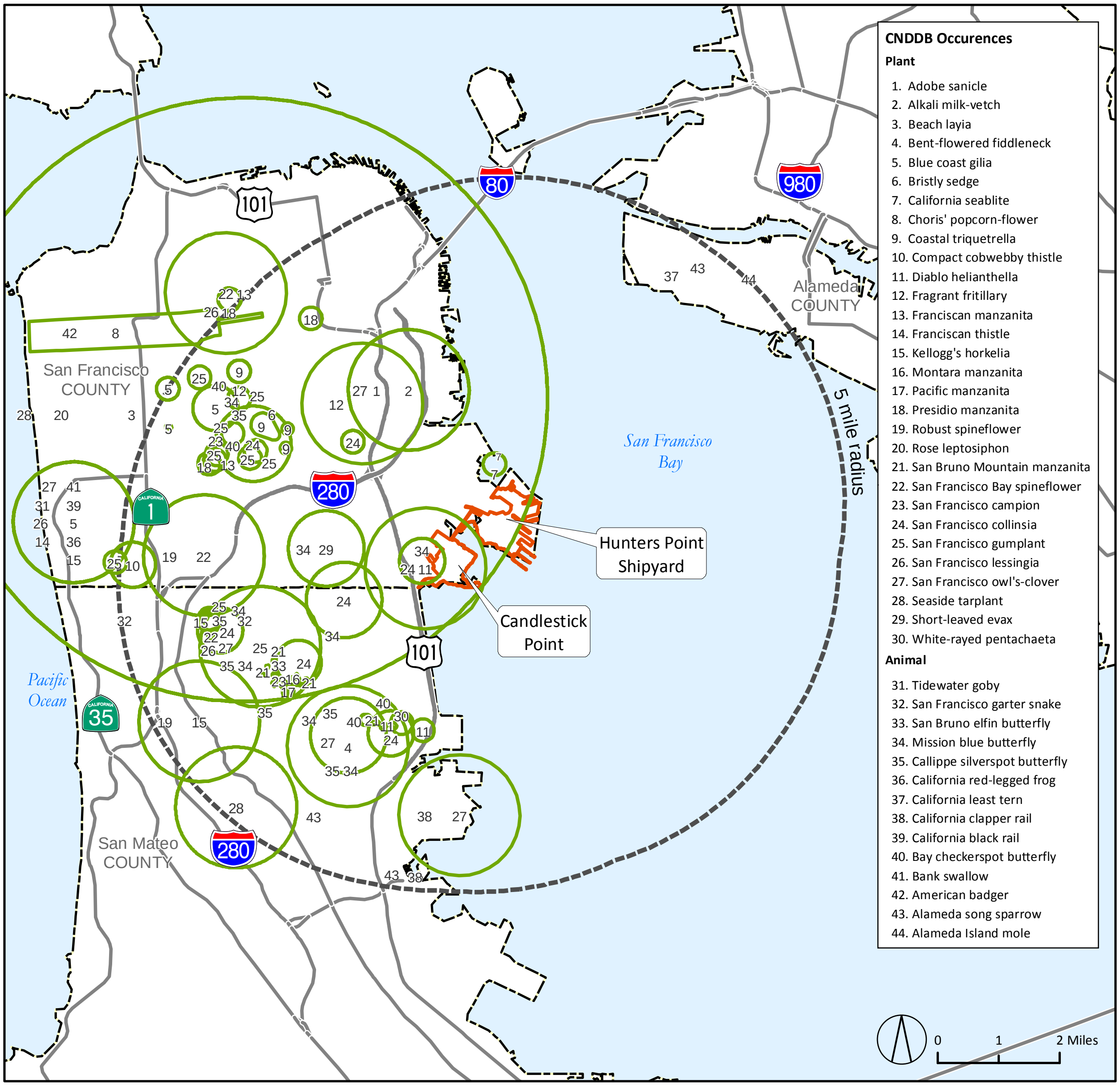
STUDY AREA HABITATS

Prior to visiting the Study Area, PBS&J biologists compiled a list of special-status plant and wildlife species that have the potential to occur in the vicinity of the Study Area. Sources consulted include the California Department of Fish and Game's (CDFG) Natural Diversity Database (CNDDB) for the US Geological Survey's (USGS) 7.5-minute San Francisco South and Hunters Point quadrangles; the California Native Plant Society (CNPS) electronic inventory for the USGS 7.5-minute San Francisco South and Hunters Point quadrangles; the US Fish and Wildlife Service (USFWS) Endangered and Threatened Species list for the USGS 7.5-minute San Francisco South and Hunters Point quadrangles; the *Final Report Yosemite Slough Watershed Wildlife Survey*, LSA, July 2004; the *Final Draft Significant Natural Resource Areas Management Plan*, Sections 6.17 and 6.18, San Francisco Recreation And Park Department, February 2006; the *Draft Wetlands Mitigation and Monitoring Plan*, Navy Base Realignment and Closure Program, November 2006; the *Hunters Point Shipyard and Candlestick Point State Recreation Area*, *Natural Environment Study Report for the Bayview Transportation Improvements Project*, Jones & Stokes, July 2007; the *Final Delineation of Wetlands and Other Waters*, H.T. Harvey & Associates, Revised 13 July 2009 and October 13, 2009; the *Draft Sustainability Plan* for the Project, Arup North America Ltd, March 2009; and Project plans and graphic renderings.

The CNDDB was re-checked in July 2009, and CNDDB records were mapped (Figure 3). Special-status species lists from the CNDDB, USFWS, and CNPS were re-checked on November 2, 2009 to determine whether any species that could potentially occur on the site were added to these databases between the date of initial consultation of these lists and the preparation of the updated report on November 2, 2009.

SURVEY METHODOLOGY

Surveys focused on identification of vegetation communities, special-status species or their potential habitat, and other biotic resources (i.e., potential wetlands or "other waters" of the US). During surveys, biologists walked transects through each habitat type while recording plant and wildlife species observed in field notes. On July 8, 2008, Navy personnel escorted a PBS&J staff biologist through HPS Phase II. The August 2007 and July 2008 surveys were in the dry season, when most annual, biennial, and perennial herbaceous plant species were dormant or had already died back, leaving only dried plant parts (i.e., leaves, stems, fruits) for identification. Lastly, a rare plant survey was conducted in May 2008. The survey was conducted by walking representative transects through the survey area while recording every plant species observed. Although the survey was conducted within the flowering window for the special-status species that could occur within the Project site, the unusually dry weather resulted in a shorter flowering period and thus, most annual, biennial, and perennial herbaceous plant species were dormant or had already died back for the growing season, leaving only dried plant parts (i.e., leaves, stems, fruits) for identification. If a plant species could not be identified in the field, diagnostic plant structures (i.e., fruits or morphology)



SOURCE: California Department of Fish & Game, California Natural Diversity Database, July 2009. **PBS&J 8.04.09**

FIGURE 3 Candlestick Point - Hunters Point Shipyard Phase II EIR

SPECIAL-STATUS SPECIES OCCURENCES WITHIN 5 MILE RADIUS

were collected for further analysis. Some plants observed during the survey could only be identified to the Genus level.[1] Floristic references for identification included *The Jepson Manual: Higher Plants of California*[2], *Plants of the San Francisco Region*[3], and specimens documented during previous CNPS surveys.[4]

Information from the sources listed above and from PBS&J's reconnaissance-level surveys was used to identify and characterize existing conditions at the Project site, and accordingly, was substantially relied upon for this analysis. In particular, LSA's Yosemite Slough Watershed Wildlife Survey (2004) and the Final Delineation of Wetlands and Other Waters conducted by H.T. Harvey & Associates (2009) provided specific information about the Study Area. LSA coordinated a wildlife survey of the Yosemite Slough Watershed between January 2003 and April 2004.[5] The survey of the Yosemite Slough Watershed included both the entire CPSRA and adjacent open water areas between HPS Phase II and the peninsula that forms the eastern extension of CPSRA.[6] From north to south, the Yosemite Slough Watershed Wildlife Survey Study Area is roughly bordered by Thomas Avenue, Ingalls Street, Carroll Avenue, Fitch Street, Arelious Walker Drive, and the Hunters Point Expressway (Figure 1). Although this survey covered only a portion of the Project site, it provides the most comprehensive data set available regarding the occurrence of wildlife in the area, and is thus cited heavily in the descriptions of existing conditions in this section. Also, because the majority of the Project site that was not covered by the Yosemite Slough Watershed Wildlife Survey is developed, we expect wildlife communities elsewhere on the Project site to be similar or depauperate in comparison to, those documented within the Yosemite Slough Survey's study area.

H.T. Harvey & Associates prepared a delineation of wetlands and other jurisdictional waters potentially meeting the regulatory definition of Waters of the United States within a majority of the Project site (February 2009 and revised on July 13 and October 13, 2009).[7] Surveys were conducted in 2008 on September 25 and 26; November 5 and 6; and December 4, 5, and 19; and in 2009 on

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[1] Plants that were identified to the Genus level are not special-status or rare plants, and, therefore, this taxonomic unit of classification does not affect the findings of this report.

[2] Hickman, J. (ed.). *The Jepson Manual: Higher Plants of California*. University of California Press, Berkeley, 1993.

[3] Beidleman, L.H. and Kozloff, E.N. *Plants of the San Francisco Bay Region: Mendocino to Monterey*. University of California Press, Berkeley, 2003.

[4] California Native Plant Society (CNPS), *Electronic plant list; Hunters Point Serpentine Hillside*, R. Hunter and J. Sigg, 2005.

[5] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[6] Ibid.

[7] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters*, San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009

January 29 and 30 and May 20. The delineation included the examination of the above-mentioned areas for wetlands using the routine determination method outlined in the US Army Corps of Engineers (USACE) Wetlands Delineation Manual. H.T. Harvey assessed topographic features, drainages, potential alterations to site hydrology, and areas of significant recent disturbance, and mapped the High Tide Line (HTL). The USACE verified the findings of the delineation with a Jurisdictional Determination dated August 31, 2009. The study area for H.T. Harvey's original wetland delineation did not include several limited areas that are now considered part of the Project site. As a result, H.T. Harvey expanded its original delineation by inspecting these additional areas in the field on October 8, 2009. H.T. Harvey & Associates has amended its wetland delineation report, and verification of jurisdictional boundaries in these additional areas by the USACE is pending. In addition, a tree survey[8] was conducted for the Project by H. T. Harvey & Associates within all of the Project site except the portion of CPSRA that is not subject to the land transfer and is not expected to be substantially modified.

Existing conditions are described with respect to observed plant species, vegetation communities, common aquatic habitats (i.e., mud flats, open water, and eelgrass (*Zostera marina*) beds), common wildlife (i.e.,. invertebrates, reptiles and amphibians, birds, and mammals), common aquatic resources (i.e., fish, shellfish, and mollusks), and sensitive species and habitats (sensitive plants, sensitive vegetation communities, sensitive wildlife [invertebrates, birds, terrestrial mammals, and marine mammals], and sensitive aquatic resources [mollusks, fish, and Essential Fish Habitat (see Sensitive Aquatic Resources)]).

RESULTS

OBSERVED PLANT SPECIES

As listed in Appendix D, a total of 187 vascular plant species were observed within the Project site during all of the biological surveys listed in the Setting section above, 103 of which are non-native. In addition, 66 of the non-native vascular plant species are considered to be invasive plant species.[9] Invasive plants are defined as those that were "moved by humans to another region." These invasive plants have a competitive advantage because they are no longer controlled by their natural predators, and can quickly spread out of control.[10] Widely scattered trees are present and appear to either be horticultural plantings associated with landscaping or represent locally naturalized

[8] H.T. Harvey & Associates, *Candlestick Point/Hunters Point Shipyard Tree Survey*. October 16, 2009.

[9] California Invasive Plant Council (Cal-IPC) Invasive plant definitions 2009. Website: http://www.cal-ipc.org/ip/definitions/index.php. Accessed July 2009.

[10] California Invasive Plant Council (Cal-IPC) Invasive plant definitions 2009. Website: http://www.cal-ipc.org/ip/definitions/index.php. Accessed July 2009.

specimens. Calflora's on-line Plant Name Library was used for the scientific nomenclature for plant names in this section.[11]

VEGETATION COMMUNITIES

For purposes of the biological resources analysis, the Study Area is first described in terms of the vegetation communities it supports, as reflected by Table 1 (Vegetation Communities within the Study Area) and further discussed below. The vegetation communities are defined according to CDFG Wildlife and Habitat Data Analysis Branch List of California Terrestrial Natural Communities[12] and H.T. Harvey & Associates' wetland delineation for HPS Phase II and Candlestick Point.[13]

Figure 2, Study Area Habitats, presents a summary of the vegetation communities observed in the Study Area. This map is a compilation of previously prepared figures for the Study Area and field surveys conducted by PBS&J.[14,15] As depicted on Figure 2, the Study Area contains four non-aquatic vegetation communities: non-native annual grassland, landscaped areas/ornamental plants, salt marsh, and seasonal freshwater wetland. In addition, approximately 568.80 acres of the Study Area is "urban." This habitat is not classified as a "vegetation community" and is thus not included in the "vegetation communities" table. Urban habitat includes developed or paved areas. The Study Area also contains three aquatic habitats: mud flats, eelgrass beds, and open waters. Table 1 provides the total acreages of each vegetation community within the Study Area. A description of each of the vegetation communities follows this table.

In some cases, vegetation communities may also be considered sensitive vegetation communities. In those cases, and there are three such cases in this analysis, they are also discussed under Sensitive Vegetation Communities, which follows this discussion. The three sensitive communities within the Study Area include salt marsh, eelgrass beds, and seasonal freshwater wetland habitats (also discussed under Sensitive Vegetation Communities).

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[11] Calflora, 2009. Website: http://www.calflora.org/index.html. Accessed July 2009.

[12] California Department of Fish and Game (CDFG), *The Vegetation Classification and Mapping Program: List of Terrestrial Natural Communities Recognized by the California Natural Diversity Database,* Wildlife and Habitat Data Analysis Branch, Sacramento, California, September 2003 edition.

[13] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

[14] Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[15] Golden Gate Audubon Society, Final Report Yosemite Slough Watershed Wildlife Survey, LSA, July 2004.

TABLE 1 VEGETATION COMMUNITIES WITHIN THE STUDY AREA

Habitat Type	Candlestick Point	Hunters Point Shipyard	Yosemite Slough	Total Acreage
Non-native Annual Grassland	30.53	44.19	—	74.72
Landscaped Areas/Ornamental Plants[a]	44.67	—	—	44.67
Salt Marsh[a]	0.93	3.56	0.06	4.55
Seasonal Freshwater Wetland[b]	—	0.20		0.20
Mud Flats/ Open Water*	21.82	169.29	4.43	195.54
Totals	***97.95***	***217.24***	***4.49***	***319.68***

SOURCES:

a. H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters, San Francisco, California*, February 2009 and revised July 13 and October 13, 2009.

Acreage discrepancies between the data contained herein and the total approximate acreage of the Study Area are due to the conversion of data from non-GIS to GIS data.

This table does not include the acreage for developed/urban areas (568.80 acres) because this classification is not a recognized vegetation community for purposes of this EIR.

* The open waters located outside of the Project boundary include those adjacent to Candlestick Point, Hunters Point Shipyard, and Yosemite Slough.

Non-native Annual Grassland

Patches of non-native annual grassland habitat are found throughout the Project site and comprise 74.72 acres. Invasive, non-native grasses characterize this community, particularly at HPS Phase II due to the intensive disturbance associated with the Navy's ongoing remediation efforts. The vegetation within this grassland consists of a mixture of invasive annuals such as wild oat (*Avena fatua*), rip-gut brome (*Bromus diandrus*), soft chess (*B. hordeaceus*), rat-tail fescue (*Vulpia myuros*), and hare barley (*Hordeum murinum var. leporinum*). Broad-leaf species occurring within the grasslands consist of wild radish (*Raphanus sativus*), painted charlock (*R. raphanistrum*), black mustard (*Brassica nigra*), Mediterranean linseed (*Bellardia trixago*), cut-leaf plantain (*Plantago coronopus*), spring vetch (*Vicia sativa*), red valerian (*Centranthus ruber*), and Italian thistle (*Carduus pycnocephalus*). Additionally, garland chrysanthemum (*Chrysanthemum coronarium*) has naturalized across much of the grasslands and showy stands of these flowers are present throughout the entire CPSRA.

Small distinct colonies of native perennial bunch grasses grow in a few areas at HPS Phase II. Clusters of single species or a combination of species including purple needle grass (*Nassella pulchra*), blue wild rye (*Elymus glaucus*), and red fescue (*Festuca rubra*) grow sporadically throughout the Project site. These small isolated occurrences of native grasses are not large enough to warrant identification as a separate vegetation community. Portions of the Study Area, including uplands along Yosemite Slough, include ruderal vegetation such as fennel (*Foeniculum vulgare*) intermixed with non-native grasses such as wild oats and Italian rye (*Lolium multiflorum*). Shrubs, mainly coyote brush (*Baccharis pilularis*), are scattered throughout the upland surrounding Yosemite Slough area.

Landscaped Areas/Ornamental Plants

Landscaped areas make up about 44.67 acres of Candlestick Point and include areas landscaped with native and non-native ornamental shrubs and trees, particularly near the walking paths along the shoreline of Candlestick Point. The tree survey[16] was conducted for the Project identified trees primarily in areas mapped as "Landscaped/Ornamental", "Urban", and "Non-Native Annual Grassland" on Figure 2. For the purpose of this survey, a "tree" was defined as any stem of a woody plant with a tree-like (as opposed to shrubby) growth habit measuring at least 2 inches in diameter at a height of 4.5 feet above the ground. As a result, single trees with multiple stems measuring at least 2 inches in diameter were represented as multiple "trees," and the high number of trees recorded during this survey was driven largely by such multi-stemmed individuals. The tree survey recorded approximately 1,876 tree stems at least 2 inches in diameter on 1,027 individual plants on Candlestick Point and 724 tree stems at least 2 inches in diameter on 283 individual plants on HPS Phase II.

On Candlestick Point, the vast majority of these trees consisted of multi-stemmed lollypop trees (*Myoporum laetum*); eucalyptus (*Eucalyptus* spp.), pines (*Pinus* spp.), and olives (*Olea europeaea*) were also well represented on Candlestick Point. All four of these species are non-natives. The most common native trees on Candlestick Point are California live oak (*Quercus agrifolia*), flannel bush (*Fremontodendron californicum*), and California buckeye (*Aesculus californica*). Monterey pine (*Pinus radiata*) and ornamental cypress (*Cupressus* spp.) are also common, although neither is native to San Francisco. There are several specimens of the native California bay (*Umbellularia californica*) and blue elderberry (*Sambucus nigra* ssp. *caerulea*) as well. Non-native, ornamental lollypop trees (*Myoporum laetum*) grow along the northwestern edge of Candlestick Point, and Australian tea trees (*Leptospermum laevigatum*) are scattered along the trails of the CPSRA. Native shrubs include coyote bush, ornamental buckbrush (*Ceanothus* spp.), firethorn (*Pyracantha* spp.), coffeeberry (*Rhamnus californica*), hummingbird sage (*Salvia spathacea*), and black sage (*S. mellifera*) which grow along the paths in clusters that are a combination of planted and volunteer specimens. Non-native evergreen shrubs such as rockrose (*Cistus* spp.) are common throughout the Project site and in some locations have naturalized.[17]

On HPS Phase II, trees recorded during the tree survey were dominated by small, multi-stemmed toyon (*Heteromeles arbutifolia*; a native species, though the trees on HPS appear to be of an ornamental variety) and several non-natives, including London planetree (*Platanus* x *acerifolia*) and acacia (*Acacia* spp.).

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[16] H.T. Harvey & Associates, *Candlestick Point/Hunters Point Shipyard Tree Survey*. October 16, 2009.

[17] Naturalized plants are those that were originally installed as ornamental plantings but are now found growing 'naturally' in a variety of habitats.

Salt Marsh

Salt marsh habitat forms along the margins of estuaries and bays whose shorelines are shallow and protected. In the Study Area, it totals approximately 4.50 acres on site and 0.05 acre in areas of off-site (i.e., areas of Yosemite Slough outside of the Project boundary) Project work.[18] It occurs in limited areas along the shoreline where riprap does not extend to the waterline and prohibit the growth of vegetation, and in several nontidal areas in the southwestern portion of HPS. Narrow patches of salt marsh habitat, varying in length from 20 to 100 feet, occur sporadically along the shoreline of the Project site, and throughout Yosemite Slough.[19]

Salt marshes are often subject to tidal influences, and species composition of tidal salt marsh vegetation varies along gradients based on elevation. The amount of time an area is inundated determines the primary species of plants found there. The highest elevations typically support almost pure stands of pickleweed (*Salicornia virginica*), which also dominates the patches of nontidal salt marsh on HPS. Associated species that occur in the zone around the high tide elevation include salt grass (*Distichlis spicata*), European sea rocket (*Cakile maritima*), coastal gumweed (*Grindelia stricta*), and sea lavender (*Limonium californicum*). Slightly lower areas above the Mean High Water (MHW) elevation support cord grass (*Spartina* spp.). In the area above the HTL, common iceplant (*Carpobrotus edulis*) grows in some locations, carpeting the upland margins in a dense monoculture. The low growing shrub silver beach bur (*Ambrosia chamissonis*) also grows in the upland areas along the shoreline.

Seasonal Freshwater Wetland

Seasonal freshwater wetland habitat occupies 0.20 acre in two linear features at the southern and west-central margins of HPS Phase II. These wetlands are characterized by the presence of annual wetland grasses and forbs in depressions that hold water for a short to medium duration during the rainy season. One of these wetlands, in the southwestern portion of HPS Phase II, consists of pools that pools are shallow basins that lack drainage outlets. Seasonal water inundation in these pools creates a condition favoring hydrophytic (water-loving) plants such as spearscale (*Atriplex triangularis*), salt grass, bird's-foot trefoil (*Lotus corniculatus*), prickly ox-tongue (*Picris echioides*), saltmarsh bulrush (*Bolboschoenus robustus*), Italian ryegrass (*Lolium multiflorum*), rabbit's foot grass (*Polypogon monspeliensis*), and willow dock (*Rumex salicifolius*), as observed in HPS Phase II. The

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[18] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters*, San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

[19] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters*, San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

second seasonal freshwater wetland, in the west-central part of HPS Phase II, consists of a narrow swale/ditch that is apparently fed by groundwater seepage.

COMMON AQUATIC HABITATS

Mudflats

Mud flats are the broad expanses of the San Francisco Bay bottom that are exposed during low tides. These areas are comprised of very soft sediments and do not support any vegetation other than eelgrass beds, which may occur within mud flats. Mud flats are an important habitat because they support a vast array of crustaceans, worms, and other invertebrates that are important food sources for resident and migratory shorebirds and waterfowl. Mud flats are exposed at low tides once or twice a day along the shore south of CPSRA and along the shorelines of Yosemite Slough and South Basin. These mud flats are relatively limited in extent compared to the vast mud flats present in other parts of San Francisco Bay, and as a result, numbers of shorebirds using these mud flats are low except for occasional, brief migratory pulses of birds.

Open Water (San Francisco Bay)

San Francisco Bay (also referred to as "the Bay" in this section) is the largest estuary on the California Coast, covering between 400 and 1,600 square miles depending on which bays are included.[20] Fresh water enters primarily through the Sacramento-San Joaquin Delta and mixes with seawater that enters via the Golden Gate. Tidal action and freshwater runoff determine the salinity of the Bay. For the purpose of this assessment, the term "open water" refers to unvegetated tidal areas located below the MHW elevation, which in this area is approximately 5.87 feet relative to the North American Vertical Datum of 1988 (NAVD88)[21] or 11.80 relative to the San Francisco City Datum (SFCD).[22] This is the same area regulated by the USACE under Section 10 of the *Rivers and Harbors Act*. These areas are subject to the normal ebb and flood of the tide. For example, mud flat habitats described above are a subset of open water aquatic habitats since these areas are inundated for at least half the tidal cycle; for this reason, acreages of mud flat and open water habitats are not distinguished in Table 1. Open water habitats support an array of relatively common estuarine/marine species from encrusting tunicates, sponges, and algae to bottom-dwelling fish such

[20] The Bay Institute, *About the Bay*. 2008. Website: http://www.bay.org/about_the_bay.htm. Accessed October 28, 2008.

[21] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

[22] San Francisco City Datum (SFCD) is a local vertical geodetic reference system specific to the City and County of San Francisco and formally established in 1964 as 8.616 feet above the National Geodetic Vertical Datum of 1929 (NGVD29), making it about 8.13 feet above mean sea level. The North American Vertical Datum was established in 1988 (NAVD88) and generally has replaced NGVD29 as a standard reference. Elevations expressed in NGVD29 may be converted to NAVD88 by adding 2.69 feet.

as the Pacific halibut (*Hippoglossus stenolepis*), flounder, and sole, to more open water fish such as the Pacific herring (*Clupea pallasi*), Pacific sardine (*Sardinops sagax*), and anchovies (*Anchoa* spp.). The on-site open waters are those nearshore areas below the MHW elevation where Project work could occur (i.e., sea wall enhancements and marina improvements). Off-site open waters within a 5-mile radius of the Project site were also considered for their potential to support sensitive species (as described under "Sensitive Species and Habitats" below). These areas are considered here because most of the sensitive species potentially occurring there have the ability to move to and from the Study Area at any time.

Eelgrass Beds

Eelgrass is an aquatic plant found on soft mud-bottom bays and estuaries along the Pacific coast. It occurs in both subtidal and intertidal areas of San Francisco Bay and approximately 1.99 acres of it occur within the Study Area.[23] Eelgrass beds are considered a sensitive resource and, therefore, are discussed in detail under Sensitive Species and Habitats.[24]

COMMON WILDLIFE

Invertebrates

Fourteen butterfly species were observed during the Yosemite Slough Watershed Wildlife Survey.[25] Common butterflies observed during that survey included cabbage whites (*Pieris rapae*), anise swallowtails (*Papilio zelicaon*), and common checkered skippers (*Pyrgus communis*). Other butterflies observed include mustard white (*Pieris napi*), orange sulphur (*Colias eurytheme*), California hairstreak (*Satyrium californicum*), gray hairstreak (*Strymon melinus*), western pygmy-blue (*Brephidium exile*), spring azure (*Celastrina ladon*), west coast lady (*Vanessa annabella*), red admiral (*Vanessa atalanta*), common buckeye (*Junonia coenia*), and common ringlet (*Coenonympha tullia*). Numerous other invertebrate species, including insects, crustaceans, worms, and other taxa, occur on the site as well.

Reptiles and Amphibians

The Yosemite Slough Watershed Wildlife Survey recorded three snake species, two lizard species, and one amphibian.[26] Reptiles and amphibians observed included California slender salamander

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[23] California Department of Fish and Game (CDFG), *The Vegetation Classification and Mapping Program: List of Terrestrial Natural Communities Recognized by the California Natural Diversity Database*, Wildlife and Habitat Data Analysis Branch, Sacramento, California, September 2003 edition.

[24] California Department of Fish and Game (CDFG), *The Vegetation Classification and Mapping Program: List of Terrestrial Natural Communities Recognized by the California Natural Diversity Database*, Wildlife and Habitat Data Analysis Branch, Sacramento, California, September 2003 edition.

[25] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[26] Ibid.

(*Batrachoseps attenuatus*), southern alligator lizard (*Elgaria multicarinata*), western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis melanoleucus*), ring-necked snake (*Diadophis punctatus*), and western garter snake (*Thamnophis elegans*). The western fence lizard, California slender salamander, and southern alligator lizard were found in relatively high numbers, with survey maxima (i.e., the maximum number of individuals observed on a single survey) of 49, 43, and 21 individuals, respectively. However, the other species were represented by few individuals, suggesting that populations of these other species are sparse in the area.

Amphibians had the lowest diversity within the Yosemite Slough Watershed Survey area, with only one species observed (the California slender salamander).[27] The California slender salamander frequents grassland, chaparral, woodland, forest, and yards and vacant lots in some suburban areas. It takes refuge under logs, boards, bark, and in damp leaf litter and rotting logs. It lays its eggs in late fall and winter, often in communal nests.[28] The San Francisco Bay and the small seasonal wetlands on the site do not provide suitable aquatic habitat for amphibians, primarily due to high salinity. The few freshwater habitats on or near the Project site do not provide breeding habitat for amphibians such as frogs or toads, likely because of their very shallow and/or ephemeral nature.[29]

Reptiles also appeared to have relatively low diversity, with only five species observed. The abandoned fields, extensive debris (providing cover), and presence of prey (i.e., mice, invertebrates, salamanders) provide suitable habitat for these five species.[30] The upland areas, dominated by disturbed vegetation and non-native grassland, support the snake and lizard species.[31]

During one survey, 21 southern alligator lizards were observed in silvery beachweed along the shoreline of the South Basin (refer to Map 2 of the Yosemite Slough Watershed Wildlife Survey for a graphic representation of the location of the South Basin).[32] The lizards were all juveniles and may have been from a single clutch that had been laid in the silvery beachweed.[33]

Although the Yosemite Slough Watershed Wildlife Survey covered only Candlestick Point and the southern shoreline of HPS Phase II, it is expected that a lower abundance of these common reptile and amphibian species would be found within the disturbed areas within HPS Phase II than at Candlestick Point. Recent, intensive disturbance due to ongoing remediation activities has undoubtedly reduced populations of these species on HPS Phase II. A few individuals of these

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[27] Ibid.

[28] Stebbins, R., Peterson, *Field Guides: Western Reptiles and Amphibians*, Houghton Mifflin Company, 1966.

[29] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[30] Ibid.

[31] Ibid.

[32] Ibid.

[33] Ibid.

reptiles and amphibians may occur within the developed portions of the Project site, which represents approximately 80 percent of the overall acreage of the site, but numbers are expected to be very low in such low-quality habitat.

Birds

One hundred and eighteen bird species (which are named herein according to the American Ornithologists' Union Checklist of North American Birds[34] except for sensitive subspecies recognized by CDFG or USFWS) were observed during the Yosemite Slough Watershed Wildlife Survey.[35] Of these, 51 species were represented by a maximum count of five or fewer individuals, indicating that, for many bird species, the site is used by relatively low numbers of individuals.[36] The majority of the species observed were terrestrial species, followed by shorebirds, waterfowl, gulls and terns, and raptors (in descending order). Terrestrial habitats supported large numbers of some common bird species such as white-crowned sparrows (*Zonotrichia leucophrys*), western meadowlarks (*Sturnella neglecta*), and house finches (*Carpodacus mexicanus*). The landbirds that are most abundant on the site are those associated with the weedy, ruderal habitats dominating the Project site and those tolerant of the urbanization and associated disturbance resulting from the site's location. In contrast, very few Neotropical and other long-distance migrant songbirds were recorded during this study. Studies have documented that bird species diversity is closely associated with structural habitat complexity. Bird species diversity (a measure of the number of species in a given area) increases with increasing foliage height diversity (a measure of the number and diversity of vertical layers of vegetation in that area).[37,38] While this has been best studied in breeding birds, the structural complexity of habitat also influences the degree to which an area provides resources to migrant birds. Multi-layered vegetation, with well-developed ground, understory, and canopy layers, would support greater diversity of migrants than the structurally simple vegetation that dominates most of Candlestick Point and HPS Phase II. Also, breeding bird abundance is often closely associated with the density or volume of vegetation, with increasingly dense vegetation supporting more individual birds[39]. The sparse vegetation present on most of the Project site limits the value of the site to breeding and migratory birds. Numbers and diversity of landbirds on HPS Phase II are likely lower than on Candlestick Point owing to the recent, intensive disturbance and even lower abundance of trees and shrubs on HPS Phase II.

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[34] American Ornithologists' Union (AOU), *Check-list of North American Birds (1998)* through Forty-ninth Supplement, July 2008.

[35] Ibid.

[36] Ibid.

[37] MacArthur, R. H. and J. W. MacArthur. 1961. On bird species diversity. Ecology 42:594-598.

[38] Karr, J. R. 1968. Habitat and avian diversity on strip-mined land in east-central Illinois. Condor 70:348-357.

The waters of the South Basin and the Bay surrounding the Study Area are used by a variety of waterbirds, some of which are fairly abundant. Common waterbirds observed in these waters include double-crested cormorant (*Phalacrocorax auritus*), California gull (*Larus californicus*), greater scaup (*Aythya affinis*), ruddy duck (*Oxyura jamaicensis*), surf scoter (*Melanitta perspicillata*), and bufflehead (*Bucephala albeola*). While these birds forage primarily or solely in aquatic habitats, some species, such as cormorants, California brown pelicans (*Pelecanus occidentalis californicus*), gulls, and possibly terns roost in large numbers on piers on HPS Phase II. Small numbers (fewer than 10 pairs) of western gulls (*Larus occidentalis*) nest on two rocks in South Basin known as Double Rock. Shorebirds such as the western sandpiper (*Calidris mauri*), least sandpiper (*Calidris minutilla*), and dunlin (*Calidris alpina*) forage on intertidal mud flats and along the shoreline of Candlestick Point and the southern part of HPS Phase II, typically in low numbers but occasionally in higher numbers when migratory pulses of shorebirds are present in the Bay. The majority of the Study Area is developed or urbanized and supports relatively few species of birds.

In addition to the 118 bird species recorded during the Yosemite Slough Watershed Wildlife Survey, that survey's report listed an additional 36 species that had been recorded by a local birder, Mr. Alan Hopkins, over the past 20 years.[40]

Mammals

The most abundant mammal observed during the Yosemite Slough Watershed Wildlife Survey was the California ground squirrel (*Spermophilus beecheyi*). This species was observed along the shoreline and riprap areas of HPS Phase II and Candlestick Point, as well as in grassland and ruderal habitats and under trees and shrubs on Candlestick Point. The substrate along the shoreline is composed mostly of small rubble such as broken bricks that had been used as fill. Riprap composed of large rocks was placed along exposed sections of the shoreline, providing refugia for small mammals.[41] Other mammals observed during the survey included feral domestic cat (*Felis silvestris*), feral domestic dog (*Canis familiaris*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), harbor seal (*Phoca vitulina*), black-tailed jackrabbit (*Lepus californicus*), Botta's pocket gopher (*Thomomys bottae*), California vole (*Microtus californicus*), and Norway rat (*Rattus norvegicus*). Of the 10 species recorded by the LSA study, three are non-natives (domestic dog, domestic cat, and Norway rat); two are common urban-adapted species (raccoon and striped skunk); and one occurs infrequently in aquatic areas (harbor seal). Of the remaining four species, the Botta's pocket gopher and California vole were represented by no more than one individual on a given survey and thus may be uncommon

[39] Mills, G. S., J. B. Dunning, Jr., and J. M. Bates. 1991. The relationship between breeding bird density and vegetation volume. Wilson Bulletin 103:468-479.

[40] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[41] Ibid.

on the site. As mentioned for reptiles and amphibians above, mammal diversity and abundance on HPS Phase II are expected to be lower than on Candlestick Point, as recent, intensive disturbance by remediation activities has likely reduced mammal populations there. The shorelines, vacant lots, and undeveloped ruderal/non-native grassland areas of HPS Phase II and CPSRA are surrounded by urban and industrial development, which limits the potential for dispersal of mammals in and out of the site. There are no CNDDB reports of the occurrence of any special-status mammal species in the Study Area.

COMMON AQUATIC RESOURCES

Fish, Crabs, and Mollusks

San Francisco Bay supports a diverse assemblage of fish species. These vary from resident fish such as assorted flat fish (flounder and sole) to a variety of rockfish (*Sebastes* spp.) and to migratory species such as Pacific herring, Pacific sardines, anchovies, and salmonids (*Oncorhynchus* spp.) which spend varying portions of their life cycle in the Bay. Estuaries provide important spawning habitat for fish and the San Francisco Bay is no exception. Pacific herring spawn in the Bay and support a small commercial fishery. Other fish for which adults spawn in the Bay include flounder, sole, and Pacific halibut. Juvenile sturgeon (*Acipenser* spp.) rear in the Bay for an undetermined length of time before moving to the ocean.

Shellfish found in the Bay and within the vicinity of the Study Area include Dungeness crab (*Cancer magister*), other rock crab, and shrimp. Dungeness are the target of an important commercial fishery in the open ocean and the Bay is important rearing habitat for young crab. Crab hatch in the Gulf of the Farallones and after several larval stages, migrate into the Bay and rear primarily in San Pablo and Suisun bays,[42] over 20 miles north of the Study Area.

The Bay also supports a variety of mollusks. These include native clams, mussels, oysters, and snails (gastropods). Some of these are native (i.e., bent-nosed macoma [*Macoma nasuta*], Olympia oyster [*Ostrea conchaphila*], and limpets [*Acmaea* spp.]) while others have been introduced either intentionally such as the Atlantic oyster (*Crassostrea virginica*) or unintentionally such as overbite clam (a.k.a. Asian clam; *Corbula amurensis*). Many of the clams use soft-bottom sediments and could be found on the seafloor near the Project site. Most oysters require a solid substrate for attachment. Suitable habitat for oysters and mussels is found throughout the Study Area on bulkheads, pilings, and riprap associated with the shoreline.

[42] California Department of Fish and Game (CDFG), 2009. Dungeness crabs (*Cancer magister*). Website: http://www.delta.dfg.ca.gov/baydelta/monitoring/cmag.asp. Accessed July 16, 2009.

In addition to the native fish and shellfish, the Bay supports a vast array of introduced species. Most of these have been introduced in ballast water of trans-Pacific traveling cargo ships. Species suspected of being ballast water introductions include Chinese mitten crab (*Eriocheir sinensis*), yellowfin goby (*Acanthogobius flavimanus*), and overbite clam. Other species, including striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*), have been introduced to support sport fisheries. The complex interaction between introduced and native species within the Bay continues to be the topic of much debate and study.

The open water of the Study Area is part of or directly connected to the Bay and all of the Bay fish species can move freely into and out of the Study Area at any time. Because of this, the species assemblage within and adjacent to the Project site is expected to be representative of the central Bay as a whole.

The portion of the San Francisco Bay immediately adjacent to the Project site has been highly modified over the years to support commercial shipping, industrial uses, and US Naval activities, and virtually the entire shoreline of the Study Area is composed of fill of various kinds. As a result, the shorelines are almost exclusively comprised of bulkheads and riprap. Dredging of shipping channels has occurred within the nearshore areas. All of these actions have combined to reduce the aquatic habitat complexity. Reductions in habitat complexity reduce the number of species that routinely utilize a particular area,[43] and, therefore, the numbers of resident fish species within the Study Area are expected to be similar to other developed areas of the Bay.

Marine Mammals

The most common marine mammals within San Francisco Bay are harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*), both of which are protected under the *Marine Mammal Protection Act*. The *Marine Mammal Protection Act* does not bestow a particular status designation for the species it protects, which is similar to the *Migratory Bird Treaty Act*. Instead, the *Marine Mammal Protection Act* and the *Migratory Bird Treaty Act* equally protect all marine mammals and native birds, respectively.

Harbor Seal (*Phoca vitulina*)

Harbor seals are year-round residents found throughout the Bay. They use haulouts scattered through the Bay to bask, rest, and use as pupping sites. The most frequently used pupping sites are in the North (Castro Rocks) and South bays (Mowry Slough); both sites are over 15 miles from the Study Area. Pupping season begins in late March and peaks in early May.[44] The closest haulout site

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[43] Moyle, P.B. *Inland Fishes of California, 2nd Edition*, University of California Press.

[44] Richmond Bay Bridge Harbor Seal Team. No date. Harbor Seal. Website: http://userwww.sfsu.edu/~halmark/educati.htm. Accessed October 31, 2008.

is on Yerba Buena Island, about 6 miles from the Project site.[45] There are no known haulout locations within the Study Area. During the 2003–2004 Yosemite Slough Watershed Wildlife Survey, LSA observed nine harbor seals in the outer South Basin (open water between Candlestick Point and HPS Phase II); however, no haulouts were detected during the survey.[46] No harbor seals or haulouts were observed during surveys by PBS&J biologists for this Project.

California Sea Lion (*Zalophus californianus*)

California sea lions do not breed in the Bay, preferring offshore islands such as the Channel Islands near Santa Barbara or the Farallon Islands, but sea lions forage and rest at various locations around the San Francisco Peninsula.[47] They are relatively social animals, frequently seen basking or foraging in large groups. On May 2, 2003, a total of ten sea lions were observed hauled out on a flat, floating structure in the outer South Basin.[48] Sea lions may occur in the Study Area, but the site does not support any known haulout locations.

SENSITIVE/JURISDICTIONAL VEGETATION COMMUNITIES AND HABITATS

Waters of the United States/State and Navigable Waters

The Study Area contains several categories of jurisdictional waters of the United States, including jurisdictional wetlands that are subject to Section 404 of the *Clean Water Act* (Section 404). The types of wetlands include salt marsh and seasonal freshwater wetlands. In addition, the Study Area also contains open waters of the San Francisco Bay, which are subject to both Section 404 of the *Clean Water Act* and Section 10 of the *Rivers and Harbors Act of 1899* (Section 10). Section 404 regulates the placement of fill into any "waters of the United States." Waters of the United States are broadly defined to include navigable waterways, their tributaries, lakes, ponds, and wetlands, including tidal waters and wetlands from the HTL seaward. Section 10 regulates the placement of fill into navigable waters of the United States, including tidal waters from the MHW elevation seaward. All of these wetlands and other waters are also regulated by the State under Section 401 of the *Clean Water Act* and under the *Porter-Cologne Water Quality Control Act*. A more detailed discussion of the regulations protecting wetlands and other waters is provided in the Regulatory Framework section below.

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[45] San Francisco State University. No date. *Richmond Bridge Harbor Seal Survey Site Map*. Website: http://userwww.sfsu.edu/~halmark/map.htm. Accessed October 31, 2008.

[46] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.

[47] Marine Mammal Center 2002. *California Sea Lion information sheet*. Website: http://www.marinemammalcenter.org/learning/education/pinnipeds/casealion.asp. Accessed October 31, 2008.

[48] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.

A wetland delineation was conducted by H.T. Harvey & Associates for the Study Area that distinguished jurisdictional wetlands and other waters of the United State/State.[49] The revised H.T. Harvey & Associates wetland delineation was submitted to the USACE in July 2009 and was verified in August 2009. The study area for that delineation included the Project site and the off-site areas where Project activities would occur (Figure 4). As indicated on Figure 4, the study area for H.T. Harvey's original wetland delineation did not included several limited areas that are now considered part of the Project site. As a result, H.T. Harvey expanded its original delineation by inspecting these additional areas in the field on October 8, 2009. H.T. Harvey & Associates has amended its wetland delineation report, and verification of jurisdictional boundaries in these additional areas by the USACE is pending.

According to USACE regulations and guidance, other waters may include lakes, seasonal ponds, channels, tributary waters, non-wetland linear drainages, and seasonal springs. Such areas are identified by the (seasonal or perennial) presence of standing or running water and generally lack hydrophytic vegetation.

In tidal waters, Section 404 other waters extend to the landward extent of vegetation associated with salt or brackish water or the HTL. The HTL is defined as the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The HTL may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gauges, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm. Confirmation of this definition and approach used by the San Francisco District of the USACE in determining the MHW and HTL locations was obtained from the Regulatory Branch of the USACE on January 29, 2009.[50] The HTL represents the upper limit of Section 404 other waters and is approximately 1.5 to 2 vertical feet above the MHW mark.[51]

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[49] H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters,* San Francisco, California, February 2009 and revised July 13, 2009 and October 13, 2009.

[50] Ibid.

[51] Ibid.

SOURCE: HT Harvey, 2009; Moffat & Nichol, 2009; PBS&J, 2009.

PBS&J 10.27.09

FIGURE 4

Candlestick Point - Hunters Point Shipyard Phase II EIR

WETLANDS AND OTHER WATERS

Table 2 (Wetlands and Other Waters of the United States [Section 404] within the Study Area) presents the acreage of waters of the United States (including jurisdictional wetlands) that were delineated for the Study Area. The acreages of jurisdictional wetlands and waters identified in Table 2 include the HT Harvey study area boundary as identified in Figure 4 (which includes open waters adjacent to Candlestick Point and HPS Phase II), as well as off-site areas of Yosemite Slough that are located outside of this boundary.

TABLE 2 WETLANDS AND OTHER WATERS OF THE UNITED STATES (SECTION 404) WITHIN THE STUDY AREA

	Area		Yosemite Slough		
Jurisdictional Feature (Waters of the United States)	**Candlestick Point**	**Hunters Point Shipyard**	**On Site**	**Off Site**	**Total Acreage**
Freshwater Wetland	—	0.20	—	—	0.20
Non-tidal Salt Marsh	—	1.81	—	—	1.81
Tidal Salt Marsh	0.93	1.75	0.01	0.05	2.74
"Other 404 Waters"	21.82	169.29	1.66	2.77	195.54
Totals for Section 404 Wetlands and Waters of the US	***22.75***	***173.05***	***1.67***	***2.82***	***200.29***

SOURCE: H.T. Harvey & Associates, *Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters, San Francisco, California*, February 2009 and revised July 13, 2009 and October 13, 2009.

a. Total equals sum of Freshwater Wetland, Non-tidal Salt Marsh, Tidal Salt Marsh, and Other 404 Waters

b. On-site areas within Yosemite Slough refer to areas within the Study Area. Off-site areas within Yosemite Slough are those areas adjacent to the slough that are outside of the Study Area boundary.

SPECIAL-STATUS AND SENSITIVE SPECIES

The potential for special-status plant and wildlife species to occur within the Study Area was determined by assessing habitat suitability information collected during biological reconnaissance surveys conducted in August 2007 and July 2008, a rare plant survey conducted in May 2008, and a review of the CNDDB, CNPS Inventories, and USFWS databases, as previously described. In addition, approximately 29 wildlife surveys were conducted in the vicinity of Yosemite Slough between January 2003 and April 2004 (in association with the Yosemite Slough Watershed Wildlife Survey), and that survey's report included a list of additional bird species that had been observed by Mr. Alan Hopkins over the past 20 years.[52] The list of potentially occurring special-status species provided in Table 3 (Special-Status Species Potentially Occurring within the Study Area) is informed by all of these sources, as well as a search of known sensitive species occurrences within a 5-mile radius of the Project site.

[52] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.

- Special-status species are defined as follows:
- Species listed, proposed, or candidate for listing as Threatened or Endangered by the USFWS pursuant to the federal *Endangered Species Act of 1973* (FESA), as amended
- Species designated by the USFWS as Species of Conservation Concern
- Species designated by the National Marine Fisheries Service (NMFS) as Species of Special Concern
- Species listed as Rare, Threatened, or Endangered by the CDFG pursuant to the *California Endangered Species Act of 1984* (CESA), as amended
- Species designated as Fully Protected under Sections 3511 (birds), 4700 (mammals), and 5050 (reptiles and amphibians) of the *California Fish and Game Code*
- Species designated by the CDFG as California Species of Special Concern
- Plant species listed as Category 1B and 2 by the CNPS; CNPS Category 3 and 4 species were not considered special-status species for the sake of this assessment, as they are not considered sufficiently rare on a regional level to warrant such status, though no such plants were recorded in the Study Area.
- Species not currently protected by statute or regulation, but considered rare, threatened or endangered under Section 15380 of the CEQA Guidelines (such as the Olympia oyster and Pacific herring)

Table 3 identifies the special-status plant and wildlife species that have been recorded or could occur within five miles of the Study Area, along with a description of their habitat requirements, protection status, and a brief description of each species' likelihood to be present within the Study Area. Several species known to occur within five miles of the Study Area and listed in Table 3 were determined not likely to occur or to be absent from the Study Area because (1) the site lacks suitable habitat or is outside of the species' range and, (2) no instances of such species were observed during any of the field surveys). Consequently, the detailed species' discussions and impact analysis in this technical report address only those species in Table 3 that have a "Low" or better probability to occur within the Study Area. Those species or habitats with a "Not Likely" or "Absent" likelihood of occurrence in Table 3 are not addressed further because they are not expected to occur on the Study Area or be affected by Project implementation.

Special-status species lists from the CNDDB, CNPS, and USFWS, originally consulted in 2008, appear in Appendices A, B, and C, respectively. These lists were re-checked on November 2, 2009 to determine whether any species that could potentially occur on the site were added to these databases between the date of initial consultation of these lists and the preparation of the updated

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
			Plants	
Adobe sanicle	*Sanicula maritima*	none/SR/1B.1	Chaparral, coastal prairie, meadows and seeps, and valley and foothill grasslands in association with clay or serpentine soils. 98–787 feet (30–240 meters); blooms February–May	**Not Likely.** Suitable habitat for this species occurs in the Study Area. However, there are no recorded occurrences of this species within 5 miles of the Study Area, and none were observed during rare plant surveys of suitable habitat in 2007 and 2008 by PBS&J.
Alkali milk-vetch	*Astragalus tener* var. *tener*	none/none/1B.2	Playas, valley and foothill grassland with adobe clay, and vernal pools with alkaline soils. 0–2051 feet (0–625 meters); blooms May–September.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area.
Arcuate bush-mallow	*Malacothamnus arcuatus*	none/none/1B.2	Chaparral and cismontane woodland. 82–295 feet (25–90 meters); blooms April–September.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area.
Beach layia	*Layia carnosa*	FE/SE/1B.1	Coastal dunes and coastal scrub with sandy soils. 0–197 feet (0–60 meters); blooms March–July.	**Not Likely.** Coastal scrub does not occur in the Study Area. This species was not observed during surveys conducted by PBS&J in 2007 and 2008.
Bent-flowered fiddleneck	*Amsinckia lunaris*	none/none/1B.2	Coastal bluff scrub, cismontane woodland, and valley and foothill grassland habitats. 10–1,640 feet (3– 500 meters); blooms March–June	**Not Likely.** Although there is one recorded occurrence of this species within 5 miles of the Study Area, no species of *Amsinckia* were observed during floristic surveys conducted in 2005 by CNPS[53] and in 2007 and 2008 by PBS&J.

[53] California Native Plant Society (CNPS), Yerba Buena Chapter, Electronic plant list; Hunters Point Serpentine Hillside, R. Hunter and J. Sigg, 2005.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Big-scale balsamroot	*Balsamorhiza macrolepis* var. *macrolepis*	none/none/1B.2	Occurs in chaparral, cismontane woodland, and valley and foothill grassland, sometimes in serpentine soil substrates at elevations ranging from 295–4,593 feet (90–1,400 meters); blooms March–June.	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Balsamorhiza* were observed during floristic surveys conducted in 2005 by CNPS[54] and in 2007 and 2008 by PBS&J.
Blue coast gilia	*Gilia capitata* ssp. *chamissonis*	none/none/1B.1	Coastal dunes and coastal scrub. 7–656 feet (2–200 meters); blooms April–July.	**Not Likely.** Coastal scrub does not occur in the Study Area. There are no recorded occurrences of this species within 5 miles of the Study Area.
Bristly sedge	*Carex comosa*	none/none/2.1	Coastal prairie, marshes and swamps (along lake margins), and valley and foothill grassland. 0–2,051 feet (0–625 meters); blooms May–September.	**Not Likely.** Marsh habitat in the Study Area has been highly degraded. This species was not observed during surveys conducted by Caltrans in 2007.[55]
California seablite	*Suaeda californica*	FE/none/1B.1	Marshes and swamps with coastal salt marsh. 0–49 feet (0–15 meters); blooms July–October.	**Not Likely.** Marsh habitat in the Study Area has been highly degraded. This species was not observed during surveys conducted by Caltrans in 2007.[56]
Coastal triquetrella	*Triquetrella californica*	none/none/1B.2	A moss that occurs in coastal bluff scrub and coastal scrub. 33–328 feet (10–100 meters).	**Not Likely.** Coastal scrub does not occur in the Study Area.

[54] Ibid.

[55] Caltrans, Natural Environmental Study Report for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[56] Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Compact cobwebby thistle	*Cirsium occidentale* var. *compactum*	none/none/1B.2	Chaparral, coastal dunes, coastal prairie, and costal scrub. 16–492 feet (5–150 meters); blooms April–June.	**Not Likely.** Coastal scrub does not occur in the Study Area. No native species of *Cirsium* were observed during floristic surveys conducted in 2005 by CNPS[57] and in 2007 and 2008 by PBS&J.
Crystal Springs lessingia	*Lessingia arachnoidea*	none/none/1B.2	Cismontane woodland, coastal scrub, and valley and foothill grassland habitats, in association with serpentinite soils along roadsides. 197–656 feet (60–200 meters); blooms July–October	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Lessingia* were observed during floristic surveys conducted by CNPS[58] and PBS&J in 2007 and 2008.
Diablo helianthella	*Helianthella castanea*	none/none/1B.2	Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and valley and foothill grassland. 197–4,265 feet (60–1,300 meters); blooms March–June.	**Not Likely.** Chaparral or oak woodland absent in Study Area.
Fountain thistle	*Cirsium fontinale* var. *fontinale*	FE/SE/1B.1	Openings in chaparral habitats; valley and foothill grassland habitats in association with serpentinite seeps. 295–574 feet (90–175 meters); blooms June–October	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no native species of *Cirsium* were observed during floristic surveys conducted by CNPS[59] and PBS&J in 2007 and 2008.

[57] California Native Plant Society (CNPS), Yerba Buena Chapter, Electronic plant list; Hunters Point Serpentine Hillside, R. Hunter and J. Sigg, 2005.

[58] Ibid.

[59] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Fragrant fritillary	*Fritillaria liliacea*	none/none/1B.2	Cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grassland habitats often in association with serpentinite soils. 10–1,345 feet (3–410 meters); blooms February–April	**Not Likely.** Although there is one recorded occurrence of this species within 5 miles of the Study Area, no species of *Fritillaria* were observed during floristic surveys conducted by CNPS[60] and PBS&J in 2007 and 2008.
Franciscan manzanita	*Arctostaphylos hookeri* ssp. *franciscana*	none/none/1A	Coastal scrub with serpentinite soil substrates. 197–984 feet (60–300 meters); blooms February–April.	**Not Likely.** Serpentinite soil substrates do not occur within Study Area. No recorded occurrences of this species within 5 miles of the Study Area. No species of *Arctostaphylos* were observed during surveys conducted by Caltrans in 2007[61] and PBS&J in 2007 and 2008.
Franciscan onion	*Allium peninsulare* var. *franciscanum*	SLC/none/1B.2	Clay and serpentine soils on dry hillsides in woodlands and valley and foothill grasslands 170–984 feet (52–300 meters); blooms May–June.	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Allium* were observed during floristic surveys conducted by CNPS[62] and PBS&J in 2007 and 2008.
Franciscan thistle	*Cirsium andrewsii*	none/none/1B.2	Broadleafed upland forest, coastal bluff scrub, coastal prairie, and coastal scrub habitats, often in association with serpentinite soils. 0–492 feet (0–150 meters); blooms March–July	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no native species of *Cirsium* were observed during floristic surveys conducted by CNPS[63] and PBS&J in 2007 and 2008.

[60] Ibid.

[61] Caltrans, Natural Environmental Study Report for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[62] California Native Plant Society (CNPS), Yerba Buena Chapter, Electronic plant list; Hunters Point Serpentine Hillside, R. Hunter and J. Sigg, 2005.

[63] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Hillsborough chocolate lily	*Fritillaria biflora* var. *ineziana*	none/none/1B.1	Cismontane woodland and valley and foothill grassland habitats in association with serpentinite soils. 492 feet (150 meters); blooms March–April	**Not Likely.** Known only from the Hillsborough area. Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no native species of *Fritillaria* were observed during floristic surveys conducted by CNPS[64] and PBS&J in 2007 and 2008.
Kellogg's horkelia	*Horkelia cuneata* ssp. *sericea*	none/none/1B.1	Closed-cone coniferous forest, chaparral, coastal dunes, and coastal scrub with sandy or gravelly openings. 33–656 feet (10–200 meters); blooms April–September.	**Not Likely.** Coastal scrub does not occur in the Study Area.
Marin western flax	*Hesperolinon congestum*	FT/ST/1B.1	Chaparral and valley and foothill grassland habitats in association with serpentinite soils. 16–1214 feet (5–370 meters); blooms April–July	**Not Likely.** Although there are recorded occurrences of this species within 5 miles of the Study Area, no species of *Hesperolinon* were observed during floristic surveys conducted by CNPS and PBS&J in 2007 and 2008.
Montara manzanita	*Arctostaphylos montaraensis*	none/none/1B.2	Chaparral and coastal scrub. 492–1,640 feet (150–500 meters); blooms January–March.	**Not Likely.** Coastal scrub does not occur in the Study Area. No species of *Arctostphylos* were observed during surveys conducted by Caltrans in 2007[65] and PBS&J in 2007 and 2008.
Most beautiful jewel-flower	*Streptanthus albidus* ssp. *permoenus*	none/none/1B.2	Chaparral, cismontane woodland, valley and foothill grasslands, often on serpentine soils. 361–3,281 feet (110–1,000 meters); blooms April–June.	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Streptanthus* were observed during floristic surveys conducted by CNPS and PBS&J in 2007 and 2008.

[64] Ibid.

[65] Caltrans, Natural Environmental Study Report for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Pacific manzanita	*Arctostaphylos pacifica*	none/SE/1B.2	Chaparral and coastal scrub. 1,083 feet (330 meters); blooms February–April.	**Not Likely.** Coastal scrub does not occur in the Study Area. Species of *Arctostaphylos* not identified during surveys.
Point Reyes bird's-beak	*Cordylanthus maritimus* ssp. *palustris*	none/none/1B.2	Coastal salt marsh. 0–33 feet (0–10 meters); blooms June–October.	**Not Likely.** Marsh habitat in the Study Area is of marginal quality and has been highly degraded. This species was not observed during surveys conducted by Caltrans in 2007.[66] Observed in adjacent off-site locations to the Yosemite Slough area according to the Yosemite Slough IS/MND.[67] Was not observed in the Yosemite Slough area during 2005 surveys conducted by LSA.
Presidio clarkia	*Clarkia franciscana*	FE/SE/1B.1	Occurs in coastal scrub and valley and foothill grassland, often on serpentine soils. 82–1,099 feet (25–335 meters); blooms May–July	**Not Likely.** Known from fewer than five occurrences. The closest two known populations are in the San Francisco Presidio approximately 6 miles northwest. Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Clarkia* were observed during floristic surveys conducted by CNPS[68] and PBS&J in 2007 and 2008.
Presidio manzanita	*Arctostaphylos hookeri ssp. ravenii*	FE/SE/1B.1	Chaparral, coastal prairie, and coastal scrub with serpentinite outcrops. 148–705 feet (45–215 meters); blooms February–March.	**Not Likely.** Serpentinite soil substrates do not occur within Study Area; however, there are no recorded occurrences of this species within 5 miles of the Study Area. Species of *Arctostaphylos* not identified during surveys.

[66] Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.

[67] California State Parks Foundation, Draft Initial Study –Mitigated Negative Declaration for the Candlestick Point State Recreation Area Yosemite Slough Restoration Project, December 2005.

[68] California Native Plant Society, California Native Plant Society, Yerba Buena Chapter, Electronic plant list; R. Hunter and J. Sigg, 2005.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Robust spineflower	*Chorizanthe robusta* var. *robusta*	FE/none/1B.1	Chaparral, cismontane woodlands (in openings), coastal dunes, coastal scrub with sandy or gravelly soil. 10–984 feet (3–300) meters; blooms April–September.	**Not Likely.** Coastal dunes are absent from the Study Area. Remnant dunes in the Study Area are disturbed habitat. This species was not observed during surveys conducted by PBS&J in 2007 and 2008.
Rose leptosiphon	*Leptosiphon rosaceus*	none/none/1B.1	Coastal bluff scrub. 0–328 feet (0–100 meters); blooms April–July.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area.
San Bruno Mountain manzanita	*Arctostaphylos imbricata*	none/SE/1B.1	Chaparral and coastal scrub with rocky substrate. 902–1,214 feet (275–370 meters); blooms February–May.	**Not Likely.** Coastal scrub does not occur in the Study Area. Species of *Arctostaphylos* not identified during surveys.
San Francisco Bay spineflower	*Chorizanthe cuspidate* var. *cuspidata*	none/none/1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, and coastal scrub with sandy soils. 10–705 feet (3–215 meters); blooms April–July (uncommon in August).	**Not Likely.** Coastal scrub does not occur in the Study Area.
San Francisco campion	*Silene vercunda* ssp. *verecunda*	none/none/1B.2	Coastal bluff scrub, chaparral, coastal prairie, coastal scrub, and valley and foothill grassland with sandy soil. 98–2,116 feet (30–645 meters); blooms March–June (uncommon in August).	**Not Likely.** Coastal scrub does not occur in the Study Area.
San Francisco Collinsia	*Collinsia multicolor*	none/none/1B.2	Closed-cone coniferous forest and coastal scrub (sometimes with serpentinite soil). 98–820 feet (30–250 meters); Blooms March–May.	**Not Likely.** Coastal scrub does not occur in the Study Area.
San Francisco gumplant	*Grindelia hirsutula* var. *maritima*	none/none/1B.2	Coastal bluff scrub, coastal scrub, and valley and foothill grassland habitats in association with sandy or serpentinite soils. 49–1,312 feet (15–400 meters); blooms June–September	**Not Likely.** Although there are a number of recorded occurrences of this species within 5 miles of the Study Area, this species was not observed during floristic surveys conducted by CNPS[69] and PBS&J in 2007 and 2008.

[69] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
San Francisco Lessingia	*Lessingia germanorum*	FE/SE/1B.1	Coastal scrub (remnant dunes). 82–295 feet (25–90 meters); blooms July–November (uncommon in June).	**Not Likely.** Coastal scrub does not occur in the Study Area. This species was not observed in sandy soil areas during surveys; no species of *Lessingia* were observed during floristic surveys conducted by CNPS[70] and PBS&J in 2007 and 2008.
San Francisco owl's-clover	*Triphysaria floribunda*	none/none/1B.2	Coastal prairie, coastal scrub, and valley and foothill grassland habitats in association with serpentinite soils. 33–525 feet (10–60 meters); blooms April–June	**Not Likely.** Although there is one recorded occurrence of this species within 5 miles of the Study Area, no species of *Triphysaria* has been observed during floristic surveys conducted by CNPS[71] and PBS&J in 2007 and 2008.
San Francisco popcornflower	*Plagiobothrys diffusus*	None/SE/ 1B.1	Occurs in coastal prairie and valley and foothill grassland. 197–1,181 feet (60–360 meters); blooms March–June.	**Not Likely.** Known from fewer than ten occurrences. Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Plagiobothrys* were observed during floristic surveys conducted by CNPS[72] and PBS&J in 2007 and 2008.
SanMateo thorn-mint	*Acanthomintha duttonii*	FE/SE/1B.1	Chaparral and valley and foothill grassland habitats, often on serpentinite soil substrates. 164–984 feet (50–300 meters); blooms April–June	**Not Likely.** Serpentinite soil substrates do not occur within Study Area, however there are no recorded occurrences of this species within 5 miles of the Study Area; species of *Acanthomintha* were not observed during floristic surveys conducted by CNPS[73] and PBS&J in 2007 and 2008.

[70] Ibid.
[71] Ibid.
[72] Ibid.
[73] Ibid.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Santa Cruz microseris	*Stebbinsoseris decipiens*	none/none/1B.2	Openings in broadleafed upland forest, closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub, valley and foothill grasslands, sometimes on serpentine soils. 33–1,640 feet (10–500 meters); blooms April–May.	**Not Likely.** Although potentially suitable habitat and soil substrates are present, there are no recorded occurrences of this species within 5 miles of the Study Area; no species of *Stebbinsoseris* were observed during floristic surveys conducted by CNPS[74] and PBS&J in 2007 and 2008.
Short-leaved evax	*Hesperevax sparsiflora* var. *brevifolia*	none/none/2.2	Coastal bluff with sandy soil and coastal dunes. 0–705 feet (0–215 meters); blooms March–June.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area.
White-rayed pentachaeta	*Pentachaeta bellidiflora*	FE/SE/List 1B.1	Occurs in cismontane woodland and valley and foothill grassland, often in serpentinite. 115–2034 feet (35–620 meters); blooms March–May	**Not Likely.** Although there is one recorded occurrence of this species within 5 miles of the Study Area, no species of *Pentachaeta* were observed during floristic surveys conducted by CNPS[75] and PBS&J in 2007 and 2008.
Sensitive Natural Communities				
Coastal brackish marsh (salt marsh)		CDFG Sensitive Habitat		**Known.** The Study Area supports representative assemblages of plant species associated with this community type. Degraded occurrences of this sensitive natural community are present along the southern portion of HPS Phase II site, along Yosemite Slough, and patches along the Candlestick Point shoreline.[76]
Invertebrates				

[74] Ibid.

[75] Ibid.

[76] H.T. Harvey & Associates, Hunters Point Shipyard and Candlestick Point State Recreation Area Final Delineation of Wetlands and Other Waters, San Francisco, California, February 2009 and revised July 13, 2009 and October 2, 2009.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT/none/none Critical habitat	All habitats for the bay checkerspot are on shallow, serpentine-derived, or similar soils. These soils support the plants on which the caterpillars (larvae) feed the primary larval host plant is dwarf plantain (*Plantago erecta*). In many years, the plantain dries up and the larvae transfer to a second host plant, Indian paintbrush, or purple owl's clover (*Castilleja exserta* spp. *exerta*), which remains edible later in the season.	**Not Likely.** It is not likely that there is a sufficient population of plantain to support Bay checkerspot in the Study Area.[77] Sites that support this species provide greater topographic heterogeneity than the serpentine grassland in the Study Area. Although there are a number of recorded occurrences for this species within 5 miles of the Study Area, this species was extirpated from the closest location of historical occurrence (San Bruno Mountain) in the 1980's.
Callippe silverspot butterfly	*Speyeria callippe callippe*	FE/none/none	Occurs in grassland habitats around the northern Bay Area containing Johnny jump-up (*Viola pedunculata*), which is the larval host plant for this species.	**Not Likely.** Although there are a number of recorded occurrences within 5 miles of the Study Area, *V. pedunculata* has not been observed within the Study Area. In addition, although there are nearby occurrences, there is an insufficient population of this species' host plant within the Study Area to sustain a population of this species.[78]

[77] Kobernus, P., Senior Biologist, TRA Environmental Sciences, Inc., email to PBS&J, August 30, 2007.
[78] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Mission blue butterfly	*Plebejus* [*Icaricia*] *icarioides missionensis*	FE/none/none	The adults feed on hairy false goldenaster (*Heterotheca villosa*), blue dicks (*Dichelostemma capitatum*), and seaside buckwheat (*Eriogonum latifolium*). They do not wander far from the three species of lupine that are the larval food plant: silver lupine (*Lupinus albifrons*), summer lupine (*L. formosus*), and many-colored lupine (*L. versicolor*). Females lay eggs throughout the mating flight. The eggs are laid singly on leaves, stems, flowers, and seedpods of lupine species.	**Not Likely.** Although there are a number of recorded occurrences for this species within 5 miles of the Study Area, including one from the Bayview Hill area, the Study Area does not support a substantial stand of lupine (*Lupinus* spp.) to support this species. [79] Isolated lupine plants intermixed within ruderal vegetation was observed along the Candlestick Point area, near Yosemite Slough. One or two lupine plants were observed in this area during the May 5, 2008 survey, but this would not constitute habitat for this species.
Monarch butterfly (wintering)[80]	*Danaus plexippus*	none/none/ESHA	Occur in many open habitats including fields, meadows, weedy areas, marshes, and roadsides. Adults migrate from August to October, flying south to hibernate along the California coast and in central Mexico. During migration and wintering, butterflies roost in trees and form huge aggregations. Caterpillars feed exclusively on milkweed (*Asclepias* spp.); early in the season, adults sip nectar from dogbane (*Apocynum* spp.), lilac (*Ceanothus* spp.), red clover (*Trifolium pratense*), *Lantana* spp., and thistles (*Cirsium* spp.). In the fall adults visit composites including goldenrods (*Solidago californica*), blazing stars (*Liatris spicata*), ironweed (*Vernonia* spp.), and tickseed sunflower (*Bidens* spp.).	**Known, but Not Likely roosting.** Although individuals have been observed on the site, there is no record of monarch butterfly autumnal (i.e., temporary bivouac site) or over-wintering use of the Study Area in the CNDDB and other records, including anecdotal observations. The nearest observations of such roosts are at Fort Mason, the Presidio of San Francisco, and Stern Grove. The modification of Hunters Point and Candlestick Park would not affect those sites.[81]

[79] United States Fish and Wildlife Service (USFWS), Endangered and Threatened Wildlife and Plants*: Proposed Determination of Critical Habitat for Six Butterflies and Two Plants*, 42 Federal Register 7972, February 8, 1977.

[80] Wintering habitat is considered an Environmentally Sensitive Habitat Area by the California Coastal Commission.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Myrtle's silverspot butterfly	*Speyeria zerene myrtleae*	FE/none/none	Occurs in grassland habitats around the northern Bay Area. The larval host plant is hookspur violet (*Viola adunca*). Adults feed on nectar from flowers including hairy gumweed, coastal sand verbena (*Abronia latifolia*), mints (or monardella) (*Monardella* spp.), bull thistle (*Cirsium vulgare*), and seaside fleabane (*Erigeron glaucus*).	**Not Likely.** There are no recorded occurrences of this species within 5 miles of the Study Area. The Study Area does not support the suitable host plants for this species.
San Bruno elfin butterfly	*Callophyrs* [*Incisalia*] *mossii bayensis*	FE/none/none	Endemic to the coastal mountains near San Francisco Bay. Eggs are laid in small clusters or strings on the upper or lower surface of broadleaf stonecrop (*Sedum spathulifolium*). The adult food plants have not been fully determined but Montara Mountain colonies are suspected to use Montara manzanita (*Arctostaphylos montaraensis*) and California huckleberry (*Vaccinium ovatum*).	**Not Likely.** There are a number of recorded occurrences for this species within 5 miles of the Study Area. However, the San Bruno elfin is found in the fog-belt of steep north facing slopes that receive little direct sunlight. It lives near prolific growths of the larval food plant, stonecrop, which is a low growing succulent. The Study Area does not support suitable larval and adult host plants.[82]
			Mollusks	
Black abalone	*Haliotes cracherodii*	FC/none/none	Endemic to Santa Barbara Channel Islands.	**Absent.** The Study Area is outside the range of this species.
White abalone	*Haliotes sorenseni*	FE/none/none	Rocky marine subtidal (to 200 feet deep) and extreme lower intertidal (below 15 feet deep) habitats. Current population extremely depleted.	**Absent.** The Study Area is too shallow and modified to provide suitable habitat.

[81] Monroe, M., Ranger, Muir Woods National Monument, telephone conversation with Todd Wong, July 16, 2008.
[82] Kobernus, P., Senior Biologist, TRA Environmental Sciences, Inc., email to PBS&J, August 30, 2007.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Olympia oyster	*Ostreola conchaphila*	none/none/CEQA	Native Olympia oysters were historically abundant in San Francisco Bay, and small populations of native oysters have been documented within the Bay. Suitable substrate includes solid surfaces to which the larvae can easily attach.	**High.** Because the larval forms of oysters are free-floating in the Bay and a large population exists south of the Study Area at Oyster Point Marina, native oysters are likely present on suitable substrate throughout the Study Area.
			Fish	
Pacific herring	*Clupea pallasi*	none/none/CEQA	Pacific herring generally enter the Bay from November through April of each year and spawn in intertidal and sub-tidal habitats.	**Known.** According to NMFS, known herring spawning areas within the Study Area include several piers and areas of shoreline both north and south of the proposed marina.
Chinook salmon –Spring-run ESU	*Oncorhynchus tshawytscha*	FT/ST/none	Central Valley streams with stable water supply, clean gravel, and good quality riparian habitat. Spawning occurs only in tributaries to the Sacramento River.	**Low.** The Study Area is outside the migratory corridor for this species. Adults migrate from the Golden Gate into the Sacramento River.
Chinook salmon –Winter-run ESU	*Oncorhynchus tshawytscha*	FE/ST/none Critical habitat	Central Valley streams with stable water supply, clean gravel, and good quality riparian habitat. Spawning occurs upstream of the Red Bluff Diversion Dam.	**Low.** The Study Area is generally outside the migratory corridor for this species. Adults migrate from the Golden Gate into the Sacramento River. Study Area is outside of designated critical habitat.
Chinook salmon –Fall/Late Fall-run ESUs	*Oncorhynchus tshawytscha*	SC/SSC/none	The most abundant Chinook in the Central Valley. Fall/Late fall-run fish spawn in streams with stable water supply, clean gravel, and good quality riparian habitat.	**Low.** The Study Area is generally outside the migratory corridor for this ESU. A population exists in the South Bay that would migrate past the Study Area on the way to and from the ocean. The origin and status of this population is unclear (refer to text).

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Coho salmon—Central California ESU	*Oncorhynchus kisutch*	FE/SE/none	Spawning in accessible coastal streams, generally in areas with complex instream habitat, heavy forest cover, and high quality water. Juveniles rear in these areas for two years before migrating to the ocean.	**Absent.** This species does not currently exist in the San Francisco Bay.[83]
Delta smelt	*Hypomesus transpacificus*	FT/SE/none	Endemic to the Sacramento-San Joaquin Delta. Adults spawn in freshwater in the upper Delta. The rest of the year, they reside primarily in the interface between salt and freshwater of the Sacramento-San Joaquin Delta at salinities less than 2 parts per million.	**Absent.** The Study Area is outside the known range of this species.
Longfin Smelt	*Spirinchus thaleichthys*	none/ST/none	Native to San Francisco Bay. Adults spawn in upper estuary in early winter. Larvae are dispersed by downstream flow and distribution is determined by outflow. Adults found outside the Bay in some years.	**Moderate.** Based on a 2009 status review, distribution of larval fish is determined by outflow from the Sacramento-San Joaquin River Estuary where adults spawn.[84] As they develop swimming ability, they could disperse into the Study Area. They are captured as by-catch in the Bay for bay shrimp (*Crangon franciscorum*).
Green sturgeon	*Acipenser medirostris*	FT/SSC/none Proposed Critical Habitat	Migrates through the San Francisco Bay to spawning grounds in the upper Sacramento River. Juveniles move into the estuary and likely rear in San Francisco Bay.	**High.** The species likely forages in the Bay including the area near the Study Area. The Study Area is within proposed critical habitat for this species.

[83] Caltrans, Biological Assessment for the Bayview Transportation Improvements Project, Jones and Stokes, July 2007.
[84] California Department of Fish and Game (CDFG), *A Status Review of the Longfin Smelt (Spirinchus thaleichthys) in California, January 2009.*

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Steelhead—Central California Coast DPS	*Oncorhynchus mykiss*	FT/none/none Critical habitat	Spawns in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for one or more years before migrating to the ocean.	**High.** Juveniles and adult steelhead could be found in the open waters adjacent to the Study Area as they migrate to and from streams in the San Francisco Bay. Populations are known from relatively nearby creeks on the peninsula (i.e., San Francisquito Creek). The Study Area is within designated critical habitat for this DPS.
Steelhead—Central Valley DPS	*Oncorhynchus mykiss*	FT/none/none Critical habitat	Spawns in cool, clear, well-oxygenated streams. Juveniles remain in freshwater for one or more years before migrating to the ocean.	**Low.** Even though their primary migratory pathway is into the Sacramento River, juveniles and adult steelhead could potentially be found in the Bay near the Project. The Study Area is outside of designated critical habitat for this DPS.
Tidewater goby	*Eucyclogobius newberryi*	FE/SSC/none	Brackish water habitats along coast, fairly still but not stagnant water and high oxygen levels.	**Absent.** The shoreline of the Study Area is influenced by tidal activity. Brackish water habitat absent. Due to degradation lagoon/estuary habitat does not exist.[85]
Amphibians				
California red-legged frog	*Rana aurora draytonii*	FT/SSC/none	Permanent and semi-permanent freshwater habitats, such as creeks and cold-water ponds, with emergent and submergent vegetation.	**Not Likely.** Perennial freshwater habitat is absent from the Study Area. There are no CNDDB records for this species in the vicinity of the Study Area.
Reptiles				
Green turtle	*Chelonia mydas*	FT/none/none	Shallow water with sufficient submergent vegetation. Breeds on islands often but also on mainland sandy beaches.	**Absent.** Suitable habitat for this species does not occur in the Study Area.

[85] Caltrans, *Biological Assessment for the Bayview Transportation Improvements Project*, Jones and Stokes, July 2007.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Leatherback turtle	*Dermochelys coriacea*	FE/none/none	Marine, open ocean often near continental shelf. Nests on sloped sandy beaches often near deep water.	**Absent.** Suitable habitat for this species does not occur in the Study Area.
Loggerhead turtle	*Caretta caretta*	FT/none/none	Open ocean up to 500 miles off shore. Nests on sandy beaches seaward of well developed dunes.	**Absent.** Suitable habitat for this species does not occur in the Study Area.
Olive (=Pacific) ridley sea turtle	*Lepidochelys olivacea*	FT/none/none	Near shore less and 15 km. bottom dwelling sea turtle, nests on sandy beaches.	**Absent.** Suitable habitat for this species does not occur in the Study Area.
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	FE/ST/FP	Inhabits ponds, streams, rivers, and reservoirs, typically with riparian or emergent vegetation. Requires upland areas for aestivation and nesting, usually within 100 yards of permanent water source.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area. There are no CNDDB records for this species in the vicinity of the Study Area.
Western pond turtle	*Actinemys marmorata*	none/SSC/none	Typically inhabit ponds, slow-moving streams and rivers, irrigation ditches, and reservoirs with abundant emergent and/or riparian vegetation.	**Not Likely.** Suitable habitat for this species does not occur in the Study Area. There are no CNDDB records for this species in the vicinity of the Study Area.
			Birds	
Alameda song sparrow	*Melospiza melodia pusillula*	none/SSC/none	Tidal salt marsh habitats along the edge of the Bay and streams where tidal flow effects the vegetation.	**Low.** Salt marsh along Yosemite Slough and the HPS shoreline provides marginal habitat for this species due to its limited extent. Song sparrows were observed between January 2003 and April 2004 along Yosemite Slough, however it is unknown whether these were Alameda song sparrows.
American peregrine falcon (nesting)	*Falco pergrinus anatum*	Delisted/SE (proposed delisted)/FP	Frequents bodies of water in open areas with cliffs and canyons nearby for cover and nesting. Known to nest on artificial substrates (bridges, buildings, etc)	**Known.** A pair of American Peregrine falcons was observed nesting in the Gantry Crane on Parcel D of the HPS Phase II site. The pair has raised several young at this location.[86]

[86] Nelson, G., Facility Coordinator, Navy, field visit with PBS&J, July 8, 2008.

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Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Bank swallow (nesting)	*Riparia riparia*	none/ST/none	Nests in steep sandy banks where it excavates burrows.	**Not Likely.** Although individuals have been observed in the vicinity, the Study Area does not provide suitable nesting habitat.
Barrow's goldeneye	*Bucephala islandica*	none/SSC/none	Breeds in high central & northern Sierra Nevada Mountains, near wooded mountain lakes or large streams. Nest in tree cavities, such as a deserted nest-hole of a pileated woodpecker or flicker; also use nest boxes.	**Known.** Although observed near the site during migration and winter, the Study Area does not provide suitable nesting habitat and is well outside the species' breeding range.
Bryant's savannah sparrow	*Passerculus sandwichensis alaudinus*	none/SSC/none	Frequents low tidally influenced habitats, adjacent to ruderal areas, moist grasslands within and just above the fog belt, and grasslands.	**Low.** Salt marsh along Yosemite Slough and the HPS shoreline provides marginal habitat for this species due to its limited extent. Savannah sparrows were observed between January 2003 and April 2004 along Yosemite Slough, however it is unknown whether these were Bryant's savannah sparrows.
Burrowing owl	*Athene cunicularia*	none/SSC/none	Found in open, dry grasslands, deserts, and ruderal areas. Requires suitable small mammal burrows.	**Known.** This species has been observed in the past on Candlestick Point and at HPS, and suitable foraging habitat is present on the site. Although suitable conditions for nesting are present, the species is not known to have nested on the site. Currently, it is either absent, or it occurs sporadically as a non-breeding visitor.
California black rail	*Laterallus jamaicensis coturniculus*	none/ST/FP	Inhabits tidal salt marshes bordering larger bays, or other freshwater and brackish marshes, at low elevations.	**Not Likely.** Small mats of pickleweed adjacent to brackish wetlands are too limited in extent and too highly disturbed to provide suitable habitat. Tidal zone is very narrow.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
California brown pelican (rookery and communal roosts)	*Pelecanus occidentalis californicus*	FPD/SPD[87]/FP	Typically in littoral ocean zones, just outside the surf line; nests on offshore islands.	**Known.** This species was observed roosting on piers within the Study Area. However, suitable nesting habitat for this species does not occur in the Study Area. The Study Area is outside this species' current breeding range.
California clapper rail	*Rallus longirostris obsoletus*	FE/SE/FP	Restricted to salt marshes and tidal sloughs; usually associated with heavy growth of pickle-weed; feeds on mollusks removed from the mud in sloughs.	**Not Likely.** Suitable habitat does not occur in the Study Area. Salt marsh is highly disturbed and limited in the Study Area. Yosemite Slough is a tidal slough, but suitable habitat for the rail is absent because the existing salt marsh in Yosemite Slough is very narrow and unsuitable. The lack of tidal channels within those marshes, feeding into Yosemite Slough further reduce habitat quality.
California least tern (nesting colony)	*Sternula antillarum browni*	FE/ST/FP	Nests on sandy, upper ocean beaches, and occasionally uses mud flats; forages on adjacent surf line, estuaries, or the open ocean.	**Not Likely.** Suitable nesting habitat does not occur in the Study Area. Individuals may forage in the open water adjacent to the Study Area.
Common loon	*Gavia immer*	none/SSC/none	Nesting locations at certain large lakes & reservoirs in interior of state, primarily in northeastern plateau region. Bodies of water regularly frequented are extensive, fairly deep, and produce quantities of large fish.	**Known.** Although observed near the site during migration and winter, the Study Area does not provide suitable nesting habitat and is well outside the species' breeding range.

[87] California Department of Fish and Game (CDFG) news release: *Fish and Game Commission votes to remove California brown pelican from State Endangered Species List*. February 17, 2009.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Harlequin duck (nesting)	*Histrionicus histrionicus*	none/SSC/none	Usually nests along shores of shallow, swift rivers with plentiful aquatic invertebrates.[88]	**Known.** This species was observed perching on the piers in the HPS Phase II site. However, the Study Area does not provide suitable nesting habitat for this species. The Study Area is outside this species' current breeding range.
Loggerhead shrike	*Lanius ludovicianus*	none/SSC/none	Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting. Typically nests in broken woodlands, savannah, pinyon-juniper, Joshua tree, and riparian woodlands, desert oases, scrub, and wash.	**Known.** Non-native grasslands provide suitable foraging habitat. Loggerhead shrike has been observed by Alan Hopkins at the CPSRA.[89] Although suitable conditions for nesting are present, the species is not known to have nested on the site. Currently, it is either absent, or it occurs sporadically as a non-breeding visitor.
Marbled murrelet	*Brachyramphus marmoratus*	FT/SE/none	Mature, coastal coniferous forests for nesting; nearby coastal water for foraging; nests in conifer stands greater than 150 years old and may be found up to 35 miles inland; winters on subtidal and pelagic waters often well offshore.	**Absent.** Suitable habitat not present in the Study Area.
Northern harrier	*Circus cyaneus*	none/SSC/none	Coastal salt & fresh-water marsh. Nest & forage in grasslands, from salt grass in desert sink to mountain cienegas. Nests on ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	**Known.** Salt marsh and ruderal habitats provide suitable foraging habitat for this species, which has been observed by Alan Hopkins at the CPSRA.[90] However, suitable breeding habitat is absent due to the limited extent of marsh, human disturbance, and vulnerability of this ground-nesting species to predation.

[88] California Department of Fish and Game (CDFG). Website: http://www.dfg.ca.gov/whdab/html/B096.html. Accessed April 6, 2005.
[89] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.
[90] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
San Francisco yellowthroat	*Geothlypis trichas sinuosa*	none/SSC/none	Inhabits emergent wetland habitat, and is a resident and summer visitor in the San Francisco Bay area. Nests are usually placed on or within 8 cm (3 inches) of ground; and may be positioned over water in emergent aquatic vegetation, dense shrubs, or other dense growth.	**Moderate.** Salt marsh along Yosemite Slough and the HPS shoreline provides potential habitat for this species. The existing salt marsh provides marginal habitat due to its limited extent. Common yellowthroats were observed between January 2003 and April 2004 along Yosemite Slough, however it is unknown whether these were San Francisco yellowthroats.[91]
Short-eared owl	*Asio flammeus*	none/SSC/none	Found in swamplands, both fresh and salt; lowland meadows; irrigated alfalfa fields. Tule patches/tall grass needed for nesting/daytime seclusion. Nests on dry ground in depression concealed in vegetation.	**Known.** Salt marsh and ruderal habitats provide suitable foraging habitat for this species, which has been observed by Alan Hopkins at the CPSRA.[92] However, suitable breeding habitat is absent due to the limited extent of marsh, human disturbance, and vulnerability of this ground-nesting species to predation.
Short-tailed albatross	*Phoebastria albatrus*	FE/none/none	Pelagic; nests on offshore islands in north Pacific.	**Absent.** Suitable habitat does not occur in the Study Area.
Tricolored Blackbird	*Agelaius tricolor*	none/SSC/none	Highly colonial species, most numerous in central valley & vicinity. Largely endemic to California. Requires open water, protected nesting substrate, & foraging area with insect prey within a few km of the colony.	**Known.** Ruderal and developed areas on the site provide potential foraging habitat for this species, and the tricolored blackbird has been observed by Alan Hopkins at the CPSRA.[93] However, suitable nesting habitat is absent due to the lack of extensive freshwater marsh vegetation.

[91] Ibid.
[92] Ibid.
[93] Ibid.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Vaux's swift	*Chaetura vauxi*	none/SSC/none	Redwood, Douglas fir, & other coniferous forests. Nests in large hollow trees & snags. Often nests in flocks. Forages over most terrains & habitats.	**Known.** Suitable nesting habitat does not occur in the Study Area. However, individuals may forage aerially over the Study Area.
Western snowy plover (nesting)	*Charadrius alexandrinus nivosus*	FT/SSC/none	Coastal beaches above the normal high tide line in flat, open areas with sandy or saline substrates; vegetation and driftwood are usually sparse or absent.	**Not Likely.** Extensive, open sandy substrate to provide nesting habitat within the Study Area is absent.
White-tailed kite	*Elanus leucurus*	none/none/FP	Preferred habitat is marshes and waste fields in the Central Valley and coastal plains of California.	**Known.** Non-native grasslands provide suitable foraging habitat. Large trees in the Study Area provide suitable nesting habitat for this species, although the species is not known to nest there.
			Mammals	
Blue whale	*Balaenoptera musculus*	FE/none/none	Coastal and pelagic environments frequently found on the continental shelf off the California coast.	**Absent.** Suitable habitat does not occur in the Study Area.
Finback whale	*Balaenoptera physalus*	FE/none/none	Pelagic; usually found 25 miles or more off shore.	**Absent.** Suitable habitat does not occur in the Study Area.
Guadalupe fur seal	*Arctocephalus townsendii*	FT/ST/FP	Rocky insular shorelines and sheltered coves.	**Absent.** Suitable habitat does not occur in the Study Area.
Right whale	*Eubalaena glacialis*	FE/none/none	Pelagic, occurs mainly over continental shelf in the Pacific Ocean.	**Absent.** Suitable habitat does not occur in the Study Area.
Salt marsh harvest mouse	*Reithrodontomys raviventris*	FE/SE/FP	Salt marshes with a dense plant cover or pickleweed or fat hen; adjacent to an upland site.	**Not Likely.** Small mats of pickleweed adjacent to brackish wetlands and salt marsh habitat in the Study Area are highly disturbed. This species has not been recorded on the Peninsula north of the Foster City/ San Mateo Bridge area in decades.
Sei whale	*Balaenoptera borealis*	FE/none/none	Pelagic; generally in deep water along continental shelf.	**Absent.** Suitable habitat does not occur in the Study Area.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Sperm whale	*Physeter catodon*	FE/none/none	Pelagic; prefers deep water but is sometimes found around islands or in shallow shelf waters.	**Absent.** Suitable habitat does not occur in the Study Area.
Steller sea-lion	*Eumetopias jubatus*	FT/none/none Critical habitat	Near shore, pelagic when in water. Otherwise on shore, talus or bare rocks. Critical habitat has been defined for stellar sea lion as a 20 nautical mile buffer around all major haulouts and rookeries, as well as associated terrestrial, air and aquatic zones, and three large offshore foraging areas.[94]	**Not Likely.** Suitable habitat does not occur in the Study Area. Designated critical habitat does not occur in the Study Area. The closest designated critical habitat for this species is the Farallon Islands, approximately 33 air miles east of the Study Area.
Western red bat	*Lasiurus blossevillii*	none/SSC/none	Roosts primarily in trees, less often in shrubs, adjacent to streams, fields, or urban areas. Preferred roost sites are protected from above, open below, and located above dark ground cover.	**Moderate.** Trees (such as eucalyptus) provide potential roost sites for solitary migrant individuals.

SOURCE: CDFG Natural Diversity Database (CNDDB), July 2008 for the US Geological Survey's (USGS) 7.5-minute San Francisco South and Hunters Point quadrangles.
California Native Plant Society (CNPS), July 2008 for the USGS 7.5-minute San Francisco South and Hunters Point quadrangles.
US Fish and Wildlife Service (USFWS), July 2008 for the USGS 7.5-minute San Francisco South and Hunters Point quadrangles

a. Status:

Federal
FE Federally listed as Endangered
FT Federally listed as Threatened
FC Federal candidate species
FPD Federally Proposed Delisted
SC National Marine Fisheries Service designated Species of Concern. Species of Concern status does not carry any procedural or substantive protections under the FESA.

State
SE State listed as Endangered
ST State listed as Threatened
SPD State Proposed for Delisting
SR State Rare
FP California Department of Fish and Game designated "Fully Protected"
SSC California Department of Fish and Game designated "Species of Special Concern"

[94] National Marine Fisheries Service (NMFS), *Designated Critical Habitat; Stellar Sea Lion*, 58 Federal Register 45269, 1993.

TABLE 3 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area

Other

ESHA Environmentally Sensitive Habitat Area by the California Coastal Commission
SLC California Native Plant Society (CNPS) Ranking Species of Local Concern
1B California Native Plant Society (CNPS) Ranking. Defined as plants that are rare, threatened, or endangered in California and elsewhere.
2 California Native Plant Society (CNPS) Ranking. Defined as plants that are rare, threatened, or endangered in California, but more common elsewhere.
3 California Native Plant Society (CNPS) Ranking. Plants About Which More Information is Needed—A Review List.
CEQA Species not currently protected by statute or regulation, but considered rare, threatened or endangered under Section 15380 of the CEQA Guidelines.

Recent modifications to the CNPS Ranking System include the addition of a new Threat Code extension to listed species (i.e., List 1B.1, List 2.2 etc.). A Threat Code extension of .1 signifies that a species is seriously endangered in California; .2 is fairly endangered in California; and .3 is not very endangered in California.

b. Likelihood of occurrence evaluations

*A rating of "**Known**" indicates that the species/natural community type has been observed on the site.*

*A rating of "**High**" indicates that the species has not been observed, but sufficient information is available to indicate suitable habitat and conditions are present in the Study Area and the species is expected to occur in the Study Area.*

*A rating of "**Moderate**" indicates that it is not known if the species is present, but suitable habitat exists in the Study Area.*

*A rating of "**Low**" indicates that species was not found during biological surveys conducted to date on the Project site and may not be expected given the species' known regional distribution or the quality of habitats located in the Study Area.*

*A rating of "**Not Likely**" indicates that the taxon would not be expected to occur in the Study Area because the Study Area does not include the known range or does not support suitable habitat.*

*A rating of "**Absent**" indicates that no recorded occurrences or suitable habitat(s) occur within the Study Area to support this species. These species are not discussed further in this document.*

report on November 2, 2009. As indicated by the updated lists, which are also included in the aforementioned appendices (with 2009 database results following the 2008 results), no new special-status species known or expected to occur on the Project site were identified by the updated database searches.

Special-status Plants

The USFWS, CNDDB, and CNPS reported 41 special-status plant species as potentially occurring within the US Geological Survey's 7.5-minute San Francisco South and Hunters Point quadrangles.

The Study Area is largely developed and most vegetation in the area was introduced as landscape plants and turf grass. Much of the Study Area, including virtually all of CPSRA, is located on Bay fill. Ruderal (disturbed) habitats and ornamental landscaping predominate in those portions that are not landscaped. Jones & Stokes conducted botanical habitat assessments of the Candlestick Point and HPS on October 29, 2004; March 1, 2006; October 6, 2006; and May 17, 2007.[95] PBS&J botanists conducted rare plant surveys for the Candlestick Point area in May 2008. The general absence of suitable habitat over a majority of the Study Area in conjunction with the absence of observed special-status plants, either as observed during focused surveys or cited in CNDDB species accounts, supports the conclusion that no sensitive plant species occur within the Study Area.

Special-status and Sensitive Wildlife

Invertebrates

Monarch Butterfly (*Danaus plexippus*)

Monarch butterflies gather in winter roosting sites along the California coast in relatively few locations, and thus roost sites that are used traditionally by large numbers of individuals are considered sensitive biological resources. Wintering sites in California are associated with wind-protected groves of large trees (primarily eucalyptus or pine) with nectar and water sources nearby, generally near the coast.

A total of seven monarch butterflies were observed during the Yosemite Slough Watershed Wildlife Survey.[96] Ms. Mia Monroe, a Ranger with the Muir Woods National Monument (US National Parks Service) and co-coordinator of the Monarch Campaign for the past 15 years, was contacted in July 2008 and July 2009 to inquire about any known monarch wintering roosts that occur in the Project

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[95] Caltrans, *Natural Environmental Study Report for the Bayview Transportation Improvements Project*, Jones and Stokes, July 2007.

[96] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

site. Ms. Monroe consulted with local monarch butterfly specialists and the Monarch Campaign Thanksgiving counts. The Monarch Campaign conducts surveys for peak monarch butterfly wintering population around the Thanksgiving holiday. Ms. Monroe reported there are no records of monarch butterfly autumnal (i.e., temporary bivouac site) nor over-wintering use of the Project site in the CNDDB or reported in other records, including anecdotal observations. The nearest observations of monarch butterfly roosts are at Fort Mason, the Presidio of San Francisco, and Stern Grove.[97]

Using the likelihood of occurrence definitions provided in Table 3, although individual monarch butterflies were observed, the sensitive winter roosting habitat is "not likely" to occur within the Study Area.

Birds

While the CNDDB reports no occurrences of any special-status bird species in the Study Area, special-status bird species have been recorded in the Study Area during the Yosemite Slough Watershed Wildlife Survey and by Alan Hopkins, as documented in that survey's report. Special-status bird species with potential to occur on the site are described below and are also summarized in Table 3. Although the harlequin duck (*Histrionicus histrionicus*), Barrow's goldeneye (*Bucephala islandica*), common loon (*Gavia immer*), yellow warbler (*Dendroica petechia*) and Vaux's swift (*Chaetua vauxi*) have all been observed within the site, these species are considered California Species of Special Concern only when breeding.[98] As they only occur within the site as non-breeders, none of them are discussed below, as they would be present only when they would not be considered Species of Concern.

Alameda Song Sparrow (*Melospiza melodia pusillula*)

The Alameda song sparrow is a CDFG Species of Special Concern. The Alameda song sparrow occurs only in the marshlands of the southern San Francisco Bay Region.[99] The primary range of the Alameda song sparrow extends from Coyote Creek, at the southern extremity of the Bay, northward along the west shore of South San Francisco Bay to Belmont Slough (south of the Study Area) and along the east shore to San Lorenzo. Song sparrows nest in dense riparian thickets,

[97] Monroe, M., Ranger, Muir Woods National Monument, telephone conversation with Todd Wong, PBS&J, July 16, 2008 and July 20, 2009.

[98] California Department of Fish and Game (CDFG). Electronic file: http://www.dfg.ca.gov/wildlife/nongame/ssc/birds.html, accessed on July 30, 2009.

[99] Walton, B., 1974. *Salt Marsh Song Sparrow Study.* California Department of Fish and Game (CDFG), 1974. Available at: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=4696. Accessed July 21, 2008.

emergent wetlands (including salt marshes), and dense thickets of other vegetation.[100] The Alameda song sparrow uses tidal salt marsh habitats along the edge of the Bay and streams where tidal flow affects the vegetation. Candlestick Point and HPS Phase II provide potential habitat for this species in salt marshes along the shoreline, but due to the very narrow nature of tidal salt marsh in the Study Area, such habitat is marginal at best for this species. Song sparrows were observed between January 2003 and April 2004 along Yosemite Slough, but the observed sparrows may or may not be Alameda song sparrows.[101] Observations in April may be of breeding birds although nesting has not been documented. Given the marginal quality of habitat on the site, the site's isolation from more extensive marshes that may serve as source populations for Alameda song sparrows, and the sedentary nature of Alameda song sparrows, it is possible that these are the more widespread race *gouldii* or that they represent migrants or wintering individuals from other races that occur in the region during the non-breeding season. The CNDDB does not report occurrences of Alameda song sparrow in the Study Area.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "low" likelihood to occur within the Study Area.

American Peregrine Falcon (*Falco peregrinus anatum*)

The American peregrine falcon is a state-listed endangered species and a CDFG fully protected species pursuant to Section 3511 of the *California Fish and Game Code*; however, the California Fish and Game Commission voted to remove the species from the state endangered species list on August 6, 2009. The bird has experienced a remarkable resurgence in California and other parts of North America. This striking recovery is due in large measure to the ban on the use of DDT in many places. The peregrine has recovered in North America to the point that the USFWS removed the species from the federal Endangered Species List on August 25, 1999.[102] A pair of American peregrine falcons has nested in the Gantry Crane on Parcel D of the Shipyard, and has raised several broods at this location over the years.[103] These birds forage widely over the entire Study Area, likely feeding primarily on rock pigeons (*Columba livia*) and waterbirds.

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area.

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[100] Madrone Audubon Society, *Sonoma County Breeding Bird Atlas*, 1995.

[101] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[102] United States Fish and Wildlife Service (USFWS), *Endangered and Threatened Wildlife and Plants; Final Rule To Remove the American Peregrine Falcon From the Federal List of Endangered and Threatened Wildlife, and To Remove the Similarity of Appearance Provision for Free-Flying Peregrines in the Conterminous United States*; Final Rule, 64 Federal Register 46542, August 1999.

[103] Nelson, G., Facility Coordinator, Department of the Navy, field visit with PBS&J, July 8, 2008.

Bryant's Savannah Sparrow (*Passerculus sandwichensis alaudinus*)

Bryant's savannah sparrow is a CDFG Species of Special Concern. Bryant's savannah sparrow is a California endemic restricted to a narrow coastal strip from Humboldt Bay south to the Morro Bay; its center of abundance appears to be the San Francisco Bay area.[104] This sparrow occupies low tidally influenced habitats, adjacent ruderal areas, moist grassland within and just above the fog belt, and infrequently, drier grasslands. Adjacent to salt marshes this sparrow also occupies weedy spoil areas, canal banks, and bottomland pastures. In South San Francisco Bay, it nests mainly on levee tops grown to grasses and in areas of high pickleweed on levee banks. Bare ground, whether provided by tidal mud flats or upland interstitial areas between clumps of vegetation, appears to be an important component of occupied habitat. The Study Area provides potential habitat for this species in salt marshes along the shoreline, but because of the very narrow nature of tidal salt marsh in the Study Area only marginal quality habitat is available. Savannah sparrows were observed between January 2003 and April 2004 along Yosemite Slough, although the observed sparrows may or may not be Bryant's savannah sparrows.[105] Observations in April 2004 may be of breeding birds although nesting has not been documented. Given the marginal quality of habitat on the site and the site's isolation from more extensive marshes that may serve as source populations for savannah sparrows, it is possible that these represent migrants or wintering individuals from other races that occur in the region during the non-breeding season. The CNDDB does not report occurrences of the Bryant's savannah sparrow bird in the Study Area.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "low" likelihood to occur within the Study Area.

Burrowing Owl (*Athene cunicularia*)

Burrowing owl, a CDFG Species of Special Concern, is an owl that dwells in generally flat, open, dry grasslands, pastures, deserts, and shrub lands, and in grass, forbs and open-shrub stages of pinyon-juniper and ponderosa pine habitats. Burrowing owls use communal ground squirrel and other small mammal burrows for nesting and cover, as well as artificial structures such as roadside embankments, levees, and berms. They can exhibit high site fidelity, often reusing burrows year after year. Occupancy of suitable burrowing owl habitat by breeding birds can be verified at a site by observation of a pair of burrowing owls during their breeding season (March to August) or, alternatively, by the presence of molted feathers, cast pellets, prey remains (rodents, small reptiles,

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104 California Department of Fish and Game (CDFG). *California Birds Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California.* Studies of Western Birds 1. 2008.

105 Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

and large insects), eggshell fragments, or whitewash (guano), at or near a burrow. Burrowing owls are fairly tolerant of human activity near their nest burrows as long as suitable foraging habitat exists nearby. Owl populations have declined sharply in some portions of California during the past two decades (i.e., the San Francisco Bay Area, Sacramento County, San Joaquin County, etc.), but they have increased greatly in some agricultural counties (particularly Imperial). Field work for the *San Francisco Breeding Bird Atlas* in 1991-1993 did not detect breeding evidence by this species anywhere in the City.[106] The CNDDB does not report occurrences of this species in the area, but burrowing owls have been recorded previously on the site. Historically, they occurred in a rubble pile in the northeastern corner of Candlestick Point, and there have been sporadic sightings of the species in various locations on HPS as well. Breeding is not known to have occurred in the Study Area, and these individuals may all have been migrants and wintering individuals.[107] The frequency of occurrence has apparently declined in recent years, and although suitable breeding, roosting, and foraging habitat is present within the Study Area, the species does not currently breed here and occurs sporadically and in low numbers, at best.

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area.

California Brown Pelican (*Pelecanus occidentalis californicus*)

The California brown pelican is on the verge of recovery. It has been proposed for delisting by the Fish and Game Commission[108] and also recently proposed for delisting under the FESA.[109] It is fully protected by CDFG under Section 3511 of the *California Fish and Game Code*. The California brown pelican is found in estuarine, marine sub-tidal, and marine pelagic (deep) waters along the California coast. Pelicans nest from the Channel Islands of Southern California southward along the Baja California coast and in the Gulf of California to coastal southern Mexico.[110] The pelican builds nests of sticks on the ground, typically on islands or offshore rocks. Post-breeding adults and immature birds are found along the Pacific Coast from Oregon south into Baja, Mexico. This species has been observed perching on piers within HPS Phase II, particularly the three piers in the southeastern corner of HPS Phase II, and it forages within San Francisco Bay; however, the species has never nested as far north as the Bay and nesting habitat for this species is not present in the

[106] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.
[107] Personal Communication between from Alan Hopkins to Steve Rottenborn, July 10, 2009.
[108] California Department of Fish and Game (CDFG) news release: *Fish and Game Commission votes to remove California brown pelican from State Endangered Species List*. February 17, 2009.
[109] United States Fish and Wildlife Service (USFWS), *Endangered and Threatened Wildlife and Plants; Species Account: California Brown Pelican* (*Pelecanus occidentalis californicus*); Classification: Proposed for delisting; Federal Register 73:9407; February 20, 2008.
[110] California Department of Fish and Game (CDFG) B043, *Brown Pelican*. Website: http://www.dfg.ca.gov/whdab/html/B043.html. Accessed April 19, 2005.

Study Area. In addition, CNDDB does not report occurrences of California brown pelican communal roosts in the Study Area.

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area.

Loggerhead Shrike (*Lanius ludovicianus*)

The loggerhead shrike, a CDFG Species of Special Concern, is a common resident and winter visitor in lowlands and foothills throughout California and prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches. Highest density occurs in open-canopied valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, pinyon-juniper, juniper, desert riparian, and Joshua tree habitats. It occurs only rarely in heavily urbanized areas, but is often found in open cropland. The *San Francisco Breeding Bird Atlas*, for which field work was conducted in 1991-1993, reported a record of possible breeding in the atlas block that included HPS and referred to a historical breeding record in the atlas block that includes Candlestick Point.[111] Low numbers of loggerhead shrikes have been observed on Candlestick Point and HPS by Alan Hopkins, and non-native grasslands provide suitable foraging habitat and on-site trees provide suitable nesting habitat for this species. However, there is no evidence of confirmed breeding in recent years, and the species currently occurs as an uncommon migrant and winter resident.[112]

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area. However, this species is considered a California Species of Special Concern only when breeding. Because it is currently known to occur in the Study Area only as a non-breeder, it would not be considered a Species of Special Concern in the Study Area.

Northern Harrier (*Circus cyaneus*)

The northern harrier, a CDFG Species of Special Concern, prefers coastal prairies, marshes, grasslands, swamps and other open areas. Although this species primarily eats small rodents (mice and voles), amphibians, small reptiles, small rabbits, and other birds, northern harriers will eat some invertebrates as well. Northern harriers usually return to the same area to nest in consecutive years. They nest on the ground in well-concealed locations, often near low shrubs or in tall clumps of vegetation. Nesting locations are usually in abandoned fields, wet meadows, and coastal and inland marshes. Wetlands and non-native grasslands provide suitable foraging habitat for small numbers of this species on the site, and northern harriers have been observed by Alan Hopkins in the Study

[111] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.
[112] Personal Communication between from Alan Hopkins to Steve Rottenborn, July 10, 2009.

Area.[113] However, due to the extent of disturbance by humans and pets, the lack of extensive wetlands suitable for nesting, and the vulnerability of ground-nesting birds to predation in upland portions of the Study Area, harriers are not expected to nest there. Field work for the *San Francisco Breeding Bird Atlas* in 1991-1993 did not detect breeding evidence by this species anywhere in the City.[114]

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area. However, this species is considered a California Species of Special Concern only when breeding. Because it is currently known to occur in the Study Area only as a non-breeder, it would not be considered a Species of Special Concern in the Study Area.

San Francisco Common Yellowthroat (*Geothlypis trichas sinuosa*)

The San Francisco common yellowthroat is a California Species of Concern and is one of four subspecies of common yellowthroat that breed in California. The breeding range of the San Francisco common yellowthroat as described by Foster is bounded by Tomales Bay on the north, Carquinez Strait on the east, and Santa Cruz County on the south, which would include the Study Area.[115] Yellowthroats are found in freshwater marshes, coastal swales, swampy riparian thickets, brackish marshes, salt marshes, and the edges of disturbed weed fields and grasslands that border soggy habitats.[116] In the San Francisco Bay region as a whole, about 60 percent of yellowthroats breed in brackish marsh, 20 percent in riparian woodland/swamp, 10 percent in freshwater marsh, 5 percent in salt marsh, and 5 percent in upland vegetation.[117] The brackish marsh in the Study Area provides potential habitat for this species, although the limited extent of such habitat limits the possibility that the species currently breeds here. Common yellowthroats were observed between January 2003 and April 2004 during surveys along Yosemite Slough, though it is unknown whether these were San Francisco common yellowthroats or migrants/wintering birds of other races.[118] Field work for the *San Francisco Breeding Bird Atlas* in 1991-1993 did not detect breeding evidence by this species anywhere in the eastern part of the City, including the Project vicinity.[119]

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113 Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

114 San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

115 Foster, M. L., *Status of the salt marsh common yellowthroat (Geothylpis trichas sinuosa) in the San Francisco Bay Area, California 1975–1976*, California Department of Fish and Game (CDFG), 1977.

116 Shuford, W.D., The Marin County breeding bird atlas. Bushtit Books. Bolinas, California. pp. 479, 1993.

117 Hobson, K., P. Perrine, E.B. Roberts, M.L. Foster and P. Woodin, *A breeding season survey of salt marsh common yellowthroats (Geothylpis trichas sinuosa) in the San Francisco Bay Region*. Report of the San Francisco Bay Bird Observatory to the US Fish and Wildlife Service, 1986.

118 Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

119 San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "moderate" likelihood to occur within the Study Area.

Short-eared owl (*Asio flammeus*)

The short-eared owl, a California Species of Concern, is usually found in open areas with few trees such as annual and perennial grasslands, prairies, meadows, dunes, irrigated lands, and saline and fresh emergent marshes. Its prey consists of small mammals, marsh birds, insects, reptiles, and amphibians.[120] The short-eared owl will usually nest on dry ground in a depression that is concealed in vegetation; occasionally the nest will be placed in a burrow. It requires dense vegetation for roosting and resting cover. This includes tall grasses, brush, ditches, and wetlands. Open, treeless areas containing elevated sites for perching are also needed. This species was observed by Alan Hopkins on the site[121] and the Study Area provides suitable foraging habitat for this species. As a result, short-eared owls are expected to forage occasionally in low numbers on the site. However, due to the extent of disturbance by humans and pets, the lack of extensive wetlands suitable for nesting, and the vulnerability of ground-nesting birds to predation in upland portions of the Study Area, short-eared owls are not expected to nest there. Field work for the *San Francisco Breeding Bird Atlas* in 1991-1993 did not detect breeding evidence by this species anywhere in the City.[122]

Using the likelihood of occurrence definitions provided in Table 3, this is "known" to occur within the Study Area. However, this species is considered a California Species of Special Concern only when breeding. Because it is currently known to occur in the Study Area only as a non-breeder, it would not be considered a Species of Special Concern in the Study Area.

Tricolored Blackbird (*Agelaius tricolor*)

The tricolored blackbird, a California Species of Concern, is a highly social, marsh-nesting bird that lives in flocks numbering from less than one hundred to many thousands. Tricolored blackbirds are permanent residents of California, but birds make extensive migrations and movements, both in the breeding season and in winter, within their restricted range.[123] Tricolored blackbirds live in large colonies, and they prefer open accessible water, a protected nesting substrate such as flooded, thorny or spiny vegetation, and a suitable foraging space providing insect prey within a few miles of nesting colonies. Nesting habitat includes cattails and bulrushes or ungrazed grasslands

[120] http://www.delta.dfg.ca.gov/gallery/shearowl.asp.

[121] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[122] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

[123] Shuford, W. D., and Gardali, T., editors. 2008. *California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in*

containing tall grasses. Other plant species that are used for nesting include young willow thickets and wild rose. This species has been observed by Alan Hopkins on the Study Area[124] and the site provides suitable foraging habitat for the species. However, no suitable breeding habitat is present, no colonies are known to occur in the area, and the *San Francisco Breeding Bird Atlas* did not confirm breeding by this species anywhere in the City.[125]

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area. However, this species is considered a California Species of Special Concern only when breeding. Because it is currently known to occur in the Study Area only as a non-breeder, it would not be considered a Species of Special Concern in the Study Area.

White-tailed Kite (*Elanus leucurus*)

The white-tailed kite is listed as a fully protected species under Section 3511 of the *California Fish and Game Code*. White-tailed kites feed on rodents, small reptiles, and large insects in fresh emergent wetlands, annual grasslands, pastures, and ruderal vegetation. They breed between February and October. Kites often roost, and occasionally nest, communally especially during the non-breeding season. Therefore, disturbance of a relatively small roost or nesting area could affect a large number of birds. The white-tailed kite can commonly be observed foraging in extensive open grasslands throughout most of the San Francisco Bay region. While white-tailed kites were not observed during surveys conducted by PBS&J biologists on the Project site, small numbers of individuals were observed during the Yosemite Slough Wildlife surveys.[126] The species is not known to nest on the site[127], but the grasslands and ruderal habitats on the Project site provide suitable foraging habitat for small numbers of non-breeding individuals that occasionally occur there.

Using the likelihood of occurrence definitions provided in Table 3, this species is "known" to occur within the Study Area.

California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

[124] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27, 2004.

[125] San Francisco Field Ornithologists. 2003. *San Francisco Breeding Bird Atlas*.

[126] Golden Gate Audubon Society, *Final Report Yosemite Slough Watershed Wildlife Survey 2003–2004*, prepared by LSA, July 27 2004.

[127] Personal Communication between from Alan Hopkins to Steve Rottenborn, July 20, 2009.

Terrestrial Mammals

Western Red Bat (*Lasiurus blossevillii*)

The only special-status bat species likely to occur within the Study Area is the western red bat (*Lasiurus blossevillii*). The western red bat is not known to breed in San Francisco, but the species is migratory, and red bats occur here during migration and possibly during winter. Western red bats are not colonial, and, thus, the species is expected to occur in the Study Area only in small numbers. They are known to roost in the foliage of a number of tree species, including eucalyptus. Potential habitat for this species is present within the eucalyptus and other mature trees within the Project site. However, most bat species are sensitive to human-generated disturbance. Identification of bats requires special surveys that were not conducted for this analysis. Therefore, the conservative assumption is that this species of sensitive bat is present within the Study Area.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "moderate" likelihood to occur within the Study Area.

Mollusks

Olympia Oyster (*Ostreola conchaphila*)

Native Olympia oysters were historically abundant in San Francisco Bay. Oyster beds are a cornerstone in the benthic habitat, improving water quality, and providing habitat complexity that favors fish and vegetation. They also provide an important link between pelagic and benthic food webs. Their function in the estuarine food web—oyster beds generally increase fish abundance and thus make up an essential part of the Essential Fish Habitat (EFH)[128]—they are considered an important resource for the purposes of this technical report as only a few relict populations remain in the Bay.[129]

Recently, small populations of native oysters have been documented within the Bay.[130,131] Detailed surveys for native oysters were not conducted as part of this Project. Suitable habitat is distributed

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[128] National Marine Fisheries Service (NMFS). 2006. Fisheries Management Plan (FMP) Species Distributions In San Francisco, San Pablo and Suisun Bays. Website: http://swr.nmfs.noaa.gov/hcd/loclist.htm#South%20SF%20Bay. Accessed October 29, 2008.

[128] National Marine Fisheries Service (NMFS). Essential Fish Habitat (EFH) for Pacific Coast Groundfish. Map dated July 26, 2008.

[129] National Marine Fisheries Service (NMFS), No Date. *Native Oyster Habitat Restoration, Program Briefing Document*. Fisheries Southwest Region.

[130] Harris, H.E., 2004. *Distribution and limiting factors of Ostrea conchaphila in San Francisco Bay, MS Thesis,* San Francisco State University.

[131] Latta, M., 2006. Personal communication with Marilyn Latta, Habitat Restoration Director, Save the Bay, with D. Ebert and others at a meeting on October 18, 2006.

throughout the shoreline of Study Area. Suitable substrate is solid surfaces to which the larvae can easily attach.[132] Because the larval forms of oysters are free-floating in the Bay and a large population exists south of the Study Area at Oyster Point Marina,[133] native oysters are likely present on suitable substrate throughout the Study Area.

Fish

Green Sturgeon (*Acipenser medirostris*)

The southern distinct population segment of green sturgeon (including those that reside in the Sacramento River) was listed as threatened under the FESA by NMFS on April 7, 2006.[134] Green sturgeon is a long-lived, anadromous, native fish that occurs in low numbers in the San Francisco Estuary and Sacramento River. Adults spawn in freshwater rivers from British Columbia south to the Sacramento River. In the Sacramento River, spawning occurs near Red Bluff and possibly in the Feather River. Larvae develop within these freshwater systems, migrate downstream, and remain in the estuaries for between 1 and 4 years before migrating to the ocean. Mature adults move into estuaries in the spring and spawning adults move up the rivers of their origins in late spring/early summer. Post spawning adults return to the estuary before migrating back to the ocean in late fall. Sub-adult fish also are thought to enter estuaries during summer and fall months. The Study Area is along the San Francisco Bay, which is a saltwater habitat; the Study Area does not support the necessary freshwater spawning habitat for adult fish.[135] Juvenile fish and sub-adults may rear in the adjacent waters of San Francisco Bay.

The NMFS designated critical habitat for green sturgeon on October 2009.[136] Specific areas designated as critical habitat include: coastal US marine waters within 60 fathoms depth (360 feet) from Monterey Bay, California, north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; and certain coastal bays and estuaries in California, Oregon, and Washington. The areas designated comprise approximately 320 miles of freshwater river habitat, 897 square miles of estuarine habitat (including the San Francisco Bay), 11,421 square miles of

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[132] Harris, H.E., 2004. *Distribution and limiting factors of Ostrea conchaphila in San Francisco Bay, MS Thesis*, San Francisco State University.

[133] MACTEC Engineering and Consulting, Inc. 2008. *Oyster Point Marina Olympia Oyster Surveys Pre- and Post-Dredging February 2008, Oyster Point Marina, South San Francisco, California*. Prepared for PBS&J.

[134] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon*, 71 Federal Register 17757, 2006.

[135] Moyle, Peter B. *Inland Fishes of California*, 2002, University of California Press.

[136] National Marine Fisheries Service (NMFS), *Endangered and Threatened Wildlife and Plants: Final Rulemaking to Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon*. 74 Federal Register 52300, October 9, 2009.

marine habitat, and 135 square miles of habitat within the Yolo and Sutter bypasses.[137] Under the FESA, critical habitat includes those areas necessary to support the continued existence and recovery of this species. Critical habitat for green sturgeon includes all of San Francisco Bay. Critical habitat designations include the specific habitat and habitat functions that are necessary for the survival and recovery of the species; these are called primary constituent elements (PCEs). Within the estuarine category of critical habitat, the PCEs include food, flow, water quality, migratory pathways, depth, and sediment quality.[138] Food is an abundance of prey items, benthic invertebrates and shrimp, within the substrate upon which sturgeon can forage. Flow refers to ample movement of water within the estuary to allow adults to orient to the Sacramento River during their spawning migrations. Water quality refers to adequate levels of dissolved oxygen, salinity, and temperatures to allow for survival and growth. Water quality also includes low levels of contaminants that could affect survival or reproductive fitness. A migratory pathway refers to the fact that sturgeon migrate through the Bay to and from upstream spawning areas. The PCE for migratory pathways allows for safe and timely passage of fish between the ocean and upstream spawning areas, but it also includes localized movement of rearing and holding sturgeon within the Bay. The depth PCE refers to the variety of water depths required to provide suitable foraging, holding, and migratory areas. Sediment quality is important because sturgeons are benthic foragers (bottom feeders) and contaminant-free sediments support higher quality prey that do not affect the survival or reproductive fitness of the fish. The Study Area includes elements of all these PCEs. However, the sediment quality may be impaired by decades of industrial use, which has resulted in contamination. This in turn probably reduces the foraging quality.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "high" likelihood to occur within the Study Area.

Chinook Salmon (*Oncorhynchus tshawytscha*)

Populations of Chinook salmon potentially found adjacent to the Project site fall into three Evolutionary Significant Units (ESUs): Winter-run, Spring-run, and Fall/late-Fall-run[139] Chinook salmon. The runs of Chinook are distinguished based on the timing of the adult return to freshwater on their spawning migration. At almost any time of year, there are Chinook at some life cycle stage or another within San Francisco Bay (Table 4 [Life Cycle Stages and Periods of Freshwater Residency for Chinook Salmon]). The occurrence of Chinook adjacent to the Project site could involve any of those life stages. Juvenile fish are more likely to be found adjacent to the Project site than adults because they are moving downstream from their natal streams and do not have the

[137] Ibid.

[138] Ibid.

[139] Fall and late-fall run Chinook are treated as a single ESU by NMFS.

same swimming ability as adults. Juvenile fish from the Sacramento River populations would be expected to occur in low numbers as they stray south of the Golden Gate. Small numbers of Chinook have also recently appeared in Coyote Creek and Guadalupe River, which are both tributaries to south San Francisco Bay near Alviso; these fish are derived from hatchery releases within the native range of the species, which did not include the South Bay.[140,141] Adult or juvenile fish from either of these populations would be expected to migrate through or past the Study Area on their way to and from the Pacific Ocean because the Study Area is between the Pacific Ocean and spawning sites in the South Bay. The overall likelihood of finding a substantial number of Chinook salmon within or adjacent to the Project site at any one time is relatively low because the open water of the Study Area is not considered suitable rearing habitat for either life stage. The residence time that either life stage may spend within or adjacent to the Project site is unknown.

TABLE 4 LIFE CYCLE STAGES AND PERIODS OF FRESHWATER RESIDENCY FOR CHINOOK SALMON

Species	Adult Migration (peak)	Spawning (peak)	Juvenile Freshwater Residency	Outmigration (peak)
Winter Run	Dec–July (Mar)	Apr–Aug (May–June)	5–10 months	July Oct
Spring Run	Mar–Sep (May–June)	Aug–Oct (Sep)	3–15 months	Nov–Mar (Jan–Mar)
Fall Run	June–Dec (Sep–Oct)	Sep–Dec (Oct–Nov)	1–7 months	Dec–Mar
Late Fall Run	Oct–Feb (Dec)	Jan–Apr (Feb–Mar)	7–13 months	Apr–June (Dec–Mar)

SOURCE: Moyle, 2002.

Winter-run Chinook are listed as endangered under the California and federal *Endangered Species Act*s. They spawn in the Sacramento River upstream of Red Bluff Diversion Dam and are distinguishable from other Chinook runs based on the timing of both upstream migration and the spawning season (Table 4). Prior to the construction of Shasta and Keswick dams in 1943 and 1955, respectively, winter-run Chinook spawned in the upper reaches of the Sacramento, McCloud, and

[140] Santa Clara County, *Santa Clara County Habitat Plan, 1st Administrative Draft* August 2008. Website: http://www.scv-habitatplan.org/www/site/alias__default/292/1st_administrative_draft_hcp.aspx. Accessed July 2009.

[141] National Marine Fisheries Service (NMFS). No Date. *Central Valley Chinook Salmon Distributions*. Southwest Regional Office. Website: http://swr.nmfs.noaa.gov/hcd/dist2.htm. Accessed July 17, 2009.

lower Pit rivers,[142] and Battle Creek. Presently, the majority of winter-run Chinook spawning occurs on the main stem of the Sacramento River between Keswick Dam and the Red Bluff Diversion Dam.[143] Designated critical habitat extends from Keswick Dam, Shasta County (River Mile 302) to Chipps Island (River Mile 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Critical habitat does not extend into the Study Area.

Spring-run Chinook salmon are listed as a threatened species under the California and federal ESAs. Spring-run Chinook enter the Sacramento River between March and September and move upstream into the headwaters, where they hold in pools until they spawn between August and October. Juveniles emigrate from the tributaries from mid-November through June; however, some juveniles spend a year in the streams and emigrate as yearlings the following October.[144] Typically, spring-run Chinook salmon use mid- to high-elevation streams that provide appropriate low water temperatures and sufficient flow, cover, and pool depth to allow over summering. Spawning occurs between August and October and, depending on water temperature, emergence occurs between November and March. Although Spring-run Chinook salmon emigration is highly variable, the emigration period extends from November to early May, with up to 69 percent of young-of-the-year out migrants passing through the lower Sacramento River between mid-November and early January.[145] Designated critical habitat extends from Keswick Dam, Shasta County (River Mile 302) to Chipps Island (River Mile 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Critical habitat does not extend into the Study Area.

Central Valley Fall and Late Fall-run Chinook salmon are not listed under the state or federal endangered species act but are classified as a Species of Special Concern. Fall-run Chinook salmon is the most abundant ESU, documented to comprise about 80 percent of the Sacramento Basin stock in the early 1980s. The ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin River basins and their tributaries, east of Carquinez Strait,

[142] Moyle, P. B. 2002. *Inland Fishes of California*, University of California Press. 2002.
[143] Ibid.
[144] Ibid
[145] Snider, B., and R.G. Titus. 2000. *Timing, composition, and abundance of juvenile anadromous salmonid emigration in the Sacramento River near Knights Landing*, October 1996.

California. Juvenile fall and late fall-run fish could stray into open waters within and adjacent to the Project site if they miss the entrance to the Golden Gate and the Pacific Ocean.

A small population of Chinook salmon has become established in recent years in Coyote Creek and the Guadalupe River.[146] The regulatory status of this population is unclear because the fall/late fall-run ESU only includes naturally spawned fish from upstream of Carquinez Strait. There is not an ESU that includes fish spawning within the tributaries of San Francisco Bay. These fish exhibit a fall-run pattern similar to the fall-run ESU of the Central Valley, and are apparently derived from wandering individuals, likely hatchery-released fish, from that ESU.[147] Regardless of where they came from or what their regulatory status may be, these fish would pass the Study Area on their way to and from the ocean.

Using the likelihood of occurrence definitions provided in Table 3, the spring-run, winter-run/ and fall/late fall-run of this species has a "High" likelihood to occur within the Study Area.

Central Valley Steelhead (*Oncorhynchus mykiss*)

Central Valley steelhead (rainbow trout) were federally listed as a threatened species in 1998[148] and this status was reaffirmed in 2006.[149] The Central Valley steelhead population is a Distinct Population Segment (DPS; aka ESU) that includes all naturally spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries. Final critical habitat, designated in September 2005 for this species, does not include the Study Area.[150] Critical habitat is designated by hydrologic unit, the closest of which to the Study Area is the Sacramento Delta Hydrologic Unit, over 25 miles north of the Project site.[151] Central Valley steelhead, especially juveniles, may occasionally stray into the South Bay during their migration to the ocean, but the area adjacent to the Project site is generally outside their migratory pathway.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "low" likelihood to occur within the Study Area.

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[146] Santa Clara County, *Santa Clara County Habitat Concept Plan, 1st Administrative Draft* August 2008. Website: http://www.scv-habitatplan.org/www/site/alias__default/292/1st_administrative_draft_hcp.aspx. Accessed July 2009.

[147] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California*, 63 Federal Register 13347, 1998.

[148] Ibid.

[149] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead*; Final Rule, 71 Federal Register 834, 2006.

[150] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Designation of Critical Habitat for Seven Evolutionarily Significant Unites of Pacific Salmon and Steelhead in California*; Final Rule, 70 Federal Register 52488, 2005.

[151] Ibid.

Central California Coast Steelhead (*Oncorhynchus mykiss*)

The Central California Coast DPS of steelhead is a federally threatened species.[152] This DPS includes all naturally spawned populations of steelhead from the Russian River south to, and including, Aptos Creek and includes the populations within San Francisco Bay.[153] Steelhead begin their migration from the ocean when winter rains provide large amounts of cold water for migration and spawning. Peak migration period for adult fish is in mid-winter. They typically spawn in smaller streams and tributaries to mainstream rivers. Juvenile steelhead generally spends one to three years in freshwater before migrating to the ocean.[154]

It is highly likely that both adults and juvenile steelhead from this DPS could be found adjacent to the Project site. The closest potential steelhead spawning streams in South San Francisco Bay are San Mateo Creek (approximately 10 miles south of the Study Area), Alameda Creek (approximately 16 miles south of the Study Area), and San Francisquito Creek (approximately 22 miles south of the Study Area). Other South Bay watersheds that support populations of steelhead include the Coyote Creek and Guadalupe River watersheds. Because the Study Area is between their spawning and rearing streams and the Pacific Ocean, fish from any of these streams could be found in the Bay adjacent to the Project site during adult migrations from the Pacific Ocean to spawning sites or during juvenile migrations from their natal streams to the Pacific Ocean.

The final critical habitat designation for the Central California Coast steelhead DPS was issued on September 2, 2005.[155] The specific primary constituent elements considered in the designation were freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas, and offshore marine areas. The lateral extent of critical habitat in estuarine areas is the area inundated by extreme high tide. The Study Area is within the designated critical habitat for this species.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "high" likelihood to occur within the Study Area.

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[152] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California*, 63 Federal Register 13347, 1998.

[153] National Marine Fisheries Service (NMFS).*Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead*; Final Rule. 71 FR 834

[154] Moyle, P. B. *Inland Fishes of California*, 2002, University of California Press, 2002.

[155] National Marine Fisheries Service (NMFS), *Endangered and Threatened Species: Designation of Critical Habitat for Seven Evolutionarily Significant Unites of Pacific Salmon and Steelhead in California*; Final Rule, 70 Federal Register 52488, 2005.

Longfin Smelt (*Spirinchus thaleichthys*)

Longfin smelt were listed under the California Endangered Species account as a threatened species in March 2009. This species is endemic to the west coast of North America with small populations likely still present in the Klamath River and Russian River estuaries.[156] However, the bulk of the longfin smelt population appears to be in San Francisco Bay.[157] Adults spawn in the Sacramento-San Joaquin Estuary almost as far upstream as the City of Sacramento on the Sacramento River and to Turner Cut on the San Joaquin River.[158] Adults spawn in these upstream freshwater locations in early winter. The larval smelt are distributed downstream by natural river flow. Because of this, the higher the outflow of freshwater from the Sacramento-San Joaquin Delta, the greater the distribution of smelt in the Bay. As they mature, swimming ability improves and their distribution expands. Adults occur into the South Bay and are also found in the ocean just outside the Golden Gate.[159] This species could be found in the Study Area from spring to fall before adults return upstream to spawn.

Using the likelihood of occurrence definitions provided in Table 3, this species has a "moderate" likelihood to occur within the Study Area.

Pacific Herring (*Clupea pallasi*)

San Francisco Bay supports a small, yet productive commercial Pacific herring fishery. Pacific herring are not protected by either the state or the federal government; however, because herring are harvested for their roe, they are an important species in the economy of the San Francisco Bay Area and their populations are closely monitored by CDFG. Pacific herring are also an important species in the ecology of San Francisco Bay because herring, along with sardines and anchovies, are a primary food source for salmon and other sport fish. Pacific herring generally enter the Bay from November through April[160] of each year and spawn in intertidal and sub-tidal habitats.[161] The actual sites where Pacific herring spawn in San Francisco Bay change from year to year and spawning may occur within numerous locations around the Bay. The North Bay is typically the preferred spawning

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[156] Moyle, P. B. *Inland Fishes of California*, 2002, University of California Press, 2002.

[157] California Department of Fish and Game (CDFG), A Status Review of the Longfin Smelt (*Spirinchus thaleichthys*) in California, January 2009.

[158] Ibid.

[159] Ibid.

[160] National Oceanic and Atmospheric Administration (NOAA). 2008. San Francisco Bay Project Impact Evaluation System—Pile Driving. Coastal Restoration and Protection Division. Interactive GIS mapping software Website: http://mapping2.orr.noaa.gov/website/portal/pies/ naturalhistory.html. Accessed December 2, 2008.

[161] Barnhart, R.A. 1988. *Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)—Pacific herring*. *US Fish and Wildlife Service Biol. Rep*. 82(11.79). US Army Corps of Engineers, TR EL-82-4. 14 pp.

area, although limited spawning has historically been observed at San Mateo Point.[162] The preferred substrate for herring spawning is eelgrass, followed by rocky seafloors, and lastly flat surfaces such as marina pilings, retaining walls, and bulkheads along the San Francisco Bay waterfront.[163] According to NMFS, known herring spawning areas within the area immediately adjacent to the Project site include several piers and areas of shoreline both north and south of the proposed marina (refer to Figure 5 [Pacific Herring Spawning Habitat]).[164] Where Figure 5 shows habitat as including piers, this refers to in-water portions of those structures. Also, the mapping data left gaps between the shoreline and the delineated habitat that is an artifact of the mapping. Spawning grounds could extend to the shoreline, especially in those areas where bulkheads define a vertical shoreline. The open channel to the northwest of the proposed marina between Blandy and E streets may be used by herring even though NMFS does not map it as spawning habitat.

OTHER SENSITIVE HABITATS

Essential Fish Habitat

The tidal aquatic habitats adjacent to the Project site are considered EFH by the NMFS for a species assemblage that includes anchovies, sardines, rockfish, sharks, sole, and flounder. Areas supporting the native Olympia oyster found in San Francisco Bay are also considered EFH by NMFS because oyster beds generally increase fish abundance. A more detailed discussion of the provisions of the Magnuson-Stevens Fisheries Conservation Act, by which effects on EFH are regulated, is provided below in the "Regulatory Framework" section.

Eelgrass Beds

Eelgrass occurs in both subtidal and intertidal areas of San Francisco Bay. The distribution of eelgrass has been mapped relatively recently (in 2003) and the results of this effort indicate that low-density eelgrass beds are found on the north side of Hunters Point peninsula offshore from the end of Earl Street and in a small patch in the South Basin.[165] Eelgrass beds form areas of important habitat for birds, fish, and crustaceans and are one of the preferred spawning habitats of Pacific

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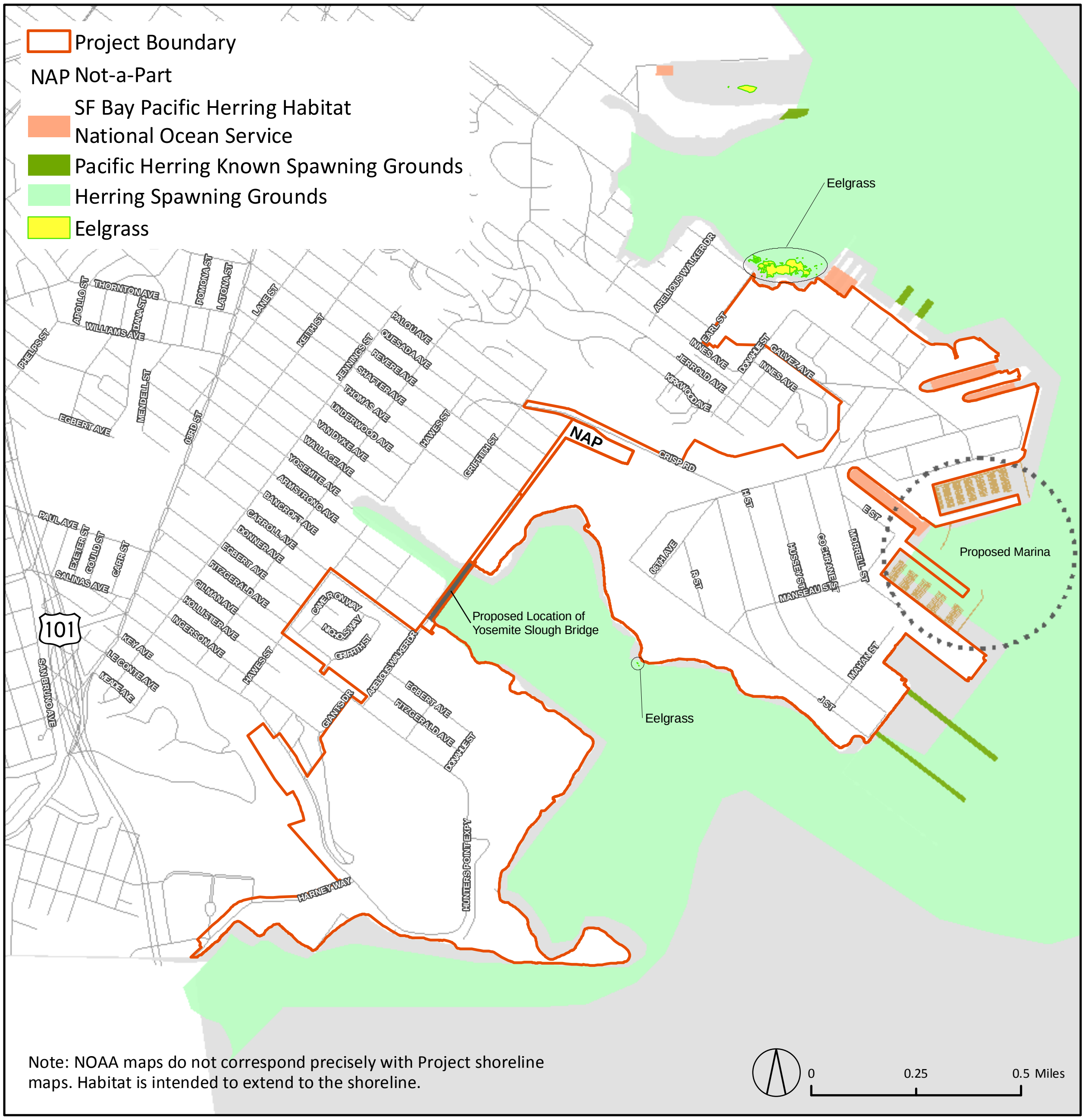
[162] Miller, D. J. and J. Schmidtke. 1956. *Report on the distribution and abundance of Pacific herring (Clupea pallasi) along the coast of Central and Southern California*. California Fish and Game (CDFG) 42(3):163-187.

[163] Barnhart, R.A. 1988. *Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)—Pacific herring*. *US Fish and Wildlife Service Biol. Rep. 82(11.79).* US Army Corps of Engineers, TR EL-82-4. 14 pp.

[164] National Oceanic and Atmospheric Administration (NOAA). 2008. *San Francisco Bay Project Impact Evaluation System—Pile Driving*. Coastal Restoration and Protection Division. Interactive GIS mapping software Website*:* http://mapping2.orr.noaa.gov/website/portal/pies/ naturalhistory.html. Accessed December 2, 2008..

[165] San Francisco Bay Eelgrass Inventory, June-October 2003. Prepared for Caltrans and NOAA Fisheries. Prepared by Merkel and Associates, 2003.



SOURCE: NOAA PIES Website, 2008, Merkel and Associates 2003 SF Bay eelgrass survey.

PBS&J 10.27.09

FIGURE 5

Candlestick Point - Hunters Point Shipyard Phase II EIR

PACIFIC HERRING SPAWNING HABITAT

herring.[166] These plants also support grazing crustaceans, shrimp, and amphipods. Because it requires light for photosynthesis, eelgrass is limited by water clarity to depths of about 6 feet or less. Because little accurate information exists about the historic distribution of eelgrass beds, and because of their current relative scarcity and importance in the overall ecology of the Bay, both the USACE and CDFG consider eelgrass beds a sensitive resource.

WILDLIFE MOVEMENT

Wildlife movement activities usually fall into one of three movement categories: (1) dispersal (i.e., juvenile animals from natal areas, or individuals extending range distributions); (2) seasonal migration; and (3) local movements related to home range activities (foraging for food or water, defending territories, searching for mates, breeding areas, or cover). A number of terms have been used in various wildlife movement studies, such as "wildlife corridor," "travel route," "habitat linkage," and "wildlife crossing," to refer to areas in which wildlife move from one area to another. To clarify the meaning of these terms and facilitate the discussion of wildlife movement in this analysis, these terms are defined as follows:

- **Travel route**—A landscape feature (such as a ridgeline, drainage, canyon, or riparian strip) within a larger natural habitat area that is used frequently by animals to facilitate movement and provide access to necessary resources (i.e., water, food, cover, den sites). The travel route is generally preferred because it provides the least amount of topographic resistance in moving from one area to another. It contains adequate food, water, and/or cover while moving between habitat areas and provides a relatively direct link between target habitat areas.
- **Wildlife corridor**—A patch of habitat, usually linear in nature, that connects two or more habitat patches that would otherwise be fragmented or isolated from one another. Wildlife corridors are usually bounded by urban land areas or other areas unsuitable for wildlife. The corridor generally contains suitable cover, food, and/or water to support species and facilitate movement while in the corridor.
- **Habitat linkage**—Larger, landscape-level movement features (often referred to as "habitat or landscape linkages") can provide both transitory and resident habitat for a variety of species to a more substantial, or wider, land connection between two habitat areas. Habitat linkages allow for the periodic exchange of animals between habitat areas, which is essential to maintain adequate gene pools.
- **Wildlife crossing**—A small, narrow area, relatively short in length and generally constricted in nature, that allows wildlife to pass under or through an obstacle or barrier that otherwise hinders or prevents movement. Crossings may be manmade and include culverts, underpasses, drainage pipes, and tunnels to provide access across or under roads,

[166] Wyllie-Echeverria, S. and M. Fonseca. Eelgrass (*Zostera marina*) research in San Francisco Bay, California from 1920 to the Present. 2003.

highways, pipelines, or other physical obstacles. These often represent “choke points” along a movement corridor.

Surveys of the Project site did not identify any major or regional wildlife corridor/travel route. The Project site is surrounded by open water and urban development that isolate habitats in the Study Area from large expanses of similar habitats in undeveloped areas elsewhere along the San Francisco Bay shoreline and in the San Bruno Mountain State Park (approximately 2 miles to the southwest). There is localized movement, as ground-dwelling animals forage for food, mate, and move between habitat patches within the Project site. Although there is localized movement between Bayview Hill and the CPSRA, Bayview Hill is also isolated from larger expanses of habitat, and movement by mammals, reptiles, and amphibians between the site and any larger expanses of natural habitat (such as San Bruno Mountain to the southwest) is severely impeded by US-101 and other roads and urban development.

In addition, although bird flyways are not traditionally considered “wildlife movement corridors,” the San Francisco Bay’s wetlands and tidal lands serve as important habitat for bird species during migration through the Pacific Flyway. Many bird species use these areas as an annual stopover location for several days of rest and feeding prior to continuing migration. These habitats also provide critical staging areas for migratory species. Thus, the Study Area is a minor, but important component of the much larger Bay system that provides habitat for migratory birds.

REGULATORY FRAMEWORK

Federal

Section 404 of the Clean Water Act

Section 404 of the *Clean Water Act* (CWA) (33 *United States Code* [USC] §§ 1344) requires that a permit be obtained from the USACE prior to the discharge of dredged or fill materials into any "waters of the United States or wetlands." Waters of the United States are broadly defined in the USACE regulations to include navigable waterways, their tributaries, lakes, ponds, and wetlands. Wetlands are defined as: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that normally do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."[167] Wetlands that are not specifically exempt from Section 404 regulations (such as drainage channels excavated on dry land) are considered to be "jurisdictional wetlands." The USACE is required to consult with the USFWS, NMFS, Environmental Protection Agency, and State Regional Water Quality Control Board (SWRCB) in carrying out its discretionary authority under Section 404.

The USACE grants three types of permits: individual, general, and nationwide. Project-specific individual permits are required for certain activities that may have a potential for more than a minimal impact and necessitate a detailed application. A permit from the USACE would be required for any placement of fill in waters of the US as part of the Project.

Section 402 of the Clean Water Act

The primary mechanism in the CWA regulating the discharge of pollutants is the National Pollutant Discharge Elimination System (NPDES), which is administered by the Environmental Protection Agency (EPA). Under the NPDES program, a permit is required from EPA or an authorized state for the discharge of any pollutant from a point source into the waters of the US (33 USC §§1342). Storm water pollution prevention plans must be prepared for construction activities as part of the NPDES permitting process.

Section 401 of the Clean Water Act

Section 401 of the CWA (33 USC §§ 1341) requires a state-issued Water Quality Certification for all projects requiring a Section 404 permit, or other federal permit or license. There are nine Regional Water Quality Control Boards (RWQCBs) across the state that issue Water Quality Certifications for various actions within their respective region. The RWQCB, San Francisco Bay Region, issues

[167] US Army Corps of Engineers, *Definition of Waters of the United States*, 33 CFR 328, November 1986.

Section 401 Water Quality Certifications for the City and County of San Francisco. A Section 401 certification requires a determination that the Project will comply with all state water quality standards.

Federal Endangered Species Act (FESA)

The FESA was enacted in 1973. Under the FESA, the Secretary of the Interior and the Secretary of Commerce have the authority to list a species as threatened or endangered (16 USC 1533[c]). The FESA is administered by both the NMFS and the USFWS. The NMFS is accountable for animals that spend most of their lives in marine waters, including marine fish, most marine mammals, and anadromous fish such as Pacific salmon. The USFWS is accountable for all other federally listed plants and animals.

Pursuant to the requirements of FESA, a federal agency authorizing, funding or carrying out a project within its jurisdiction must determine whether any federally listed threatened or endangered species may be present within the Study Area and determine whether the agency's action could affect any federally listed species (16 USC 1536(a)(2), (3).) If the action would likely affect a listed species, the agency must consult with the USFWS or NMFS under Section 7 of the FESA to determine whether the action is likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of designated critical habitat (16 USC 1536(a)(2).) Project-related adverse effects to these species or their habitats are typically considered significant under CEQA and thus would require mitigation.

The USFWS Regional Office in Sacramento maintains a list of "species of concern" that receive special attention from other federal agencies (i.e., NMFS) during environmental review, although they are not protected under FESA. Project-related impacts to such species could be considered significant under CEQA Guidelines section 15380 and could require mitigation.

Section 9 of the FESA prohibits any person or federal agency from "taking" endangered or threatened wildlife. The definition of "take" includes harassing, harming, hunting, shooting, wounding, killing, trapping, capturing, or collecting, or attempting to engage in any such conduct. A notable component of this definition is the definition of "harm." "Harm" in the definition of "take" means an act that actually kills or injures protected wildlife. Such acts may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering.

Projects that would result in "take" of any federally listed threatened or endangered species are required to obtain incidental take authorization from NMFS or USFWS through either the Section 7 (interagency consultation) process described above or Section 10(a) (incidental take permit) of FESA. The Section 7 authorization process is used to determine if a project with a federal nexus would jeopardize the continued existence of a listed species and what mitigation measures would be required to avoid jeopardizing the species. The Section 10(a) process allows take of endangered species or their habitat when no other federal government action is involved. Because the Project could affect a federally listed species and would require a federal (Section 404) permit, pursuant to Section 7 of the FESA, the USACE must initiate consultation with USFWS or NMFS prior to carrying out its discretionary authority under Section 404 of the CWA.

Migratory Bird Treaty Act (MBTA)

The federal *Migratory Bird Treaty Act* (MBTA; 16 USC, Sec. 703, Supp. I, 1989) prohibits killing, possessing, or trading in any native bird that may occur within the Study Area except in accordance with regulations prescribed by the Secretary of the Interior. It is an international treaty for the conservation and management of bird species that migrate through more than one country, and is enforced in the United States by the USFWS. This act encompasses whole birds, parts of birds, and bird nests and eggs and provides protection to over 800 species in the United States. All native birds in the Study Area are protected by the MBTA.

Marine Mammal Protection Act

The *Marine Mammal Protection Act* (MMPA) was enacted in 1972 and amended through 2007(16 USC 1631). All marine mammals are protected by the MMPA, which prohibits their take in US Waters. Take is defined in the MMPA as "harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect" [16 USC 1631 Section 3(13)]. This is a slightly different definition than the FESA, which also encompasses "attempts" to engage in these activities. Under the MMPA, "harassment" is further defined as any action that of pursues, torments, or annoys a marine mammal and which has the potential to injure or disturb a marine mammal or marine mammal stock in the wild including alteration of behavior patterns including migration, breathing, nursing, breeding, feeding, or sheltering [16 USC 1631 Section 3(18(A))].

Species that occur within San Francisco Bay on a regular basis that are protected by the MMPA include the harbor seal and the California sea lion. The MMPA would apply to the Project, because in-water construction activities such as pile driving could harass these animals.

Magnuson-Stevens Fisheries Conservation Act and Management Act

The NMFS has the authority to implement the *Magnuson-Stevens Fisheries Conservation and Management Act* (Public Law 94-264; MSA). The *Magnuson-Stevens Act* (MSA) was amended and reauthorized on January 12, 2007, by the *Magnuson-Stevens Fisheries Conservation and Management Reauthorization Act* (PL 109-479). The MSA was put into place to promote conservation and management of the Nation's fishery resources. The MSA established the Pacific Fishery

Management Council, which was tasked with creating the Pacific Coast Groundfish Fishery Management Plan (FMP).[168] The most recent amendment to the FMP was adopted by NMFS in May 2006.[169] The FMP develops recommendations for the management of groundfish fisheries, and in some cases, it contains specific fishery management recommendations. [170] In addition, the FMP addresses provisions in the MSA relating to EFH to ensure that fishery resources are managed through the regulation of EFH. The MSA defines EFH as "... those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" [16 USC 1802 MSA Section 3(10)]. The terms in this definition have been further defined to include:[171]

- Aquatic habitat and associated physical, chemical, and biological properties that are used by fish (historically used areas may be included)
- Sediment, stream substrates, instream structure, and associated biological communities
- The habitat required to support a sustainable fishery including that particular species' place in a properly functioning ecosystem
- The habitat required to support a full life cycle for the species under consideration

The tidal aquatic habitats adjacent to the Project site are considered EFH by NMFS for a species assemblage that includes anchovies, sardines, rockfish, sharks, sole, and flounder.[172,173] Areas supporting the native Olympia oyster found in San Francisco Bay are also considered EFH by NMFS because oyster beds generally increase fish abundance. The NMFS consults with federal action agencies under the MSA in a process similar and often parallel to the Section 7 FESA consultation. Because the Project would modify designated EFH, consultation with NMFS under the MSA is anticipated and would be initiated by the USACE during the permitting process for the Project.

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[168] PFMC (Pacific Fisheries Management Council) 2006. *Pacific Coast Groundfish Fishery Management Plan as revised through Amendment 19* (March 2006).

[169] National Marine Fisheries Service (NMFS). 2006. *Magnuson-Stevens Act Provisions; Fisheries off West Coast States; Pacific Coast Groundfish Fishery: Final Rule*. 71 FR 27408.

[170] National Marine Fisheries Service (NMFS). 2006. *Magnuson-Stevens Act Provisions; Fisheries off West Coast States; Pacific Coast Groundfish Fishery: Final Rule*. 71 FR 27408.

[171] Pacific Fisheries Management Council (PFMC) 2003. *Pacific Coast Salmon Plan – Fishery management plan for commercial and recreational salmon fisheries off the coast of Washington, Oregon, and California as revised through Amendment 14* (adopted March 1999).

[172] National Marine Fisheries Service (NMFS). 2006. Fisheries Management Plan (FMP) *Species Distributions In San Francisco, San Pablo and Suisun Bays*. Website: http://swr.nmfs.noaa.gov/hcd/loclist.htm#South%20SF%20Bay. Accessed October 29, 2008.

[173] National Marine Fisheries Service (NMFS).Essential Fish Habitat (EFH) for Pacific Coast Groundfish. Map dated July 26, 2008.

Section 10 of the Rivers and Harbors Act of 1899

Section 10 of the *Rivers and Harbors Act of 1899* (33 USC 403) gives the USACE jurisdiction over tidal waters of the US from the MHW elevation seaward (33 USC 403.382.4b). Specifically, it prohibits the construction, dredging, or fill of any navigable water without a permit from the USACE. This includes construction of breakwaters or marinas, installation of pilings, docks, or bridges, and excavation of existing substrates.

The Project would require placement of fill for bridge construction, shoreline revetments, breakwaters, installation of pilings and marina floats, and installation of gangways for access to the docks. All of these activities would be subject to the USACE jurisdiction under Section 10 of the *Rivers and Harbors Act*, and USACE authorization of these activities must be obtained through the permitting process for the Project.

State

California Endangered Species Act (CESA)

The CESA was enacted in 1984. Under the CESA, the California Fish and Game Commission has the responsibility for maintaining a list of threatened and endangered species. Pursuant to the requirements of CESA, an agency reviewing a project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present in the Study Area and determine whether the Project would have an adverse affect on such species. In addition, CDFG encourages informal consultation on any project that may impact a candidate species. Peregrine falcons nest within the Study Area, as noted above, and are listed as endangered under the CESA, although the species is proposed to be delisted.

Section 2080 of the *California Fish and Game Code* prohibits “take” of any species that the commission determines to be an endangered species or a threatened species. Take is defined in Section 86 of the *California Fish and Game Code* as “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.” Sections 2081(b) and (c) of the *California Fish and Game Code* allow CDFG to issue an incidental take permit for a state-listed threatened or endangered species only if specific criteria are met, such as take incidental to an otherwise lawful activity. CESA emphasizes early consultation to avoid potential impacts to rare, endangered, and threatened species and to develop appropriate mitigation planning to offset project-caused losses of listed species populations and their essential habitats.

Fish and Game Code—Sections 1602, 3503, 3503.5, 3511, 3513, 4150, 4700, 5050, and 5515

California Fish and Game Code Section 3503 states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by the code. Birds of prey are further protected under *California Fish and Game Code* Section 3503.5, which states that "it is unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird, except as otherwise provided by this code or any regulation adopted pursuant thereto." Construction disturbance during the breeding season could result in the incidental loss of eggs or nestlings, or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered take by CDFG. Similarly, Section 4150 of the *California Fish and Game Code* describes protections for nongame mammals.

California Species of Special Concern is a designation used by the CDFG for some declining wildlife species that are not state candidates for listing as threatened or endangered. This designation does not provide legal protection but signifies that these species are recognized as having special status by the CDFG. Under CEQA Guidelines (Section 15380), potential impacts to these species must be assessed.

California laws relating to Fully Protected species (i.e., Section 3511) were among the first attempts in the nation to provide additional protection to animals that were rare or faced possible extinction, predating even the FESA. Most fully protected species have also been given additional protection under more recent laws and regulations, and many have been listed under state and federal versions of the FESA. Fully Protected species (such as the peregrine falcon and white-tailed kite) may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock. Four sections of the *California Fish and Game Code* list 37 fully protected species (*California Fish and Game Code* Sections 3511, 4700, 5050, and 5515). Each of these statutes (1) prohibits take or possession "at any time" of the species listed in the statute, with few exceptions, (2) states that no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to "take" the species, and (3) states that no previously issued permits or licenses for take of the species "shall have any force or effect" for authorizing take or possession.

Section 1602 of the *California Fish and Game Code* requires a Streambed Alteration Agreement for any activity that may alter the bed and/or bank of a lake, stream, river, or channel. Typical activities that require a Streambed Alteration Agreement include excavation or fill placed within a channel, vegetation clearing, structures for diversion of water, installation of culverts and bridge supports, cofferdams for construction dewatering, and bank reinforcement. A Streambed Alteration Agreement would be required as part of the permitting process for this Project.

CEQA Guidelines Section 15380

Although threatened and endangered species are protected by specific federal and state statutes, CEQA Guidelines section 15380(b) provides that a species not listed on the federal or state list of protected species may be considered rare or endangered if the species can be shown to meet certain criteria. These criteria have been modeled after the definition in FESA and the section of the California Fish and Game Code dealing with rare or endangered plants and animals, and allows a public agency to undertake a review to determine if a significant effect on species that have not yet been listed by either the USFWS or CDFG (i.e., species of concern) would occur. Whether a species is rare, threatened, or endangered can be legally significant because, under CEQA Guidelines Section 15065, an agency must find an impact to be significant if a project would "substantially reduce the number or restrict the range of an endangered, rare, or threatened species." Thus, CEQA provides an agency with the ability to protect a species from a project's potential impacts until the respective government agencies have an opportunity to list the species as under an endangered species act, if warranted.

The CEQA Guidelines for biological resources are influenced by the California Native Plant Society's inventory of special-status plant species. CNPS maintains four species lists of varying rarity.[174] Vascular plants listed as rare or endangered by the CNPS,[175] but which have no designated status or protection under federal or state-endangered species legislation, are defined as follows:

List 1A	Plants Believed Extinct.
List 1B	Plants Rare, Threatened, or Endangered in California and elsewhere.
List 2	Plants Rare, Threatened, or Endangered in California, but more numerous elsewhere.
List 3	Plants About Which More Information is Needed - A Review List.
List 4	Plants of Limited Distribution - A Watch List.

In general, plants appearing on CNPS List 1 or 2 are considered to meet CEQA Guidelines section 15380 criteria and project effects to these species may be considered significant.

It is this section that provides for the inclusion of the various species of special concern and CNPS List 1 and 2 plants presented previously (Table 3).

174 Recent modifications to the CNPS Ranking System include the addition of a new Threat Code extension to listed species (e.g., List 1B.1, List 2.2 etc.). A Threat Code extension of .1 signifies that a species is seriously endangered in California; .2 is fairly endangered in California; and .3 is not very endangered in California.

175 California Native Plant Society, *California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California* (sixth edition), Sacramento, CA., 2001.

Porter-Cologne Water Quality Control Act

The *Porter-Cologne Water Quality Control Act* (California Water Code Sections 13000 et seq.) charges the SWRCB and the nine RWQCBs statewide with protecting water quality throughout California. Typically, the SWRCB and RWQCB act in concert with the USACE under Section 401 of the *Clean Water Act* in relation to permitting fill of federally jurisdictional waters. The US Supreme Court has acted to limit the regulatory jurisdiction of the USACE under Section 404 of the *Clean Water Act*.[176] This action did not limit the State's regulatory jurisdiction over Waters of the State.[177] Waters of the State are defined in Section 13050(e) of the *Porter-Cologne Water Quality Control Act* as "…any surface water or groundwater, including saline waters, within the boundaries of the state."

Wetlands are delineated in accordance with methodology presented in the 1987 *Corps of Engineers Wetlands Delineation Manual*[178] and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region*.[179] Applicants have this delineation verified by the USACE and, in cases where an area meets the criteria to be considered a wetland, but the USACE does not have jurisdiction, the applicant is referred to the appropriate RWQCB. For the Study Area, the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) could exercise its jurisdiction over wetlands where a project does not require a federal permit, but involves removal or placement of material into Waters of the State. The USACE has indicated that the waters and wetlands potentially impacted by the Project are subject to its jurisdiction. A Section 401 clean water certification or waiver would be required as part of the permitting process for this Project.

Regional and Local

The McAteer-Petris Act (California Government Code 66600–66682)

The *McAteer-Petris Act* created the San Francisco Bay Conservation and Development Commission (BCDC) in 1965. BCDC's mission is the preservation of San Francisco Bay from indiscriminate filling. BCDC's first task was compilation of a comprehensive study of the Bay and determination of how future development of the Bay should occur. This effort resulted in the San Francisco Bay Plan in 1968. In 1969 the findings and policies of the Bay Plan were incorporated into the *McAteer-Petris*

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[176] United States Supreme Court (USSC), *Solid Waste Agency of Northern Cook County v. US Army Corps of Engineers*. 531 US 159(2001), also known as the "SWANCC decision."

[177] Guzy, G.S. and R.J. Andersen., *Memorandum from the Corps regarding: Supreme Court ruling concerning CWA jurisdiction over isolated waters.* Website: http://www.spn.usace.army.mil/regulatory/ swancc.pdf, 2001.

[178] Environmental Laboratory, *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, US Army Engineer Waterways Experiment Station. Vicksburg, Miss., 1987.

[179] US Army Corps of Engineers, *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)*, Wetlands Regulatory Assistance Program, Vicksburg, Miss., September 2008.

Act, which was amended making BCDC a permanent state agency. The Bay Plan continues to evolve and remains the guiding document for BCDC's actions. Section 66610 of the *McAteer-Petris Act* establishes the boundaries of San Francisco Bay in relation to BCDC's jurisdiction. Essentially, all areas below the mean high tide line and an area within a shoreline band that extends landward for 100 feet from the mean high tide line are subject to their jurisdiction. Section 66632 of the *McAteer-Petris Act* establishes the permitting process for projects that would place fill in, on, or over any part of BCDC's jurisdiction as defined in Section 66610. Some aspects of the Project would be in the water or within the shoreline band and, therefore, subject to BCDC's jurisdiction.

Long Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region (LTMS) Management Plan

In 1999, under the authority of the federal FESA, NOAA Fisheries and the USFWS, and the CDFG, under the CESA, completed a programmatic consultation for the Long Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region (LTMS) Management Plan[180]. NOAA Fisheries, USFWS and CDFG concluded that the LTMS program was not likely to jeopardize the continued existence of listed species under their jurisdiction. The respective biological opinions provided an incidental take statement, which authorized the take of listed species that may inadvertently occur during dredging and dredged material disposal activities that adhere to the environmental work windows set forth in the LTMS Management Plan. Therefore, permitted dredging activities that conform to the Environmental Work Windows can be completed without the need to consult with the resource agencies under the FESA and the CESA. Any project proposing to conduct dredging activities outside of the LTMS environmental work windows is required to undertake either informal or formal consultation with the appropriate resource agencies (NOAA Fisheries, USFWS, and CDFG).

San Francisco Bay Trail Plan

Environmental Protection Policies of the San Francisco Bay Trail Plan relevant to the Project are listed below. [181]

> 23. The Committee is aware of the ecological value of wetlands; in many cases, they provide habitat for a variety of endangered species. In the San Francisco Bay Area, these areas serve as a vital link in the Pacific flyway for feeding, breeding, nesting and cover for migratory birds. To

[180] LTMS Environmental Work Windows Work Group. LTMS Informal work windows, Informal consultation preparation packet. Draft version 1.4. February 2004. Website: http://www.spn.usace.army.mil/conops/informal.pdf.

[181] Bay Trail Plan. 1999. Electronic file: http://baytrail.abag.ca.gov/baytrailplan.html#designguidelines. July 30.

avoid impacts in wetlands habitats, the Bay Trail should not require fill in wetlands, and should be designed so that use of the trail avoids adverse impacts on wetland habitats.

24. Future support facilities serving the Bay Trail should be designed and constructed in such a manner that they do not impact fish and wildlife resources, especially wetlands. These facilities should be located and designed in a way that no fill of wetlands will be required.

26. The path will not always follow the Bay shoreline; inland reaches may be more appropriate, especially for bicycle travel, in some parts of the San Francisco Bay region.

28. Where the alignment of the Bay Trail may more appropriately be located away from the shoreline in order to protect particularly sensitive habitats, access to shoreline areas may be possible by connecting the Bay Trail to existing loop trails and other interpretive facilities. These access points should be planned and designed to make clear the distinction between the continuous Bay Trail and the interpretive trail. (Features may include different trail surfaces, marked entry points to interpretive areas, expanded facilities for education and shoreline interpretation, signage, regulation and enforcement of regulations.)

29. Provision of land or funds for Bay Trail planning or construction shall not be considered mitigation for wetland losses.

Candlestick Point State Recreation Area General Plan

The following excerpt from the CPSRA General Plan is related to natural resource management:[182]

> It is the policy of the department to protect the scenic values and to enhance, manage, and protect the biotic and natural resources of the area, while fully realizing the potential of the area for fulfillment of outdoor recreation needs. A wetland restoration and management plan shall be developed for the area north and east of the extension of Yosemite Avenue to the Bay, an area known as the Nature Area. The plan shall include provisions for natural restoration and removal of debris, design of a shoreline configuration that provides a healthy intertidal action, revegetation, and wildlife habitat enhancement. This plan shall be developed in coordination with local, Bay protection, and wildlife agencies.

San Francisco Bay Plan

A summary of the policies of the San Francisco Bay Plan related to biological resources is provided below.

[182] State Department of Parks and Recreation. Candlestick Point State Recreation Area General Plan, March, 1988.

Policies Concerning Fish, Other Aquatic Organisms and Wildlife in the Bay, Tidal Marshes and Tidal Flats Around the Bay , and Subtidal Areas in the Bay [183]

The SFBCDC shall protect native fish species, other aquatic organisms, other listed wildlife species and their specific habitats under the *California Endangered Species Act* or federal *Marine Mammal Protection Act* within the Bay's tidal marshes, tidal flats, and subtidal habitat. To the greatest extent feasible, specific habitats such as tidal marsh, tidal flats, and subtidal habitats shall be conserved, restored, and increased. Specific habitats that are needed to conserve, increase or prevent the extinction of any native species, species threatened or endangered, species that the CDFG has determined are candidates for listing as endangered or threatened under the California *Endangered Species Act*, or any species that provides substantial public benefits, should be protected, whether in the Bay or behind dikes. In reviewing or approving habitat restoration programs the SFBCDC should follow the recommendations in the Baylands Ecosystem Habitat Goals and provide a diversity of habitats for native aquatic and terrestrial plant and animal species. For projects that may adversely affect an endangered or threatened plant, fish, other aquatic organism or wildlife species the SFBCDC should consult and give appropriate consideration to the recommendations of the California Department of Fish and Game and the US Fish and Wildlife Service or the National Marine Fisheries Service and not authorize projects that would result in the "taking" of any plant, fish, other aquatic organism or wildlife species listed as endangered or threatened pursuant to the state or federal endangered species acts, or species that are candidates for listing under the CESA, unless the project applicant has obtained the appropriate "take" authorization from the US Fish and Wildlife Service, National Marine Fisheries Service or the California Department of Fish and Game. However, the SFBCDC may permit a minor amount of fill or dredging in wildlife refuges, shown on the Plan Maps, necessary to enhance fish, other aquatic organisms and wildlife habitat or to provide public facilities for wildlife observation, interpretation and education.

Policies Concerning Shoreline Protection around the Bay[184]

New shoreline erosion control projects and the maintenance or reconstruction of existing erosion control facilities should be authorized if *(a)* the project is necessary to protect the shoreline from erosion; *(b)* the type of the protective structure is appropriate for the project site and the erosion conditions at the site; and *(c)* the project is properly designed and constructed. Professionals knowledgeable of the Commission's concerns, such as civil engineers experienced in coastal processes, should participate in the design of erosion control projects.

Policies Concerning Dredging in the Bay[185]

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[183] SFBCDC, San Francisco Bay Plan, Reprinted February 2008.
[184] Ibid.
[185] Ibid.

Dredging and dredged material disposal should be conducted in an environmentally and economically sound manner. Dredgers should reduce disposal in the Bay and certain waterways over time to achieve the LTMS goal of limiting in-Bay disposal volumes to a maximum of one million cubic yards per year. The LTMS agencies should implement a system of disposal allotments to individual dredgers to achieve this goal only if voluntary efforts are not effective in reaching the LTMS goal. In making its decision regarding disposal allocations, the Commission should confer with the LTMS agencies and consider the need for the dredging and the dredging projects, environmental impacts, regional economic impacts, efforts by the dredging community to implement and fund alternatives to in-Bay disposal, and other relevant factors. Small dredgers should be exempted from allotments, but all dredgers should comply with the SFBCDC policies.

Yosemite Slough Restoration Plan

The Yosemite Slough Restoration Plan (2005) was developed on behalf of the State Parks Department, in accordance with the CPSRA GP. The restoration of Yosemite Slough would create the largest contiguous wetland area in San Francisco. The restoration project would help restore essential wildlife habitat, improve water quality, and prevent erosion along the shoreline of the City—an area of the bay where tidal wetlands have been most impacted and suffered the greatest loss due to urbanization.

Goals and objectives of the restoration include the following:

- Increase the area subject to tidal influence by excavating three areas that were formerly part of San Francisco Bay.
- Restore habitat diversity by adding 12 acres of tidally influenced wetlands and marsh area and remove chemically impacted soils from upland areas to improve the quality of existing habitat.
- Improve habitat for special-status species (i.e., western snowy plover and double-crested cormorants) by creating two nesting islands.
- Improve the quality of life for the surrounding community by creating a clean, beautiful local park for viewing wildlife habitat.
- Create an environmental area that local schools can use for field trips.
- Connect to the Blue Greenway, an important effort to build 13 miles of Bay Trail along the southern waterfront of the San Francisco Bay Trail.

City of San Francisco General Plan

The following goals and policies related to biological resources protection are included in the Environmental Protection Element of the *San Francisco General Plan*, and are relevant to the Project:

General

Objective 1 Achieve a proper balance among the conservation, utilization, and development of San Francisco's natural resources.

Policy 1.1 Conserve and protect the natural resources of San Francisco.

Policy 1.2 Improve the quality of natural resources.

Policy 1.3 Restore and replenish the supply of natural resources.

Policy 1.4 Assure that all new development meets strict environmental quality standards and recognizes human needs.

Bay, Ocean, and Shorelines

Objective 3 Maintain and improve the quality of the bay, ocean, and shoreline areas.

Policy 3.1 Cooperate with and otherwise support regulatory programs of existing regional, state, and federal agencies dealing with the Bay, Ocean, and Shorelines.

Policy 3.2 Promote the use and development of shoreline areas consistent with the General Plan and the best interest of San Francisco.

Land

Objective 7 Assure that the land resources in San Francisco are used in ways that both respect and preserve the natural values of the land and serve the best interests of all the City's citizens.

Policy 7.3 Require that filling of land adhere to the highest standards of soils engineering consistent with the proposed use.

Flora and Fauna

Objective 8 Ensure the protection of plant and animal life in the City.

Policy 8.1 Cooperate with and otherwise support the California Department of Fish and Game and its animal protection programs.

Policy 8.2 Protect the habitats of known plant and animal species that require a relatively natural environment.

Policy 8.3 Protect rare and endangered species.

San Francisco Municipal Code

Urban Forestry Ordinance

The City provides protection for trees around the City by way of its Urban Forestry Ordinance (Ord. 165-95, App. 5/19/95), Article 16, Sections 806 (Planting and Removal of Street Trees) through 810 (Significant Trees) of the *Public Works Code*. "Significant trees" are defined as trees within 10 feet of a public right-of-way that also meet one of the following size requirements: 20 feet or greater in height; 15 feet or greater in canopy width; or 12 inches or greater diameter of trunk measured at 4.5 feet above grade. Among the factors considered in the removal of significant trees are the following: their size, age, and species; visual and aesthetic characteristics; cultural or historic characteristics; ecological and location characteristics. Street trees are also protected by the City's Urban Forestry Ordinance and both require a permit for removal. The ordinance also provides a process for designating trees as landmark trees, and protects significant, landmark, and street trees during construction activities. This ordinance applies to limited areas of the Project site where there are significant trees, street trees, and/or landmark trees.

Planning Code

Section 143 of the San Francisco Planning Code requires the installation of one street tree for each 20 feet of property frontage along each street or alley, with any remaining fraction of 10 feet or more of frontage requiring an additional tree for the owner or developer of a new or relocated building, or a building with 20% or more floor area expansion in specified districts.[186] This ordinance applies to the R, SPD, RSD, NC, C-3, DTR, MUG, MUO, MUR, UMU, SLR, SLI, and SSO Districts.

DISCUSSION

This Biological Technical Report describes the existing biological resources of the CPHPS Project site and vicinity and the regulatory framework under which Project activities must be conducted. The Biological Resources Chapter of the Project's EIR will analyze impacts of the Project on these resources. In addition, pursuant to the regulations described in the "Regulatory Framework" section of this report, permits from various regulatory agencies must be obtained to authorize Project impacts to regulated resources.

[186] Amended by Ord. 414-85, App. 9/17/85; Ord. 69-87, App. 3/13/87; Ord. 115-90, App. 4/6/90; Ord. 298-08, File No. 081153, App. 12/19/2008.

APPENDIX A
CNDDB SPECIAL-STATUS SPECIES LIST

California Department of Fish and Game
Natural Diversity Database
Selected Elements by Scientific Name - San Francisco South and Hunter's Point quads

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
1	***Actinemys marmorata*** western pond turtle	ARAAD02030			G3G4	S3	SC
2	***Amsinckia lunaris*** bent-flowered fiddleneck	PDBOR01070			G2	S2.2	1B.2
3	***Arctostaphylos hookeri ssp. franciscana*** Franciscan manzanita	PDERI040J3			G3TXC	SX	1A
4	***Arctostaphylos hookeri ssp. ravenii*** Presidio manzanita	PDERI040J2	Endangered	Endangered	G3T1	S1.1	1B.1
5	***Arctostaphylos imbricata*** San Bruno Mountain manzanita	PDERI040L0		Endangered	G1	S1.2	1B.1
6	***Arctostaphylos montaraensis*** Montara manzanita	PDERI042W0			G2	S2.2	1B.2
7	***Arctostaphylos pacifica*** Pacific manzanita	PDERI040Z0		Endangered	G1	S1.1	1B.2
8	***Astragalus tener var. tener*** alkali milk-vetch	PDFAB0F8R1			G1T1	S1.1	1B.2
9	***Banksula incredula*** incredible harvestman	ILARA14100			G1	S1	
10	***Caecidotea tomalensis*** Tomales isopod	ICMAL01220			G2	S2	
11	***Callophrys mossii bayensis*** San Bruno elfin butterfly	IILEPE2202	Endangered		G4T1	S1	
12	***Carex comosa*** bristly sedge	PMCYP032Y0			G5	S2?	2.1
13	***Charadrius alexandrinus nivosus*** western snowy plover	ABNNB03031	Threatened		G4T3	S2	SC
14	***Chorizanthe cuspidata var. cuspidata*** San Francisco Bay spineflower	PDPGN04081			G2T2	S2.2	1B.2
15	***Chorizanthe robusta var. robusta*** robust spineflower	PDPGN040Q2	Endangered		G2T1	S1.1	1B.1
16	***Cicindela hirticollis gravida*** sandy beach tiger beetle	IICOL02101			G5T2	S1	
17	***Cirsium andrewsii*** Franciscan thistle	PDAST2E050			G2	S2.2	1B.2
18	***Cirsium occidentale var. compactum*** compact cobwebby thistle	PDAST2E1Z1			G3G4T2	S2.1	1B.2
19	***Collinsia multicolor*** San Francisco collinsia	PDSCR0H0B0			G2	S2.2	1B.2
20	***Dufourea stagei*** Stage's dufourine bee	IIHYM22010			G1?	S1?	
21	***Eucyclogobius newberryi*** tidewater goby	AFCQN04010	Endangered		G3	S2S3	SC
22	***Euphydryas editha bayensis*** Bay checkerspot butterfly	IILEPK4055	Threatened		G5T1	S1	
23	***Fritillaria liliacea*** fragrant fritillary	PMLIL0V0C0			G2	S2.2	1B.2

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
24	***Geothlypis trichas sinuosa*** saltmarsh common yellowthroat	ABPBX1201A			G5T2	S2	SC
25	***Gilia capitata ssp. chamissonis*** blue coast gilia	PDPLM040B3			G5T2	S2.1	1B.1
26	***Grindelia hirsutula var. maritima*** San Francisco gumplant	PDAST470D3			G5T2	S2.1	1B.2
27	***Helianthella castanea*** Diablo helianthella	PDAST4M020			G3	S3.2	1B.2
28	***Hesperevax sparsiflora var. brevifolia*** short-leaved evax	PDASTE5011			G4T2T3	S2S3	2.2
29	***Horkelia cuneata ssp. sericea*** Kellogg's horkelia	PDROS0W043			G4T1	S1.1	1B.1
30	***Hydroporus leechi*** Leech's skyline diving beetle	IICOL55040			G1?	S1?	
31	***Ischnura gemina*** San Francisco forktail damselfly	IIODO72010			G2	S2	
32	***Lasiurus cinereus*** hoary bat	AMACC05030			G5	S4?	
33	***Laterallus jamaicensis coturniculus*** California black rail	ABNME03041		Threatened	G4T1	S1	
34	***Layia carnosa*** beach layia	PDAST5N010	Endangered	Endangered	G2	S2.1	1B.1
35	***Leptosiphon rosaceus*** rose leptosiphon	PDPLM09180			G1	S1.1	1B.1
36	***Lessingia germanorum*** San Francisco lessingia	PDAST5S010	Endangered	Endangered	G1	S1.1	1B.1
37	***Lichnanthe ursina*** bumblebee scarab beetle	IICOL67020			G2	S2	
38	***Malacothamnus arcuatus*** arcuate bush-mallow	PDMAL0Q0E0			G2Q	S2.2	1B.2
39	***Melospiza melodia pusillula*** Alameda song sparrow	ABPBXA301S			G5T2?	S2?	SC
40	***Pentachaeta bellidiflora*** white-rayed pentachaeta	PDAST6X030	Endangered	Endangered	G1	S1.1	1B.1
41	***Phalacrocorax auritus*** double-crested cormorant	ABNFD01020			G5	S3	
42	***Plebejus icarioides missionensis*** Mission blue butterfly	IILEPG801A	Endangered		G5T1	S1	
43	***Rallus longirostris obsoletus*** California clapper rail	ABNME05016	Endangered	Endangered	G5T1	S1	
44	***Rana draytonii*** California red-legged frog	AAABH01022	Threatened		G4T2T3	S2S3	SC
45	***Riparia riparia*** bank swallow	ABPAU08010		Threatened	G5	S2S3	
46	***Sanicula maritima*** adobe sanicle	PDAPI1Z0D0		Rare	G2	S2.2	1B.1

	Scientific Name/Common Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
47	***Silene verecunda ssp. verecunda*** San Francisco campion	PDCAR0U213			G5T2	S2.2	1B.2
48	***Speyeria callippe callippe*** callippe silverspot butterfly	IILEPJ6091	Endangered		G5T1	S1	
49	***Suaeda californica*** California seablite	PDCHE0P020	Endangered		G1	S1.1	1B.1
50	***Thamnophis sirtalis tetrataenia*** San Francisco garter snake	ARADB3613B	Endangered	Endangered	G5T2	S2	
51	***Trachusa gummifera*** A leaf-cutter bee	IIHYM80010			G1	S1	
52	***Triphysaria floribunda*** San Francisco owl's-clover	PDSCR2T010			G2	S2.2	1B.2
53	***Triquetrella californica*** coastal triquetrella	NBMUS7S010			G1	S1.2	1B.2
54	***Tryonia imitator*** mimic tryonia (=California brackishwater snail)	IMGASJ7040			G2G3	S2S3	

Name (Scientific/Common)	CNDDB Ranks	Other Lists	Listing Status	Total EO's	Element Occ Ranks A	B	C	D	X	U	Population Status Historic >20 yr	Recent <=20 yr	Presence Pres. Extant	Poss. Extirp.	Extirp.
Actinemys marmorata western pond turtle	G3G4 S3	CDFG: SC	Fed: None Cal: None	1092 S:2	0	1	1	0	0	0	0	2	2	0	0
Amsinckia lunaris bent-flowered fiddleneck	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	50 S:1	0	0	0	0	0	1	1	0	1	0	0
Arctostaphylos hookeri ssp. franciscana Franciscan manzanita	G3TXC SX	CNPS: 1A	Fed: None Cal: None	3 S:1	0	0	0	0	1	0	1	0	0	0	1
Arctostaphylos hookeri ssp. ravenii Presidio manzanita	G3T1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: Endangered	7 S:1	0	0	0	0	1	0	1	0	0	0	1
Arctostaphylos imbricata San Bruno Mountain manzanita	G1 S1.2	CNPS: 1B.1	Fed: None Cal: Endangered	3	0	0	0	0	0	3	1	2	3	0	0
Arctostaphylos montaraensis Montara manzanita	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	4 S:1	0	0	0	1	0	0	1	0	1	0	0
Arctostaphylos pacifica Pacific manzanita	G1 S1.1	CNPS: 1B.2	Fed: None Cal: Endangered	1	0	0	1	0	0	0	0	1	1	0	0
Astragalus tener var. tener alkali milk-vetch	G1T1 S1.1	CNPS: 1B.2	Fed: None Cal: None	66 S:1	0	0	0	0	1	0	1	0	0	1	0
Banksula incredula incredible harvestman	G1 S1	CDFG:	Fed: None Cal: None	1	0	0	0	0	0	1	0	1	1	0	0
Caecidotea tomalensis Tomales isopod	G2 S2	CDFG:	Fed: None Cal: None	6 S:2	0	0	1	1	0	0	2	0	2	0	0
Callophrys mossii bayensis San Bruno elfin butterfly	G4T1 S1	CDFG:	Fed: Endangered Cal: None	10 S:3	0	0	0	0	0	3	2	1	3	0	0
Carex comosa bristly sedge	G5 S2?	CNPS: 2.1	Fed: None Cal: None	11 S:1	0	0	0	0	1	0	1	0	0	1	0
Charadrius alexandrinus nivosus western snowy plover	G4T3 S2	CDFG: SC	Fed: Threatened Cal: None	116 S:1	0	0	0	0	0	1	1	0	1	0	0
Chorizanthe cuspidata var. cuspidata San Francisco Bay spineflower	G2T2 S2.2	CNPS: 1B.2	Fed: None Cal: None	20 S:7	0	0	3	0	0	4	4	3	7	0	0
Chorizanthe robusta var. robusta robust spineflower	G2T1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: None	23 S:2	0	0	0	0	2	0	2	0	0	2	0

Name (Scientific/Common)	CNDDB Ranks	Other Lists	Listing Status	Total EO's	Element Occ Ranks A	B	C	D	X	U	Population Status Historic >20 yr	Recent <=20 yr	Presence Pres. Extant	Poss. Extirp.	Extirp.
Cicindela hirticollis gravida sandy beach tiger beetle	G5T2 S1	CDFG:	Fed: None Cal: None	34 S:1	0	0	0	0	1	0	1	0	0	0	1
Cirsium andrewsii Franciscan thistle	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	27 S:1	0	0	0	0	1	0	1	0	0	1	0
Cirsium occidentale var. compactum compact cobwebby thistle	G3G4T2 S2.1	CNPS: 1B.2	Fed: None Cal: None	14 S:1	0	0	0	0	1	0	1	0	0	1	0
Collinsia multicolor San Francisco collinsia	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	22 S:7	0	0	0	0	0	7	7	0	7	0	0
Dufourea stagei Stage's dufourine bee	G1? S1?	CDFG:	Fed: None Cal: None	1	0	0	0	0	0	1	1	0	1	0	0
Eucyclogobius newberryi tidewater goby	G3 S2S3	CDFG: SC	Fed: Endangered Cal: None	116 S:1	0	0	0	0	1	0	1	0	0	0	1
Euphydryas editha bayensis Bay checkerspot butterfly	G5T1 S1	CDFG:	Fed: Threatened Cal: None	24 S:3	0	0	0	0	3	0	3	0	0	0	3
Fritillaria liliacea fragrant fritillary	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	59 S:1	0	0	0	0	1	0	1	0	0	1	0
Geothlypis trichas sinuosa saltmarsh common yellowthroat	G5T2 S2	CDFG: SC	Fed: None Cal: None	110 S:2	0	0	0	0	0	2	2	0	2	0	0
Gilia capitata ssp. chamissonis blue coast gilia	G5T2 S2.1	CNPS: 1B.1	Fed: None Cal: None	29 S:3	0	1	0	0	0	2	2	1	3	0	0
Grindelia hirsutula var. maritima San Francisco gumplant	G5T2 S2.1	CNPS: 1B.2	Fed: None Cal: None	15 S:8	0	0	1	1	1	5	8	0	7	0	1
Helianthella castanea Diablo helianthella	G3 S3.2	CNPS: 1B.2	Fed: None Cal: None	82 S:3	0	1	0	0	0	2	2	1	3	0	0
Hemizonia congesta ssp. congesta seaside tarplant	G5T2T3 S2S3	CNPS: 1B.2	Fed: None Cal: None	33 S:2	0	0	0	0	1	1	2	0	1	1	0
Hesperevax sparsiflora var. brevifolia short-leaved evax	G4T2T3 S2S3	CNPS: 1B.2	Fed: None Cal: None	36 S:1	0	0	0	0	0	1	1	0	1	0	0
Horkelia cuneata ssp. sericea Kellogg's horkelia	G4T1 S1.1	CNPS: 1B.1	Fed: None Cal: None	38 S:3	0	0	0	0	0	3	3	0	3	0	0

Name (Scientific/Common)	CNDDB Ranks	Other Lists	Listing Status	Total EO's	Element Occ Ranks A	B	C	D	X	U	Population Status Historic >20 yr	Recent <=20 yr	Presence Pres. Extant	Poss. Extirp.	Extirp.
Hydroporus leechi Leech's skyline diving beetle	G1? S1?	CDFG:	Fed: None Cal: None	13 S:1	0	0	0	0	0	1	1	0	0	1	0
Ischnura gemina San Francisco forktail damselfly	G2 S2	CDFG:	Fed: None Cal: None	6 S:2	0	0	0	0	0	2	2	0	2	0	0
Lasiurus cinereus hoary bat	G5 S4?	CDFG:	Fed: None Cal: None	235 S:4	0	0	0	0	0	4	3	1	4	0	0
Laterallus jamaicensis coturniculus California black rail	G4T1 S1	CDFG:	Fed: None Cal: Threatened	233 S:1	0	0	0	0	0	1	1	0	1	0	0
Layia carnosa beach layia	G2 S2.1	CNPS: 1B.1	Fed: Endangered Cal: Endangered	22 S:1	0	0	0	0	1	0	1	0	0	0	1
Leptosiphon rosaceus rose leptosiphon	G1 S1.1	CNPS: 1B.1	Fed: None Cal: None	25 S:1	0	0	0	0	1	0	1	0	0	1	0
Lessingia germanorum San Francisco lessingia	G1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: Endangered	5 S:2	0	0	1	0	1	0	1	1	1	1	0
Lichnanthe ursina bumblebee scarab beetle	G2 S2	CDFG:	Fed: None Cal: None	8 S:2	0	0	0	0	0	2	2	0	2	0	0
Malacothamnus arcuatus arcuate bush-mallow	G2Q S2.2	CNPS: 1B.2	Fed: None Cal: None	21 S:1	0	0	0	0	0	1	1	0	1	0	0
Melospiza melodia pusillula Alameda song sparrow	G5T2? S2?	CDFG: SC	Fed: None Cal: None	38 S:3	0	0	0	0	0	3	3	0	3	0	0
Mylopharodon conocephalus hardhead	G3 S3	CDFG: SC	Fed: None Cal: None	32 S:1	0	0	0	0	0	1	1	0	1	0	0
Pentachaeta bellidiflora white-rayed pentachaeta	G1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: Endangered	14 S:1	0	0	0	0	1	0	1	0	0	1	0
Phalacrocorax auritus double-crested cormorant	G5 S3	CDFG:	Fed: None Cal: None	37 S:2	0	0	2	0	0	0	0	2	2	0	0
Plebejus icarioides missionensis Mission blue butterfly	G5T1 S1	CDFG:	Fed: Endangered Cal: None	14 S:12	0	2	1	0	1	8	2	10	12	0	0
Rallus longirostris obsoletus California clapper rail	G5T1 S1	CDFG:	Fed: Endangered Cal: Endangered	90 S:2	0	0	1	0	0	1	1	1	2	0	0

Name (Scientific/Common)	CNDDB Ranks	Other Lists	Listing Status	Total EO's	Element Occ Ranks A	B	C	D	X	U	Population Status Historic >20 yr	Recent <=20 yr	Presence Pres. Extant	Poss. Extirp.	Extirp.
Rana draytonii California red-legged frog	G4T2T3 S2S3	CDFG: SC	Fed: Threatened Cal: None	1238 S:6	1	2	1	0	0	2	1	5	6	0	0
Riparia riparia bank swallow	G5 S2S3	CDFG:	Fed: None Cal: Threatened	190 S:3	0	1	0	0	0	2	3	0	3	0	0
Sanicula maritima adobe sanicle	G2 S2.2	CNPS: 1B.1	Fed: None Cal: Rare	16 S:1	0	0	0	0	1	0	1	0	0	1	0
Silene verecunda ssp. verecunda San Francisco campion	G5T2 S2.2	CNPS: 1B.2	Fed: None Cal: None	12 S:2	0	0	0	0	0	2	1	1	2	0	0
Speyeria callippe callippe callippe silverspot butterfly	G5T1 S1	CDFG:	Fed: Endangered Cal: None	6 S:5	0	1	0	0	0	4	0	5	5	0	0
Suaeda californica California seablite	G1 S1.1	CNPS: 1B.1	Fed: Endangered Cal: None	17 S:2	0	0	0	0	1	1	1	1	1	0	1
Thamnophis sirtalis tetrataenia San Francisco garter snake	G5T2 S2	CDFG:	Fed: Endangered Cal: Endangered	41 S:2	1	0	0	1	0	0	0	2	2	0	0
Trachusa gummifera A leaf-cutter bee	G1 S1	CDFG:	Fed: None Cal: None	2 S:1	0	0	0	0	0	1	1	0	1	0	0
Triphysaria floribunda San Francisco owl's-clover	G2 S2.2	CNPS: 1B.2	Fed: None Cal: None	41 S:5	0	0	0	0	2	3	5	0	3	1	1
Triquetrella californica coastal triquetrella	G1 S1.2	CNPS: 1B.2	Fed: None Cal: None	11 S:1	0	0	0	0	0	1	0	1	1	0	0
Tryonia imitator mimic tryonia (=California brackishwater snail)	G2G3 S2S3	CDFG:	Fed: None Cal: None	34 S:1	0	0	0	0	1	0	1	0	0	0	1

APPENDIX B
CNPS SPECIAL-STATUS SPECIES LIST

Inventory of Rare and Endangered Plants

v7-08b 4-02-08

Status: search results for "+"San Francisco South (448B) 3712264"" - Mon, Jul. 7, 2008, 14:48 b

+"San Francisco South (448B) 3712264" Search

Tip: `CNPS_LIST:"List 3"` (note the field name) returns only taxa on List 3. `"List 3"` by itself, matches the phrase wherever found. Browse the list of **field names**.[all tips and help.][search history]

Hits 1 to 19 of 19
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.
ADD checked items to Plant Press | check all | check none
Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Amsinckia lunaris**	bent-flowered fiddleneck	Boraginaceae	List 1B.2
		1	**Arctostaphylos imbricata**	San Bruno Mountain manzanita	Ericaceae	List 1B.1
		1	**Arctostaphylos montaraensis**	Montara manzanita	Ericaceae	List 1B.2
		1	**Arctostaphylos pacifica**	Pacific manzanita	Ericaceae	List 1B.2
		1	**Centromadia parryi ssp. parryi**	pappose tarplant	Asteraceae	List 1B.2
		1	**Chorizanthe cuspidata var. cuspidata**	San Francisco Bay spineflower	Polygonaceae	List 1B.2
		1	**Cirsium andrewsii**	Franciscan thistle	Asteraceae	List 1B.2
		1	**Collinsia multicolor**	San Francisco collinsia	Scrophulariaceae	List 1B.2
		1	**Equisetum palustre**	marsh horsetail	Equisetaceae	List 3
		1	**Gilia capitata ssp. chamissonis**	blue coast gilia	Polemoniaceae	List 1B.1
		1	**Grindelia hirsutula var. maritima**	San Francisco gumplant	Asteraceae	List 1B.2
		1	**Helianthella castanea**	Diablo helianthella	Asteraceae	List 1B.2
		1	**Horkelia cuneata ssp. sericea**	Kellogg's horkelia	Rosaceae	List 1B.1
		1	**Lessingia germanorum**	San Francisco lessingia	Asteraceae	List 1B.1
		1	**Malacothamnus arcuatus**	arcuate bush-mallow	Malvaceae	List 1B.2
		1	**Plagiobothrys chorisianus var. chorisianus**	Choris' popcorn-flower	Boraginaceae	List 1B.2
		1	**Silene verecunda ssp. verecunda**	San Francisco campion	Caryophyllaceae	List 1B.2
		1	**Triphysaria floribunda**	San Francisco owl's-clover	Scrophulariaceae	List 1B.2
		1	**Triquetrella californica**	coastal triquetrella	Pottiaceae	List 1B.2

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

No more hits.

powered by WODA

CNPS California Native Plant Society — Inventory of Rare and Endangered Plants

v7-08b 4-02-08

Status: search results - Mon, Jul. 7, 2008, 14:48 b

{QUADS_123} =~ m/\(448B\)*/ Search
Tip: Want to search by county? Try the **county index**.[all tips and help.][search history]

Hits 1 to 7 of 7
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.
ADD checked items to Plant Press | check all | check none
Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Arctostaphylos hookeri ssp. franciscana**	Franciscan manzanita	Ericaceae	List 1A
		1	**Arctostaphylos hookeri ssp. ravenii**	Presidio manzanita	Ericaceae	List 1B.1
		1	**Astragalus tener var. tener**	alkali milk-vetch	Fabaceae	List 1B.2
		1	**Chorizanthe robusta var. robusta**	robust spineflower	Polygonaceae	List 1B.1
		1	**Cirsium occidentale var. compactum**	compact cobwebby thistle	Asteraceae	List 1B.2
		1	**Hesperevax sparsiflora var. brevifolia**	short-leaved evax	Asteraceae	List 2.2
		1	**Pentachaeta bellidiflora**	white-rayed pentachaeta	Asteraceae	List 1B.1

No more hits.

CNPS California Native Plant Society Inventory of Rare and Endangered Plants

v7-08b 4-02-08

Status: search results for "+"Hunters Point (448A) 3712263"" - Mon, Jul. 7, 2008, 14:46 b

+"Hunters Point (448A) 3712263" Search

Tip: `CNPS_LIST:"List 3"` (note the field name) returns only taxa on List 3. `"List 3"` by itself, matches the phrase wherever found. Browse the list of **field names**.[all tips and help.][search history]

Hits 1 to 1 of 1
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press check all check none

Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Suaeda californica**	California seablite	Chenopodiaceae	List 1B.1

No more hits.

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Inventory of Rare and Endangered Plants

v7-09d 10-07-09

Status: search results for "+"San Francisco South (448B) 3712264"" - Mon, Nov. 2, 2009, 18:48 b

+"San Francisco South (448B) 3712264" Search
Tip: Want to search by habitat? Try the **Checkbox and Preset** search page.[all tips and help.]
[search history]

Hits 1 to 20 of 20
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.
ADD checked items to Plant Press | check all | check none
Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Amsinckia lunaris**	bent-flowered fiddleneck	Boraginaceae	List 1B.2
		1	**Arctostaphylos imbricata**	San Bruno Mountain manzanita	Ericaceae	List 1B.1
		1	**Arctostaphylos montaraensis**	Montara manzanita	Ericaceae	List 1B.2
		1	**Arctostaphylos pacifica**	Pacific manzanita	Ericaceae	List 1B.2
		1	**Centromadia parryi ssp. parryi**	pappose tarplant	Asteraceae	List 1B.2
		1	**Chorizanthe cuspidata var. cuspidata**	San Francisco Bay spineflower	Polygonaceae	List 1B.2
		1	**Cirsium andrewsii**	Franciscan thistle	Asteraceae	List 1B.2
		1	**Collinsia multicolor**	San Francisco collinsia	Scrophulariaceae	List 1B.2
		1	**Equisetum palustre**	marsh horsetail	Equisetaceae	List 3
		1	**Gilia capitata ssp. chamissonis**	blue coast gilia	Polemoniaceae	List 1B.1
		1	**Grindelia hirsutula var. maritima**	San Francisco gumplant	Asteraceae	List 1B.2
		1	**Helianthella castanea**	Diablo helianthella	Asteraceae	List 1B.2
		1	**Hemizonia congesta ssp. congesta**	pale yellow hayfield tarplant	Asteraceae	List 1B.2
		1	**Horkelia cuneata ssp. sericea**	Kellogg's horkelia	Rosaceae	List 1B.1
		1	**Lessingia germanorum**	San Francisco lessingia	Asteraceae	List 1B.1
		1	**Malacothamnus arcuatus**	arcuate bush-mallow	Malvaceae	List 1B.2

		1	**Plagiobothrys chorisianus var. chorisianus**	Choris' popcorn-flower	Boraginaceae	List 1B.2
		1	**Silene verecunda ssp. verecunda**	San Francisco campion	Caryophyllaceae	List 1B.2
		1	**Triphysaria floribunda**	San Francisco owl's-clover	Scrophulariaceae	List 1B.2
		1	**Triquetrella californica**	coastal triquetrella	Pottiaceae	List 1B.2

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press   check all   check none

Selections will appear in a new window.

No more hits.

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

v7-09d 10-07-09

Status: search results - Mon, Nov. 2, 2009, 18:50 b

{QUADS_123} =~ m/\(448B\)*/ Search

Tip: Having trouble with a multi-word search? Try a single word, e.g. `ginger` or `cobra`.
[all tips and help.][search history]

Hits 1 to 7 of 7

Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.

ADD checked items to Plant Press | check all | check none

Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Arctostaphylos hookeri ssp. franciscana**	Franciscan manzanita	Ericaceae	List 1A
		1	**Arctostaphylos hookeri ssp. ravenii**	Presidio manzanita	Ericaceae	List 1B.1
		1	**Astragalus tener var. tener**	alkali milk-vetch	Fabaceae	List 1B.2
		1	**Chorizanthe robusta var. robusta**	robust spineflower	Polygonaceae	List 1B.1
		1	**Cirsium occidentale var. compactum**	compact cobwebby thistle	Asteraceae	List 1B.2
		1	**Hesperevax sparsiflora var. brevifolia**	short-leaved evax	Asteraceae	List 1B.2
		1	**Pentachaeta bellidiflora**	white-rayed pentachaeta	Asteraceae	List 1B.1

No more hits.

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

v7-09d 10-07-09

Status: search results for "+"Hunters Point (448A) 3712263"" - Mon, Nov. 2, 2009, 18:52 b

+"Hunters Point (448A) 3712263" Search

Tip: `Lathyrus Astragalus` returns species from both genera.[all tips and help.]
[search history]

Hits 1 to 1 of 1
Requests that specify topo quads will return only Lists 1-3.

To save selected records for later study, click the ADD button.
ADD checked items to Plant Press | check all | check none
Selections will appear in a new window.

open	save	hits	scientific	common	family	CNPS
		1	**Suaeda californica**	California seablite	Chenopodiaceae	List 1B.1

No more hits.

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APPENDIX C
USFWS SPECIAL-STATUS SPECIES LIST

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 080707032523

Database Last Updated: January 31, 2008

Quad Lists

HUNTERS POINT (448A)

Listed Species

Invertebrates

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Birds

Charadrius alexandrinus nivosus
western snowy plover (T)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Mammals

Reithrodontomys raviventris
salt marsh harvest mouse (E)

SAN FRANCISCO SOUTH (448B)

Listed Species

Invertebrates

Euphydryas editha bayensis
Critical habitat, bay checkerspot butterfly (X)

Haliotes sorenseni
white abalone (E) (NMFS)

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Speyeria callippe callippe
callippe silverspot butterfly (E)

Speyeria zerene myrtleae
Myrtle's silverspot butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Reptiles

Caretta caretta
loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)
green turtle (T) (NMFS)

Dermochelys coriacea
leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)

Thamnophis sirtalis tetrataenia
San Francisco garter snake (E)

Birds

Brachyramphus marmoratus
marbled murrelet (T)

Charadrius alexandrinus nivosus
western snowy plover (T)

Diomedea albatrus
short-tailed albatross (E)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Mammals

Arctocephalus townsendi
Guadalupe fur seal (T) (NMFS)

Balaenoptera borealis
sei whale (E) (NMFS)

Balaenoptera musculus
blue whale (E) (NMFS)

Balaenoptera physalus
finback (=fin) whale (E) (NMFS)

Eubalaena (=Balaena) glacialis
right whale (E) (NMFS)

Eumetopias jubatus
Steller (=northern) sea-lion (T) (NMFS)

Physeter catodon (=macrocephalus)
sperm whale (E) (NMFS)

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Lessingia germanorum
San Francisco lessingia (E)

Candidate Species

Invertebrates

Haliotes cracherodii
black abalone (C) (NMFS)

County Lists

San Francisco County

Listed Species

Invertebrates

Haliotes sorenseni
white abalone (E) (NMFS)

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Reptiles

Caretta caretta
loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)
green turtle (T) (NMFS)

Dermochelys coriacea
leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)

Birds

Charadrius alexandrinus nivosus
western snowy plover (T)

Diomedea albatrus
short-tailed albatross (E)

Pelecanus occidentalis californicus

California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Mammals

Arctocephalus townsendi
Guadalupe fur seal (T) (NMFS)

Balaenoptera borealis
sei whale (E) (NMFS)

Balaenoptera musculus
blue whale (E) (NMFS)

Balaenoptera physalus
finback (=fin) whale (E) (NMFS)

Eubalaena (=Balaena) glacialis
right whale (E) (NMFS)

Eumetopias jubatus
Critical Habitat, Steller (=northern) sea-lion (X) (NMFS)
Steller (=northern) sea-lion (T) (NMFS)

Megaptera novaeangliae
humpback whale (E) (NMFS)

Physeter catodon (=macrocephalus)
sperm whale (E) (NMFS)

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Arctostaphylos hookeri ssp. ravenii
Presidio (=Raven's) manzanita (E)

Clarkia franciscana
Presidio clarkia (E)

Hesperolinon congestum
Marin dwarf-flax (=western flax) (T)

Lessingia germanorum
San Francisco lessingia (E)

Candidate Species

Invertebrates

Haliotes cracherodii

black abalone (C) (NMFS)

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

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- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our critical habitat page for maps.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts.

More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be October 05, 2008.

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 091102032902

Database Last Updated: January 29, 2009

Quad Lists

Listed Species

Invertebrates

Euphydryas editha bayensis
Critical habitat, bay checkerspot butterfly (X)

Haliotes cracherodii
black abalone (E) (NMFS)

Haliotes sorenseni
white abalone (E) (NMFS)

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Speyeria callippe callippe
callippe silverspot butterfly (E)

Speyeria zerene myrtleae
Myrtle's silverspot butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Central Valley spring-run chinook salmon (T) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Reptiles

Caretta caretta
loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)

green turtle (T) (NMFS)

Dermochelys coriacea
leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)

Thamnophis sirtalis tetrataenia
San Francisco garter snake (E)

Birds

Brachyramphus marmoratus
marbled murrelet (T)

Charadrius alexandrinus nivosus
western snowy plover (T)

Diomedea albatrus
short-tailed albatross (E)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Sternula antillarum (=Sterna, =albifrons) browni
California least tern (E)

Mammals

Arctocephalus townsendi
Guadalupe fur seal (T) (NMFS)

Balaenoptera borealis
sei whale (E) (NMFS)

Balaenoptera musculus
blue whale (E) (NMFS)

Balaenoptera physalus
finback (=fin) whale (E) (NMFS)

Eubalaena (=Balaena) glacialis
right whale (E) (NMFS)

Eumetopias jubatus
Steller (=northern) sea-lion (T) (NMFS)

Physeter catodon (=macrocephalus)
sperm whale (E) (NMFS)

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Lessingia germanorum
San Francisco lessingia (E)

Proposed Species

Amphibians

Rana aurora draytonii
Critical habitat, California red-legged frog (PX)

Quads Containing Listed, Proposed or Candidate Species:

HUNTERS POINT (448A)

SAN FRANCISCO SOUTH (448B)

County Lists

Listed Species

Invertebrates

Haliotes cracherodii
black abalone (E) (NMFS)

Haliotes sorenseni
white abalone (E) (NMFS)

Icaricia icarioides missionensis
mission blue butterfly (E)

Incisalia mossii bayensis
San Bruno elfin butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
tidewater goby (E)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana aurora draytonii
California red-legged frog (T)

Reptiles

Caretta caretta
loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)
green turtle (T) (NMFS)

Dermochelys coriacea
leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)

Birds

Charadrius alexandrinus nivosus
western snowy plover (T)

Diomedea albatrus
short-tailed albatross (E)

Pelecanus occidentalis californicus
California brown pelican (E)

Rallus longirostris obsoletus
California clapper rail (E)

Mammals

Arctocephalus townsendi
Guadalupe fur seal (T) (NMFS)

Balaenoptera borealis
sei whale (E) (NMFS)

Balaenoptera musculus
blue whale (E) (NMFS)

Balaenoptera physalus
finback (=fin) whale (E) (NMFS)

Eubalaena (=Balaena) glacialis
right whale (E) (NMFS)

Eumetopias jubatus
Critical Habitat, Steller (=northern) sea-lion (X) (NMFS)
Steller (=northern) sea-lion (T) (NMFS)

Megaptera novaeangliae
humpback whale (E) (NMFS)

Physeter catodon (=macrocephalus)
sperm whale (E) (NMFS)

Reithrodontomys raviventris
salt marsh harvest mouse (E)

Plants

Arctostaphylos hookeri ssp. ravenii
Presidio (=Raven's) manzanita (E)

Clarkia franciscana
Presidio clarkia (E)

Hesperolinon congestum
Marin dwarf-flax (=western flax) (T)

Lessingia germanorum
San Francisco lessingia (E)

Key:

(E) *Endangered* - Listed as being in danger of extinction.
(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.
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- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

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Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be January 31, 2010.

APPENDIX D
PLANT SPECIES OBSERVED IN THE STUDY AREA

APPENDIX D Candlestick Point - Hunters Point Shipyard Phase II Project Plant Species Observed		
Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Acacia melanoxylon	Blackwood acacia	Introduced*
Achillea millefolium	Yarrow	Native
Aesculus californica	California buckeye	Native
Agoseris grandiflora	California dandelion	Native
Ailanthus altissima	Tree-of-heaven	Introduced*
Alnus sp.	ornamental Alder	
Amaranthus albus	tumbleweed	Introduced
Ambrosia chamissonis	Silver beach bur	Native
Ammannia coccinea	red ammannia	Native
Anagallis arvensis	Scarlet pimpernel	Introduced
Aster sp.	Perennial aster	
Atriplex sp.	Salt bush	
Atriplex triangularis	spearscale	Native
Avena fatua	Wild oat	Introduced*
Baccharis pilularis	Coyote brush	Native
Bellardia trixago	Mediterranean linseed	Introduced*
Bolboschoenus robustus	saltmarsh bulrush	Native
Brassica nigra	Black mustard	Introduced*
Brodiaea elegans	Harvest brodiaea	Native
Brodiaea terrestris	Dwarf brodiaea	Native
Bromus carinatus	California brome grass	Native
Bromus carinatus var. carinatus	Mountain brome	Native
Bromus diandrus	Rip-gut brome	Introduced*
Bromus hordeaceus	Soft chess brome	Introduced*
Bromus madritensis ssp. rubens	Red brome	Introduced*
Cakile maritime	European sea rocket	Introduced*
Calandrinia ciliata	Red maids	Native
Calochortus luteus	Yellow mariposa lily	Native
Calystegia subacaulis	Stemless morning glory	Native
Capsella bursa-pastoris	Shepard's purse	Introduced
Carduus pycnocephalus	Italian thistle	Introduced*
Carpobrotus chilensis	Sea fig	Introduced*
Carpobrotus edulis	Ice plant	Introduced*
Ceanothus sp.	Ornamental buck brush	
Cedrus deodara	Deodar cedar	Introduced
Centaurea calcitrapa	purple star thistle	Introduced*
Centaurea melitensis	Napa star thistle	Introduced*
Centaurea solstitialis	yellow star-thistle	Introduced*
Centranthus ruber	red valerian	Introduced

APPENDIX D Candlestick Point - Hunters Point Shipyard Phase II Project Plant Species Observed		
Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Cercis occidentalis	redbud	Native
Chamomilla suaveolens	Pineapple weed	Introduced
Chenopodium album	Lamb's quarters	Introduced
Chlorogalum pomeridianum	Soap Root	Introduced
Chrysanthemum coronarium	Garland chrysanthemum	Introduced*
Cirsium vulgare	bull thistle	Introduced*
Cistus sp.	ornamental rock rose	Introduced
Claytonia perfoliata	Miner's lettuce	Native
Conium maculatum	poison hemlock	Introduced*
Convolvulus arvensis	field bindweed	Introduced*
Conyza canadensis	Horseweed	Native
Cortaderia jubata	Pampas grass	Introduced*
Cortaderia selloana	Uruguayan pampas grass	Introduced*
Cotula coronopidolia	Brass buttons	Introduced*
Crassula connata	Pygmy weed	Native
Crepis vesicaria	beaked hawksbeard	Introduced
Cupressus ssp.	Ornamental cypress	
Cynodon dactylon	bermuda grass	Introduced*
Cyperus eragrostis	tall flatsedge	Native
Dactylis glomerata	Orchard grass	Introduced*
Danthonia californica	California oatgrass	Native
Dichelostemma capitatum	Blue dicks	Native
Distichlis spicata	Salt grass	Native
Elymus glaucus	Blue wildrye	Native
Epilobium brachycarpum	Annual fireweed	Native
Epilobium ciliatum ssp. ciliatum	fringed willowherb	Native
Epilobium sp.	willowherb	Native
Eriodictyon californicum	Yerba Santa	Native
Eriogonum latifolium	coast buckwheat	Native
Erodium botrys	Filaree	Introduced*
Erodium cicutarium	Red stem filaree	Introduced*
Erodium moschatum	White stemmed filaree	Introduced*
Eschscholzia californica	California poppy	Native
Festuca arundinaceae	Tall Fescue	Introduced*
Festuca rubra	Red Fescue	Native
Filago gallica	narrowleaf cottonrose	Introduced
Foeniculum vulgare	fennel	Introduced*
Frankenia salina	Alkali Heath	Native
Fremontodendron californicum	Flannel bush	Native
Fumaria capreolata	White ramping fumitory	Native

APPENDIX D **Candlestick Point - Hunters Point Shipyard Phase II Project** **Plant Species Observed**		
Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Fumaria officinalis	Fumitory	Introduced*
Galium sp.	Bedstraw	
Genista monspessulana	French broom	Introduced*
Geranium carolinianum	Carolina geranium	Native
Geranium dissectum	Cut-leaf geranium	Introduced*
Geranium molle	Cranesbill	Introduced*
Gilia clivorum	Purple spot gilia	Native
Gnaphalium sp.	Cudweed	
Grindelia sp.	gumweed	
Grindelia stricta	coastal gumweed	Native
Heteromeles arbutifolia	Toyon	Native
Heterotheca grandiflora	Telegraph weed	Native
Hordeum marinum ssp. gussoneanum	Mediterranean barley	Introduced
Hordeum murinum ssp. *leporinum*	hare barley	Introduced
Hypochaeris glabra	Smooth cat’s ear	Introduced*
Jaumea carnosa	Fleshy jaumea	Native
Juncus effusus	Common rush	Native
Lactuca serriola	Prickly lettuce	Introduced*
Lantana sp.	Ornamental Lantana	
Lasthenia californica	California goldfields	Native
Lepidium latifolium	broad leaved pepper grass	Introduced*
Lepidium nitidum	Peppergrass	Native
Leptospermum laevigatum	Australian tea tree	Introduced*
Leymus triticoides	Creeping wildrye	Native
Limonium californicum	Sea lavender	Native
Limonium perezii	Perez’s sea lavender	Introduced
Lobularia maritima	Sweet alyssum	Introduced*
Lolium multiflorum	Italian rye	Introduced*
Lomatium caruifolium	Alkali parsnip	Native
Lomatium utriculatum	common lomatium	Native
Lotus corniculatus	Bird’s-foot trefoil	Introduced*
Lotus wrangelianus	Chile lotus	Native
Lupinus albifrons	Silver bush lupine	Native
Lupinus arboreus	Coastal bush lupine	Native*
Lupinus bicolor	Miniature lupine	Native
Lupinus succulentus	arroyo lupine	Native
Lythrum hyssopifolium	hyssop loosestrife	Introduced*
Malva neglecta	common mallow	Introduced
Malva nicaeensis	Bull mallow	Introduced
Malva parviflora	cheeseweed mallow	Introduced

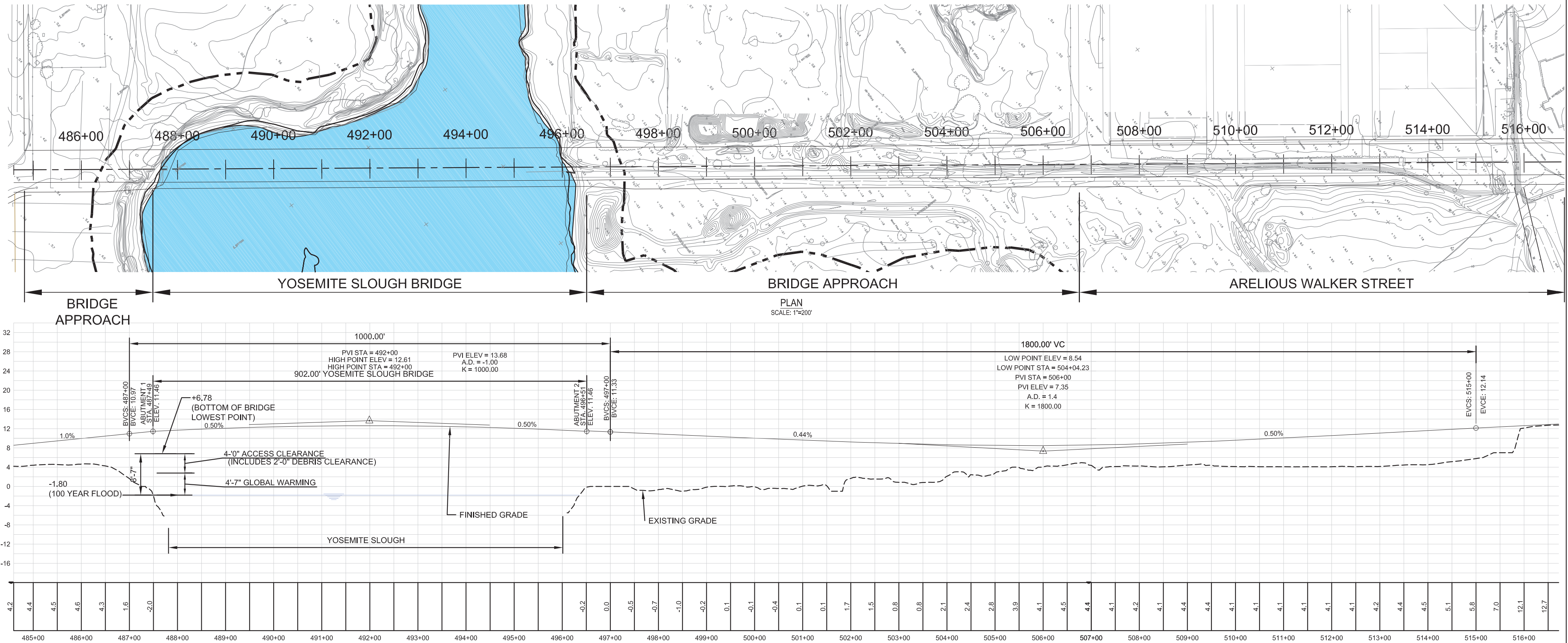
APPENDIX D Candlestick Point - Hunters Point Shipyard Phase II Project Plant Species Observed		
Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Marah fabaceus	California man-root	Native
Medicago polymorpha	California bur-clover	Introduced*
Melica sp.	Onion grass	Native
Melilotus alba	White sweetclover	Introduced*
Melilotus indica	Yellow sweet clover	Introduced
Microseris douglasii	Douglas' microseris	Native
Muhlenbergia rigens	deergrass	Native
Myoporum laetum	Lollypop tree	Introduced*
Nassella pulchra	Purple needlegrass	Native
Oxalis corniculata	Yellow sorrel	Introduced*
Oxalis pes-caprae	Bermuda buttercup	Introduced*
Paspalum dilatatum	Dallis grass	Introduced
Picris echioides	Prickly ox-tongue	Introduced*
Pinus radiata	Monterey pine	Native*
Piptatherum miliaceum	Smilo grass	Introduced*
Plantago coronopus	Cut leaf plantain	Introduced*
Plantago erecta	California plantain	Native
Plantago major	common plantain	Introduced
Plantago maritima	alkali plantain	Native
Platanus racemosa	California sycamore	Native
Poa annua	Blue grass	Introduced
Polygonum arenastrum	Common knotweed	Introduced
Polypogon monspelienensis	Rabbit's foot grass	Introduced*
Pyracantha sp.	Firethorn	Introduced
Quercus agrifolia	Live oak	Introduced
Ranunculus muricatus	Spiny-fruited buttercup	Introduced
Raphanus raphanistrum	painted charlock	Introduced
Raphanus sativa	Wild radish	Introduced*
Rhamnus californica	Coffeeberry	Native
Ribes sp.	Gooseberry	Native
Robinia pseudoacacia	Black locust	Introduced*
Rubus discolor	Himalayan blackberry	Introduced*
Rumex acetosella	Sheep sorrel	Introduced*
Rumex crispus	Curly dock	Introduced*
Rumex pulcher	Fiddle dock	Introduced
Rumex salicifolius	willow dock	Native
Salicornia virginica	Pickleweed	Native
Salix lasiolepis	Arroyo willow	Native
Salsola kali	Russian thistle	Introduced*
Salsola tragus	tumbleweed	Introduced*

APPENDIX D Candlestick Point - Hunters Point Shipyard Phase II Project Plant Species Observed		
Scientific Name	**Common Name**	**Native / Introduced (*Designates Invasive)**
Salvia mellifera	Black sage	Native
Salvia spathacea	hummingbird sage	Native
Sambucus nigra ssp. caerulea	Blue elderberry	Native
Sanicula bipinnatifida	Purple sanicle	Native
Schinus molle	Peruvian peppertree	Introduced *
Senecio vulgaris	Common groundsel	Introduced
Silene gallica	Campion, Catchfly	Introduced
Silybum marianum	Milk thistle	Introduced*
Sisyrinchium bellum	Blue-eyed grass	Introduced
Solanum physalifolium	hoe nightshade	Introduced
Soliva sessilis	common soliva	Introduced
Sonchus asper	Sow thistle	Introduced*
Sonchus oleraceus	common sow thistle	Introduced
Spartina sp.	Cord grass	
Spergularia macrotheca	Large flowered sand spurry	Native
Spergularia media	Coast sand spurry	Introduced
Stellaria media	Chickweed	Introduced
Tragopogon porrifolius	Salsify	Introduced
Trifolium campestre	Hop clover	Introduced
Trifolium hirtum	Rose clover	Introduced*
Triteleia laxa	Ithuriel's spear	Native
Typha latifolia	Broad -leaved cattail	Native
Umbellularia californica	California bay	Native
Vicia sativa	Spring vetch	Introduced
Vicia villosa	Hairy vetch	Introduced*
Vulpia bromoides	Six week fescue	Introduced*
Vulpia myuros	Rattail fescue	Introduced*
Vulpia myuros var. myuros	False foxtail fescue	Introduced

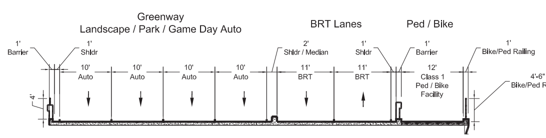
* California Invasive Plant Council (Cal-IPC) invasive plant

HT Harvey Wetland delineation
Julia's list
Julia's survey
Yosemite Slough report

Appendix N2 MACTEC, Yosemite Slough Bridge Drawings—Stadium and Non-Stadium Options

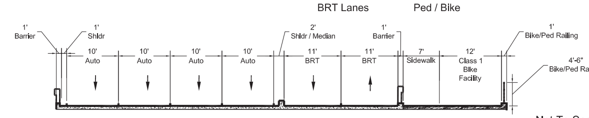


YOSEMITE SLOUGH BRIDGE TYPICAL SECTION
81 FEET



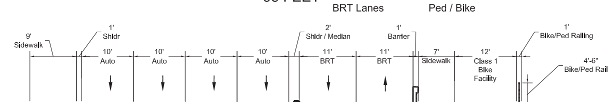
Not To Scale

BRIDGE APPROACH TYPICAL SECTION
87 FEET

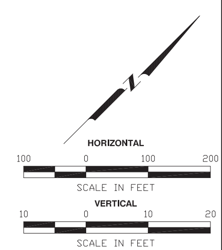


Not To Scale

ARELIOUS WALKER STREET TYPICAL SECTION
95 FEET



Not To Scale



REFERENCE: *YOSEMITE SLOUGH ROAD PLAN, PROFILE AND SECTIONS,*
FIG. P-1HP, DATED 09/17/08, WINZLER AND KELLY

PRELIMINARY DRAFT

NO.	DATE	REVISIONS
3	10-19-2009	ADJUST FOR CHANGE IN100 YEAR FLOOD ELEVATION TO -1.80.
2	10-8-2009	ADJUST FOR ALLOWING DEBRIS AND ACCESS CLEARANCE, CHANGE 100 YEAR FLOOD ELEVATION TO -1.70.

DRAWN: JHD
PROJECT NO: 4096097772
ENGINEER:
SCALE: AS SHOWN
CHECKED:
APPROVED:
DATE: 10-27-09
DATE:

MACTEC

HUNTERS POINT / CANDLESTICK POINT
SAN FRANCISCO, CALIFORNIA

YOSEMITE SLOUGH BRIDGE, APPROACH AND ARELIOUS WALKER STREETS PLAN, PROFILE & SECTIONS

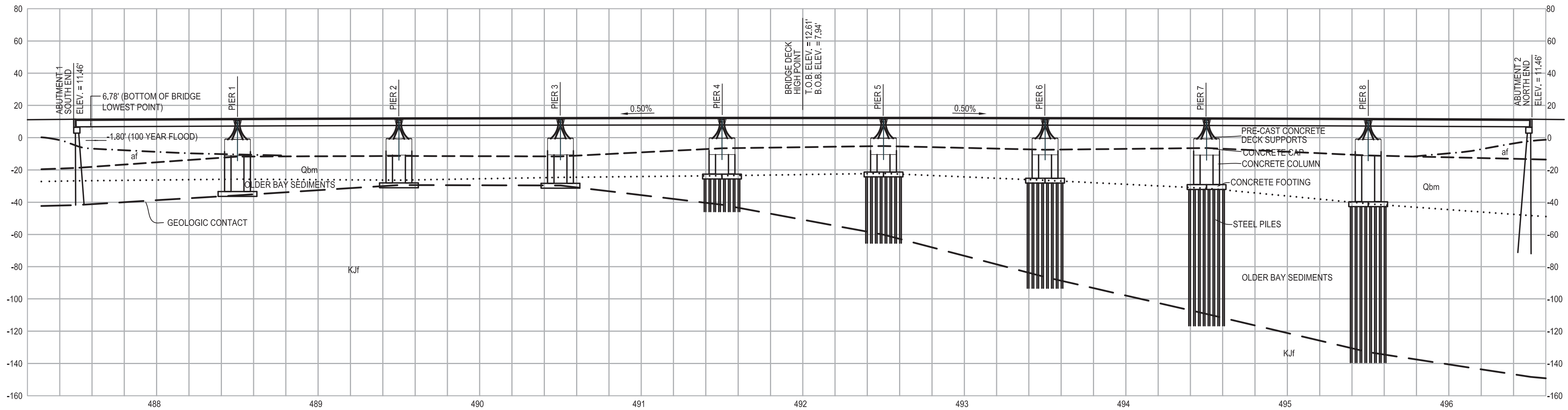
DRAWING: 1
SHEET: 1 OF 7

20091027_YSB_MLC_FIG-1.DWG 300.0

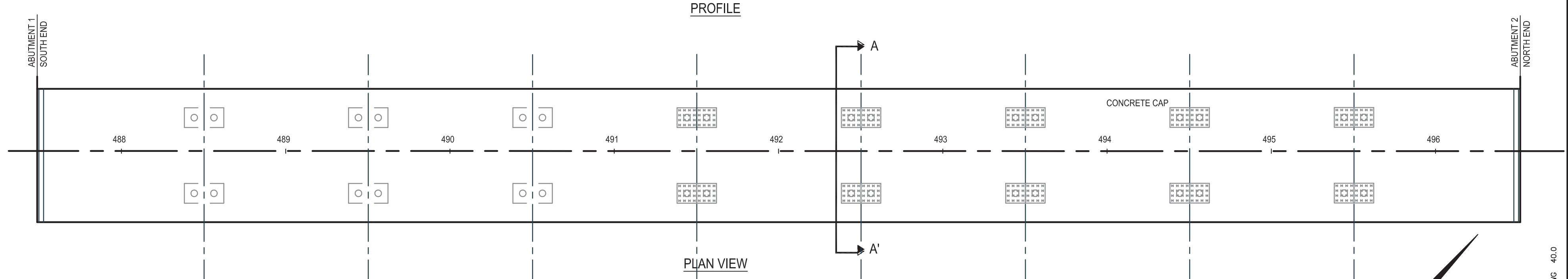
NOTE:
VERTICAL DATUM IS CCSF.

LEGEND

— · — · —	af	ARTIFICIAL FILL CONSISTING OF CLAY, SILT AND SAND WITH CONSTRUCTION DEBRIS SUCH AS CONCRETE AND WOOD DEBRIS
— — — —	Qbm	BAY MUD DEPOSIT CONSISTING OF HIGHLY COMPRESSIBLE SOFT CLAY AND SILT SUSCEPTIBLE TO CONSOLIDATION SETTLEMENT
· · · · · · · ·	OLDER BAY SEDIMENTS	OLD BAY DEPOSIT CONSISTING OF CONSOLIDATED CLAY SILT AND SAND THAT MAY BE SUSCEPTIBLE TO MINOR CONSOLIDATION SETTLEMENT
—— ——	KJf	FRANCISCAN COMPLEX ROCK
	496	STATIONING BASED ON WINZLER AND KELLY FIGURE NUMBER P-1HP DATED 09-17-2008



PROFILE



PLAN VIEW

20091019-YSB-MLC_FIG-2-3.DWG 40.0
20091027.1159

PRELIMINARY DRAFT

NO.	DATE	REVISIONS
3	10-19-2009	ADJUST FOR CHANGE IN 100 YEAR FLOOD ELEVATION TO -1.80.
2	10-8-2009	ADJUST FOR ALLOWING DEBRIS AND ACCESS CLEARANCE, CHANGE 100 YEAR FLOOD ELEVATION TO -1.70.

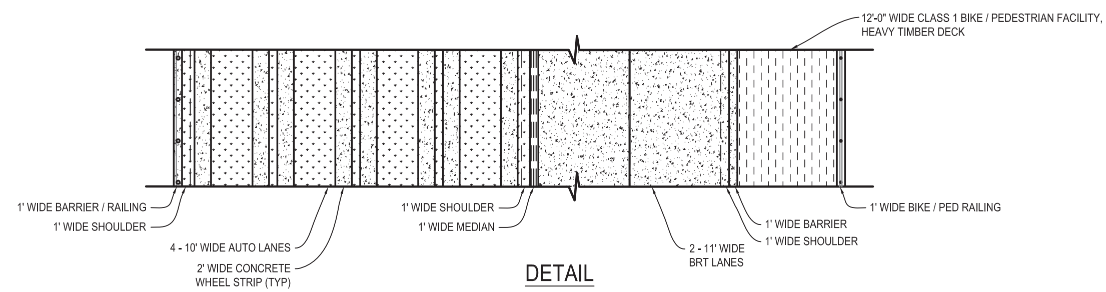
DRAWN:	JHD	PROJECT NO:	4096097772
ENGINEER:		SCALE:	AS SHOWN
CHECKED:		APPROVED:	
DATE:	10-27-09	DATE:	

MACTEC

HUNTERS POINT / CANDLESTICK POINT
SAN FRANCISCO, CALIFORNIA

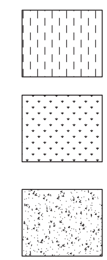
YOSEMITE SLOUGH BRIDGE
PLAN AND PROFILE

DRAWING: 2
SHEET: 2 OF 7



DETAIL

LEGEND

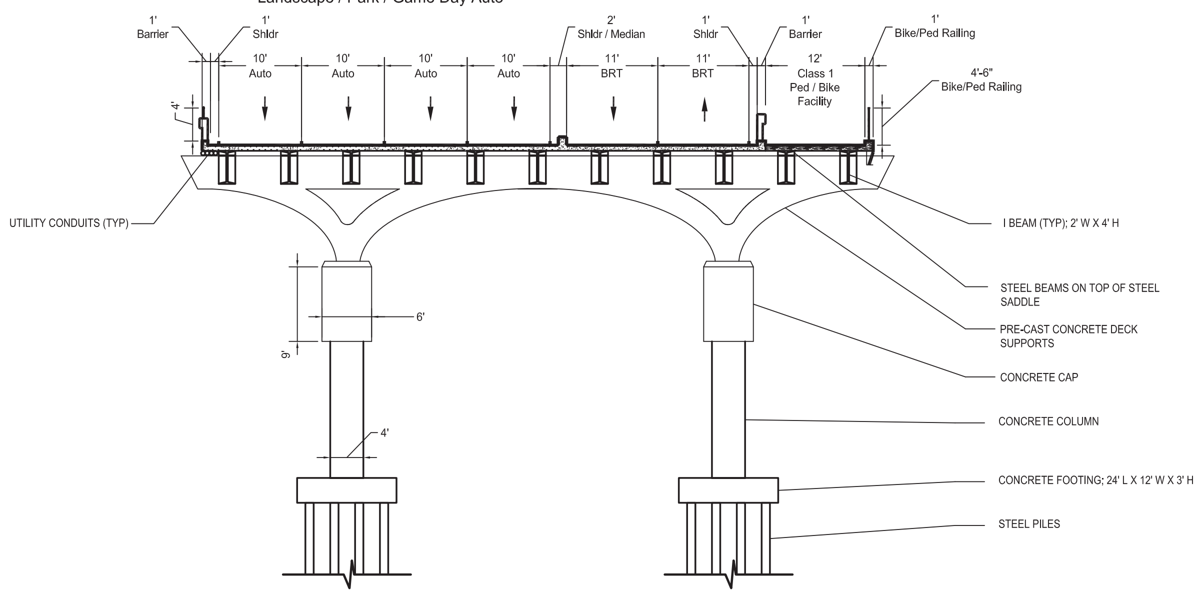


HEAVY TIMBER

GRASS TURF BLOCK

CONCRETE

YOSEMITE SLOUGH BRIDGE
81 FEET



SECTION A-A'

15 0 7.5 15
SCALE IN FEET

20090925-YSB-MLC_FIG-2-3.DWG 40.0
20090617.1056

PRELIMINARY DRAFT

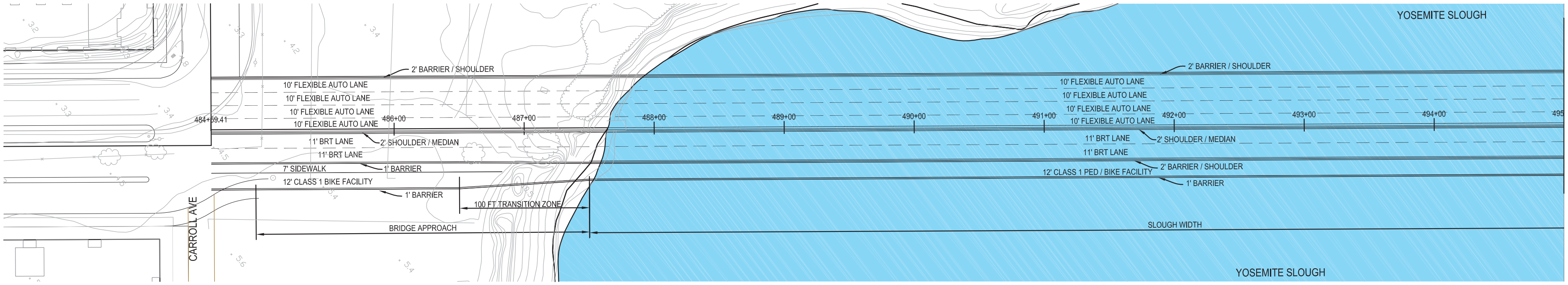
NO.	DATE	REVISIONS	DRAWN: JHD	PROJECT NO: 4096097772
			ENGINEER:	SCALE: AS SHOWN
			CHECKED:	APPROVED:
			DATE: 10-27-09	DATE:

MACTEC

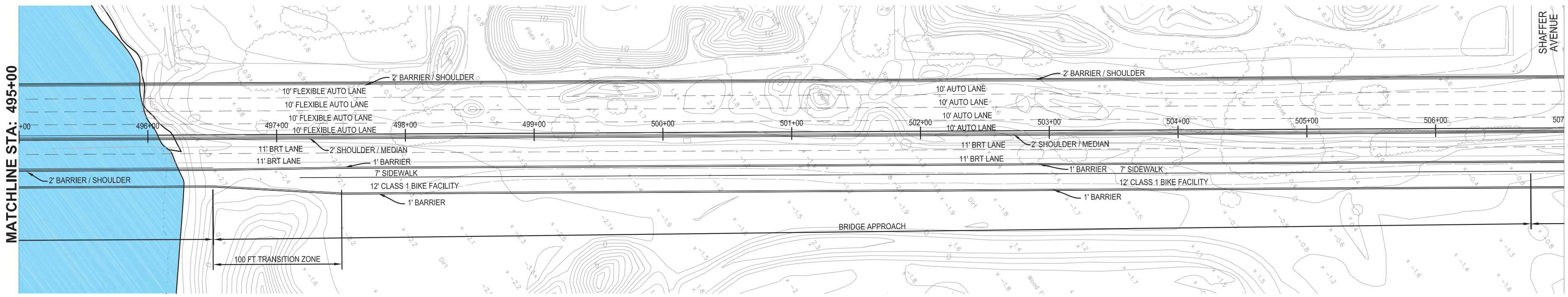
HUNTERS POINT / CANDLESTICK POINT
SAN FRANCISCO, CALIFORNIA

YOSEMITE SLOUGH BRIDGE
SECTION AND DETAIL

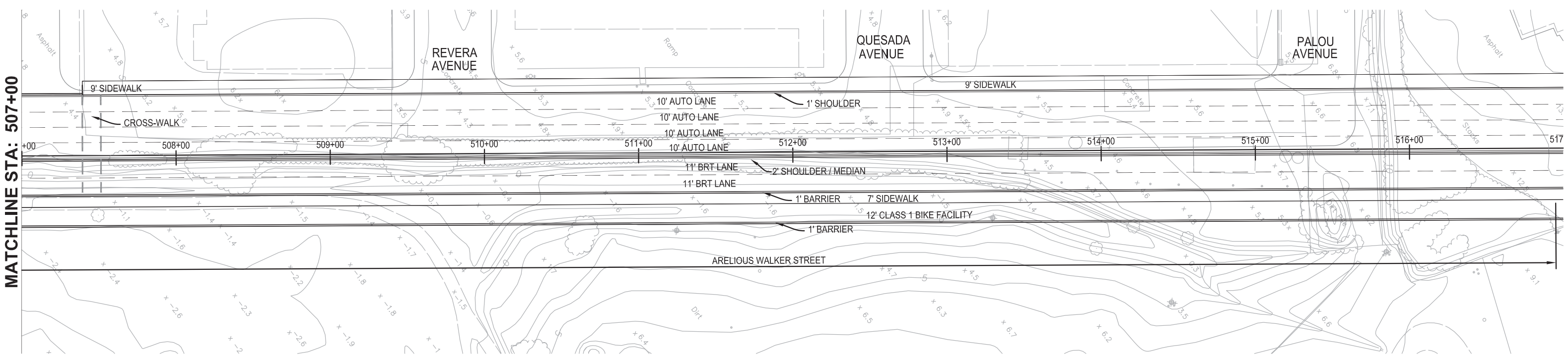
DRAWING: 3
SHEET: 3 OF 7



PLAN VIEW



PLAN VIEW



PLAN VIEW

PRELIMINARY DRAFT

40 0 40 80
SCALE IN FEET

20091027-YSMT BRDG-MLC_FIG-4.DWG 300.0
20091027.1730

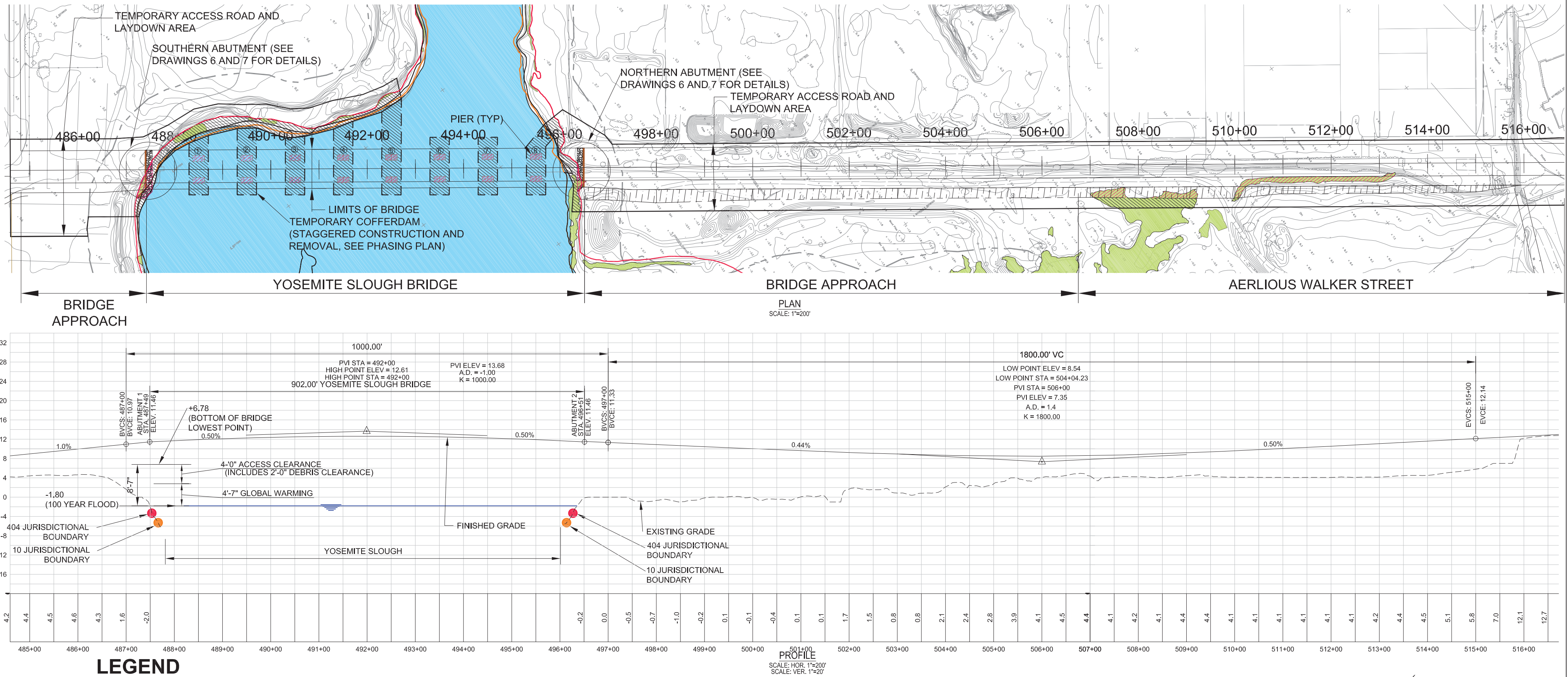
NO.	DATE	REVISIONS	DRAWN: JHD	PROJECT NO: 4096097772
			ENGINEER:	SCALE: AS SHOWN
			CHECKED:	APPROVED:
			DATE: 10-27-09	DATE:

MACTEC

HUNTERS POINT / CANDLESTICK POINT
SAN FRANCISCO, CALIFORNIA

YOSEMITE SLOUGH BRIDGE APPROACH & ARELIOUS WALKER STREET PLAN VIEW

DRAWING: 4
SHEET: 4 OF 7



PROFILE
SCALE: HOR. 1"=200'
SCALE: VER. 1"=20'

LEGEND

- PERMANENT IMPACT - JURISDICTIONAL WATERS OR WETLAND HABITAT AREAS
- TEMPORARY IMPACT - JURISDICTIONAL WATERS OR WETLAND HABITAT AREAS
- JURISDICTIONAL WETLANDS
- APPROACH AND ARELIOUS WALKER STREET EMBANKMENT
- SECTION 10 JURISDICTIONAL BOUNDARY
- SECTION 404 JURISDICTIONAL BOUNDARY (TIDAL)
- TEMPORARY ACCESS ROAD AND CONTRACTOR LAYDOWN AREA
- 1 TEMPORARY COFFERDAMS AND NUMBER
- BCDC LIMIT (100 FT FROM SHORELINE)

Cofferdam Construction Phasing Plan

Phase	Cofferdam Constructed	Cofferdam Removed
A	1	
B	2	
C	3	1
D	4	2
E	5	3
F	6	4
G	8	5
H	7	
I		6 7 8

HORIZONTAL
100 0 100 200
SCALE IN FEET
VERTICAL
10 0 10 20
SCALE IN FEET

REFERENCE: *YOSEMITE SLOUGH ROAD PLAN, PROFILE AND SECTIONS,* FIG. P-1HP, DATED 09/17/08, WINZLER AND KELLY

PRELIMINARY DRAFT

20091027-YSB_MLC_FIG-5.DWG 300.0
20091027,1738

NO.	DATE	REVISIONS
3	10-19-2009	ADJUST FOR CHANGE IN 100 YEAR FLOOD ELEVATION TO -1.80.
2	10-8-2009	ADJUST FOR ALLOWING DEBRIS AND ACCESS CLEARANCE, CHANGE 100 YEAR FLOOD ELEVATION TO -1.70.

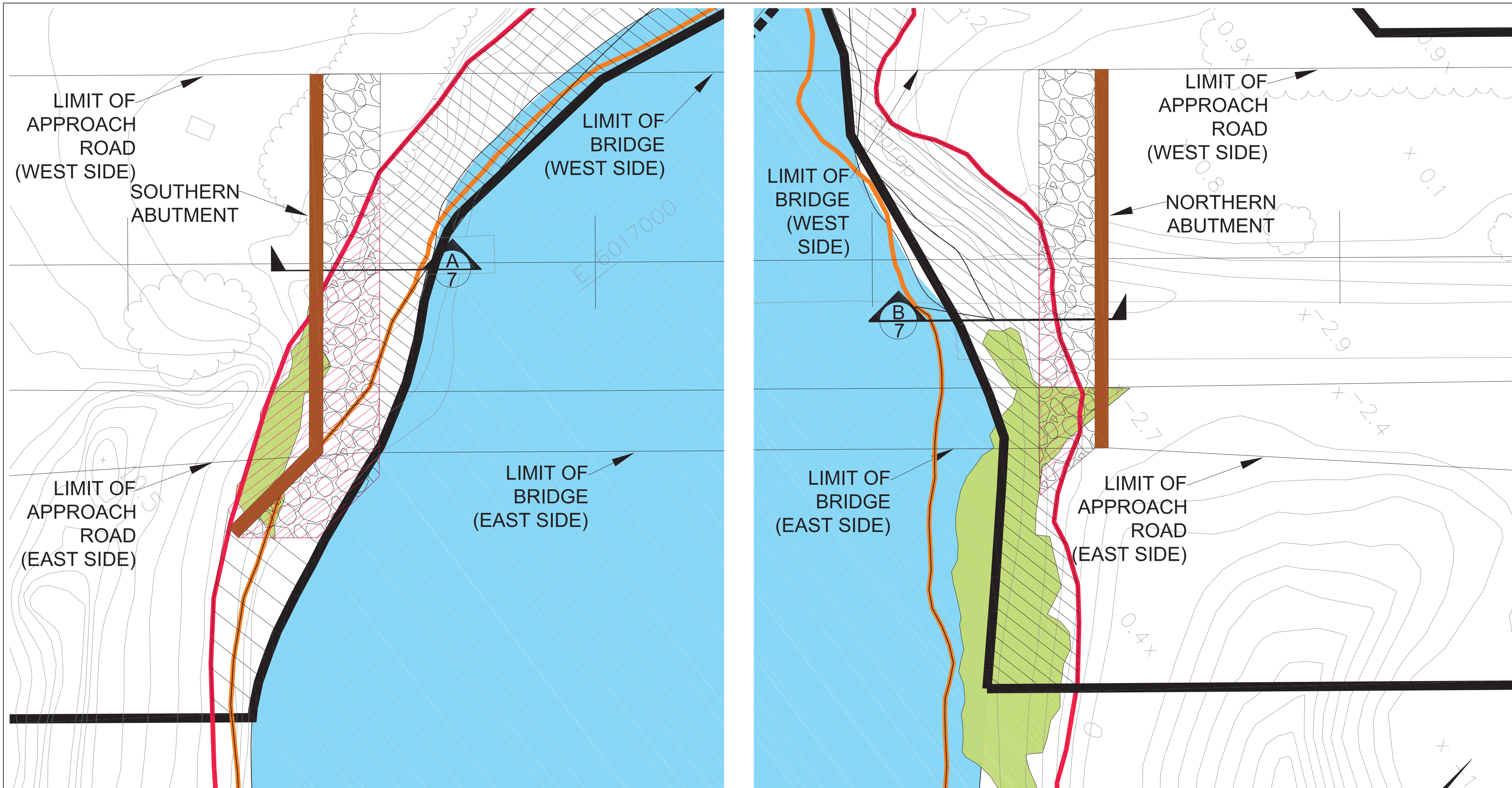
DRAWN: JHD PROJECT NO: 4096097772
ENGINEER: SCALE: AS SHOWN
CHECKED: APPROVED:
DATE: 10-27-09 DATE:

MACTEC

HUNTERS POINT / CANDLESTICK POINT
SAN FRANCISCO, CALIFORNIA

YOSEMITE SLOUGH BRIDGE, JURISDICTIONAL IMPACTS PLAN AND PROFILE

DRAWING: 5
SHEET: 5 OF 7



LEGEND

- SECTION 10 JURISDICTIONAL BOUNDARY
- SECTION 404 JURISDICTIONAL BOUNDARY (TIDAL)
- ABUTMENT
- ABUTMENT AND RIPRAP CROSS-SECTIONS (SEE DRAWING 7)
- TEMPORARY ACCESS ROAD AND CONTRACTOR LAYDOWN AREA
- PROPOSED RIPRAP
- PERMANENT IMPACT - JURISDICTIONAL WATERS OR WETLAND HABITAT AREAS
- TEMPORARY IMPACT - JURISDICTIONAL WATERS OR WETLAND HABITAT AREAS
- JURISDICTIONAL WETLANDS

N

10 0 10 20
SCALE IN FEET

PRELIMINARY DRAFT

REFERENCE: *YOSEMITE SLOUGH ROAD PLAN, PROFILE AND SECTIONS,* FIG. P-1HP, DATED 09/17/08, WINZLER AND KELLY

20091027_YSB_MLC_FIG-6-7.DWG 300.0

NO.	DATE	REVISIONS

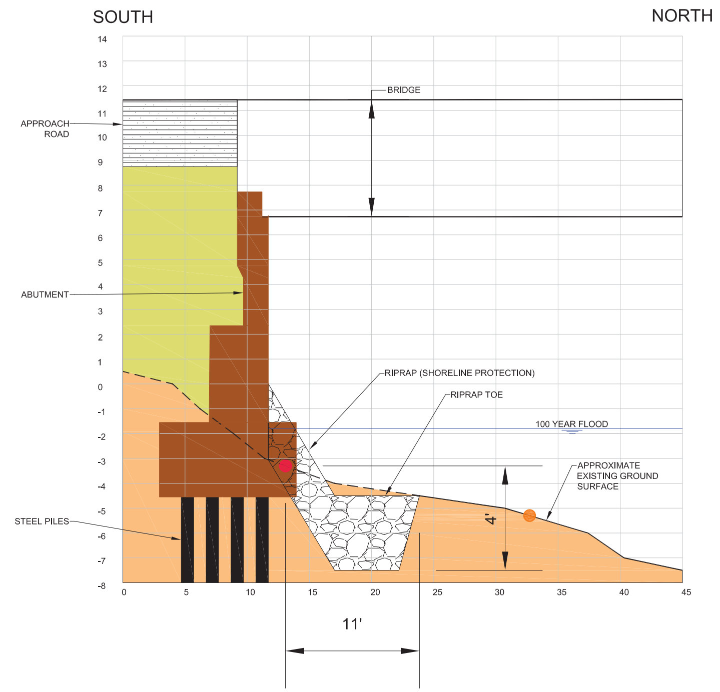
DRAWN: JHD | PROJECT NO: 4096097772
ENGINEER: | SCALE: AS SHOWN
CHECKED: | APPROVED:
DATE: 10-27-09 | DATE:

MACTEC

HUNTERS POINT / CANDLESTICK POINT
SAN FRANCISCO, CALIFORNIA

YOSEMITE SLOUGH BRIDGE, JURISDICTIONAL IMPACTS AND ABUTMENT PLAN VIEW

DRAWING: 6
SHEET: 6 OF 7



SOUTHERN ABUTMENT A --

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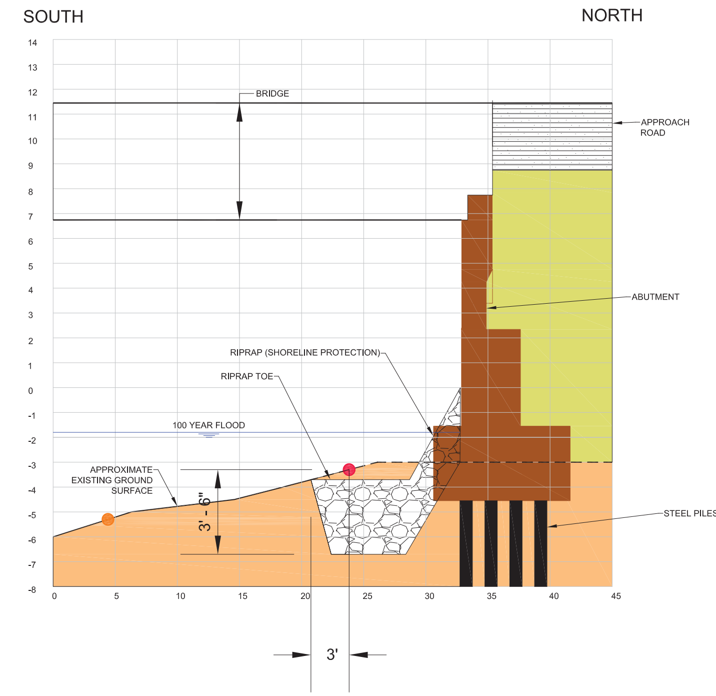
VERTICAL SCALE 1" = 5'



NORTHERN ABUTMENT B --

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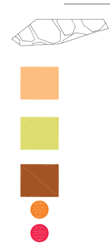
LEGEND



RIP-RAP

EXISTING FILL

NEW FILL

ABUTMENT

SECTION 10 JURISDICTIONAL BOUNDARY

SECTION 404 JURISDICTIONAL BOUNDARY (TIDAL)

PRELIMINARY DRAFT

REFERENCE: *YOSEMITE SLOUGH ROAD PLAN, PROFILE AND SECTIONS,* FIG. P-1HP, DATED 09/17/08, WINZLER AND KELLY

NO.	DATE	REVISIONS
3	10-19-2009	ADJUST FOR CHANGE 100 YEAR FLOOD ELEVATION TO -1.80.
2	10-8-2009	ADJUST FOR ALLOWING DEBRIS AND ACCESS CLEARANCE, CHANGE 100 YEAR FLOOD ELEVATION TO -1.70.

DRAWN:	JHD	PROJECT NO:	4096097772
ENGINEER:		SCALE:	AS SHOWN
CHECKED:		APPROVED:	
DATE:	10-27-09	DATE:	

MACTEC

HUNTERS POINT / CANDLESTICK POINT
SAN FRANCISCO, CALIFORNIA

YOSEMITE SLOUGH BRIDGE, JURISDICTIONAL IMPACTS AND ABUTMENT SECTION VIEW

DRAWING: 7
SHEET: 7 OF 7

EXHIBIT-YSB_MLC_FIG-6-7.DWG 300.0

Appendix N3 Draft Parks, Open Space, and Habitat Concept Plan, November 2009

DRAFT Parks, Open Space, and Habitat Concept Plan

Candlestick Point and Hunters Point Shipyard Phase II
San Francisco, CA

November 03, 2009

LENNAR URBAN

R | H | A | A

Cover image: View from The Neck area of the Candlestick Point State Recreation Area

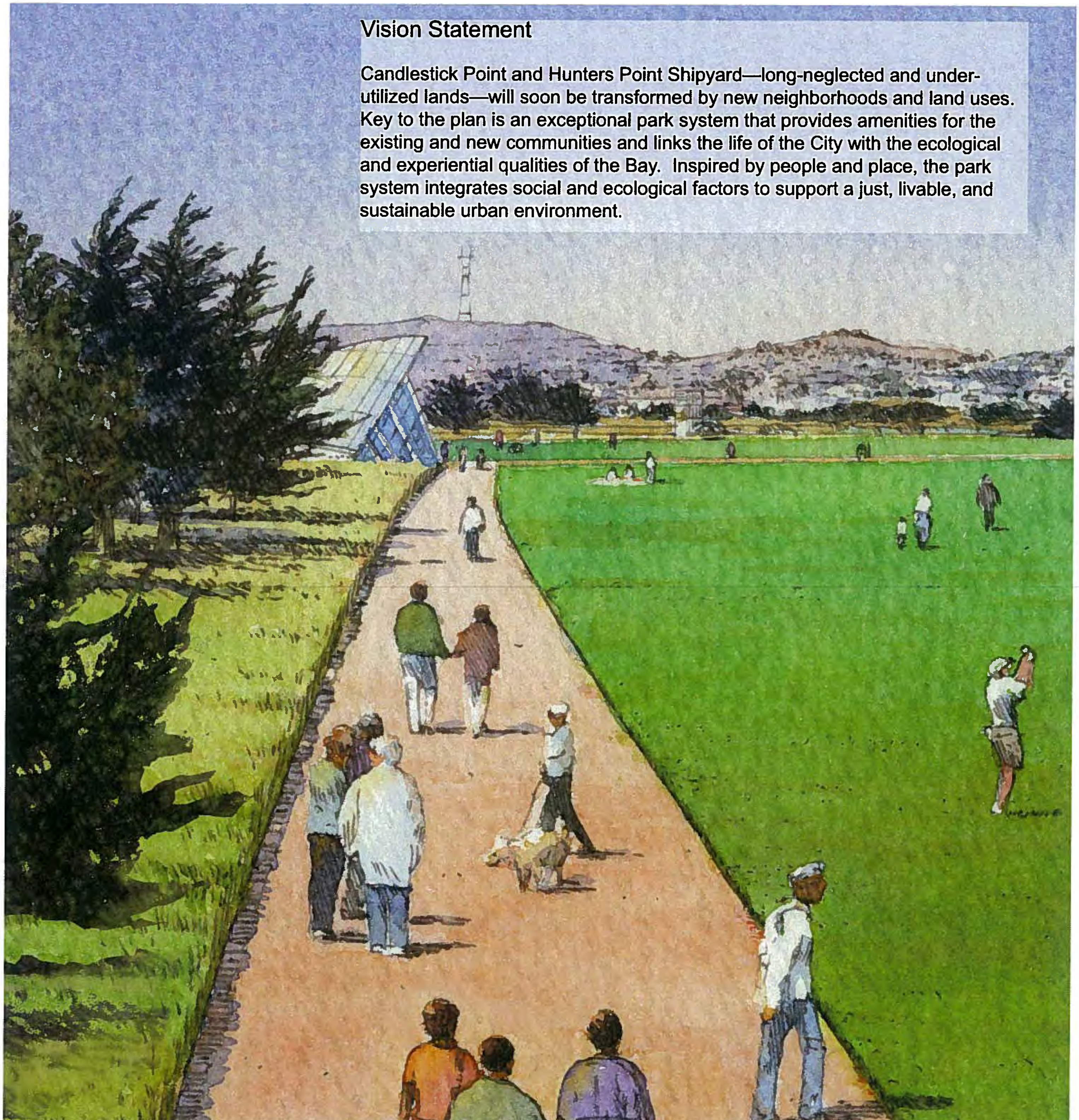
Contents

Introduction

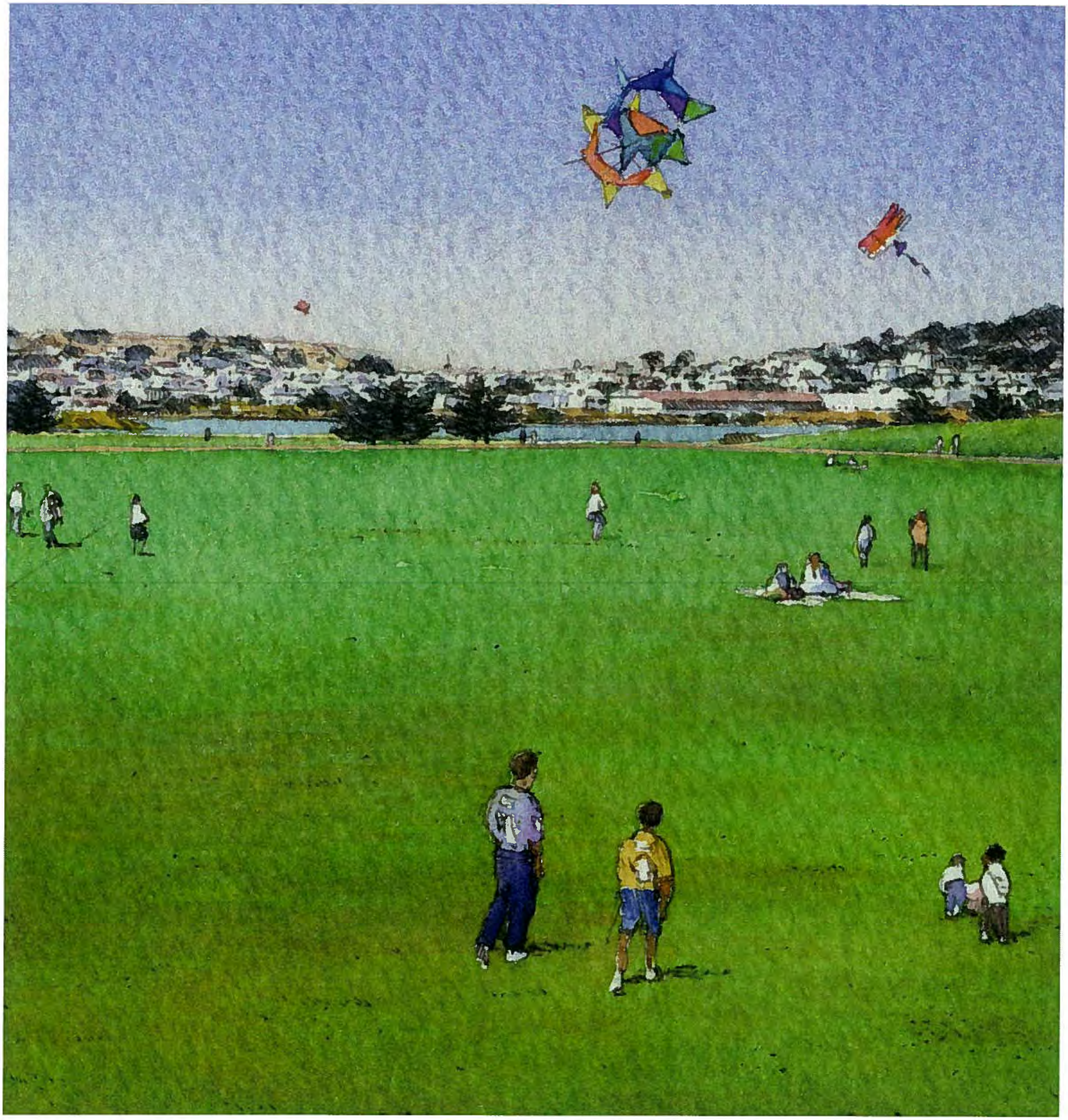
The Proposal

Vision Statement

Candlestick Point and Hunters Point Shipyard—long-neglected and under-utilized lands—will soon be transformed by new neighborhoods and land uses. Key to the plan is an exceptional park system that provides amenities for the existing and new communities and links the life of the City with the ecological and experiential qualities of the Bay. Inspired by people and place, the park system integrates social and ecological factors to support a just, livable, and sustainable urban environment.



View from the Great Meadow at the Last Rubble area of the Candlestick Point State Recreation Area



Plan Highlights

Extensive Parkland

Over 330 acres will be dedicated to new and improved parks, open space, and habitat areas. These areas cover over half the site's acreage and represent San Francisco's largest park development since Golden Gate Park.

Neighborhood Parks

New neighborhood parks will serve existing and future neighborhood residents with places for community gathering and a broad range outdoor recreation and leisure activities.

Sports Field Complex

A new Sport Field Complex will help to meet the City's unmet-demand for lit sports fields. The multi-use fields will accommodate youth, high-school, and adult intra-mural field sports and will be able to host regional tournaments.

Cultural Heritage Park

The Cultural Heritage Park will relate the history of Hunters Point to visitors from throughout the Bay Area and beyond. Historic buildings will be retained and may be used as museum spaces.

Trails Network

The San Francisco Bay Trail / San Francisco Blue Greenway will provide a continuous recreational multi-use trail along the Candlestick and Hunters Point waterfront filling a gap in the regional network planned to eventually encircle the entire Bay. Similarly, kayak and windsurf launch points will enhance access to the regionally-planned Bay Area Water Trail. For commuters and neighborhood cyclists, a secondary network of off-street multi-use trails will link parks and neighborhoods with the on-street bicycle network.

Candlestick Point State Recreation Area

Major renovation of the Candlestick Point State Recreation Area will transform it into the "Crissy Field" of southeast San Francisco with restored habitat areas and public access to the Bay.

Habitat Enhancements

New parks, open space, and habitat restoration areas will support the biodiversity and ecology of the San Francisco Bay shoreline. The plan features new native grasslands, wetlands, extensive planting of native trees and shrubs, and a net removal of bay fill.

Green Infrastructure and Urban Sustainability

Parks and open space will be designed as "green infrastructure" integrating urban design and infrastructure with natural systems. Elements of this system include, ecological stormwater treatment systems, vegetated parking, and streetside and median boulevard parks.

Parks, Open Space, and Habitat Plan

Introduction

Background

Purpose of the Document

The purpose of this draft document is to describe the intent of the parks and open space system of the Candlestick and Hunters Point Shipyard Phase II development project. Building on the *Candlestick Point/Hunters Point Shipyard Phase II Urban Design Plan*, and the *Draft Sustainability Plan*, the *Draft Parks, Open Space, and Habitat Master Plan* highlights aesthetic, social, recreational, and ecological opportunities and p rovides a framework for public parks, open spaces, and natural areas. A final version of this plan will be included as part of the Disposition and Development Agreement between the City of San Francisco, San Francisco Redevelopment Agency and Lennar.

Project Summary

The proposed Candlestick Point and Hunters Point Shipyard development project (CP HPS) is a 702-acre master-planned urban infill project proposed in the southeastern waterfront of San Francisco. The proposed development envisions two neighborhoods (Candlestick Point and Hunters Point Phase II) including housing, commercial, retail and office uses along with over 330 acres of parks and open space. Adjoining the existing Bayview and Hunters Point neighborhoods and bounded by San Francisco Bay, the plan emphasizes an extensive parks and open space system, including waterfront parks and trails along approximately 9 miles of shoreline.

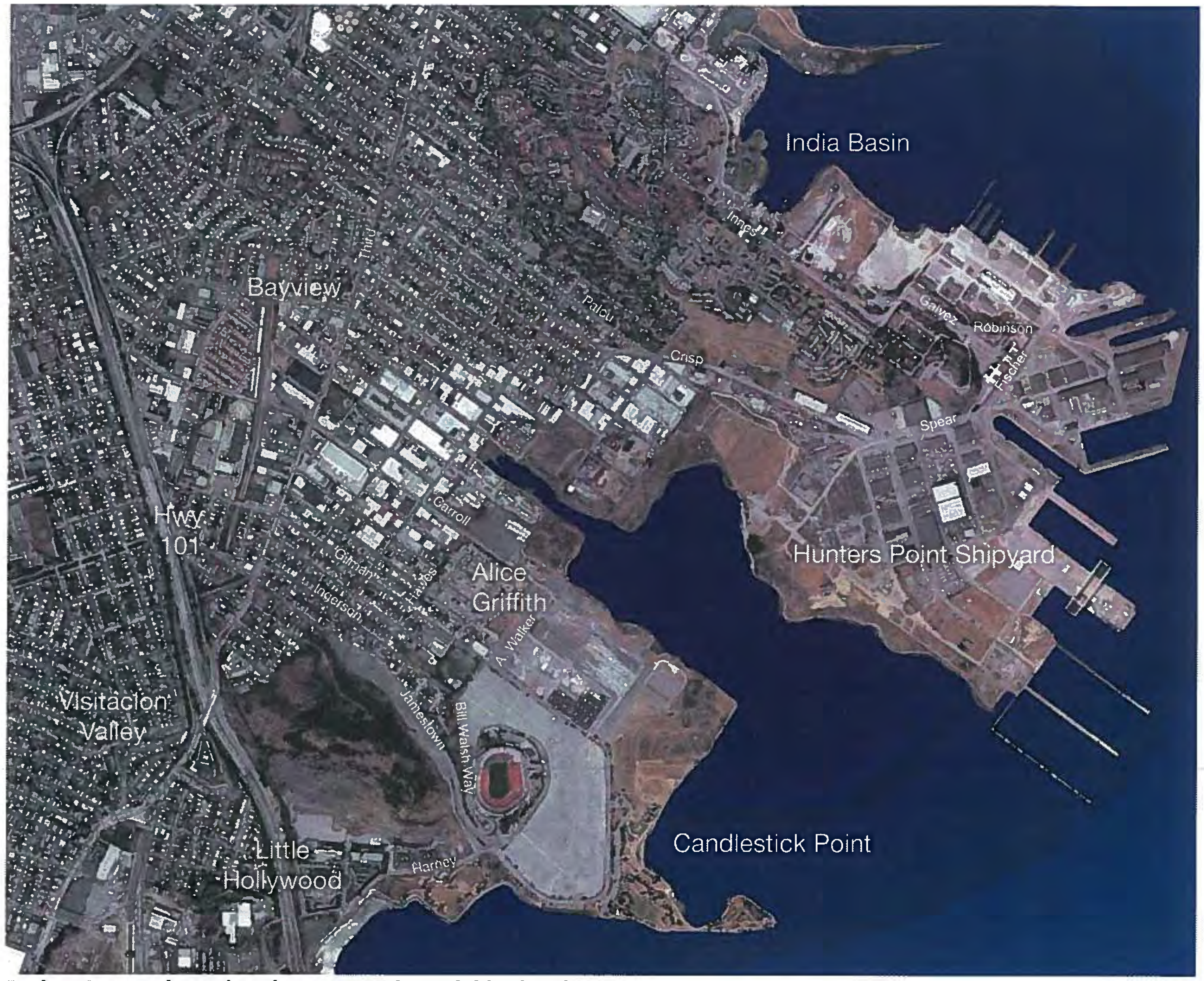
Setting

The Candlestick Point and Hunters Point Shipyard project site is located at the southeastern corner of the City of San Francisco, bounded by the San Francisco Bay to the east, India Basin to the north, Bayview Hill Park to the south, and the Hunters Point/Bayview community to the west. The site is the current location of Candlestick Park (the home of the San Francisco 49ers), Candlestick Park State Recreation Area and the former Hunters Point Naval Shipyards. The site is located in close proximity to Highway 101 (Bayshore Freeway) and is approximately 8 miles from downtown San Francisco.

Four major site adjacencies inform the future development of the Shipyard & Candlestick Point site. To the west, the Bayview Hunters Point neighborhood is a predominantly residential and industrial area and home to a diverse and transitioning population. The neighborhood grew dramatically during the second world war, as predominantly African American workers came to the shipyard for Navy-related jobs. The area has historically been under serviced.

To the east, the San Francisco Bay creates a well-defined natural edge to the project area.

Finally, both the Bayview Hill, and Hunters Point Hill create unique geographical limits to development. Bayview Hill is currently a city park area, with trails that wind to the top, overlooking the entire site. Hunters Point Hill is currently being developed as both the Hilltop and Hillside Phase I developments of Hunters



Project Area and Bayview / Hunters Point Neighborhood Area

Point Shipyard. The southeastern portion of the Hunters Point Hill is currently being developed as a park, which will link into the proposed Shipyard Phase II development.

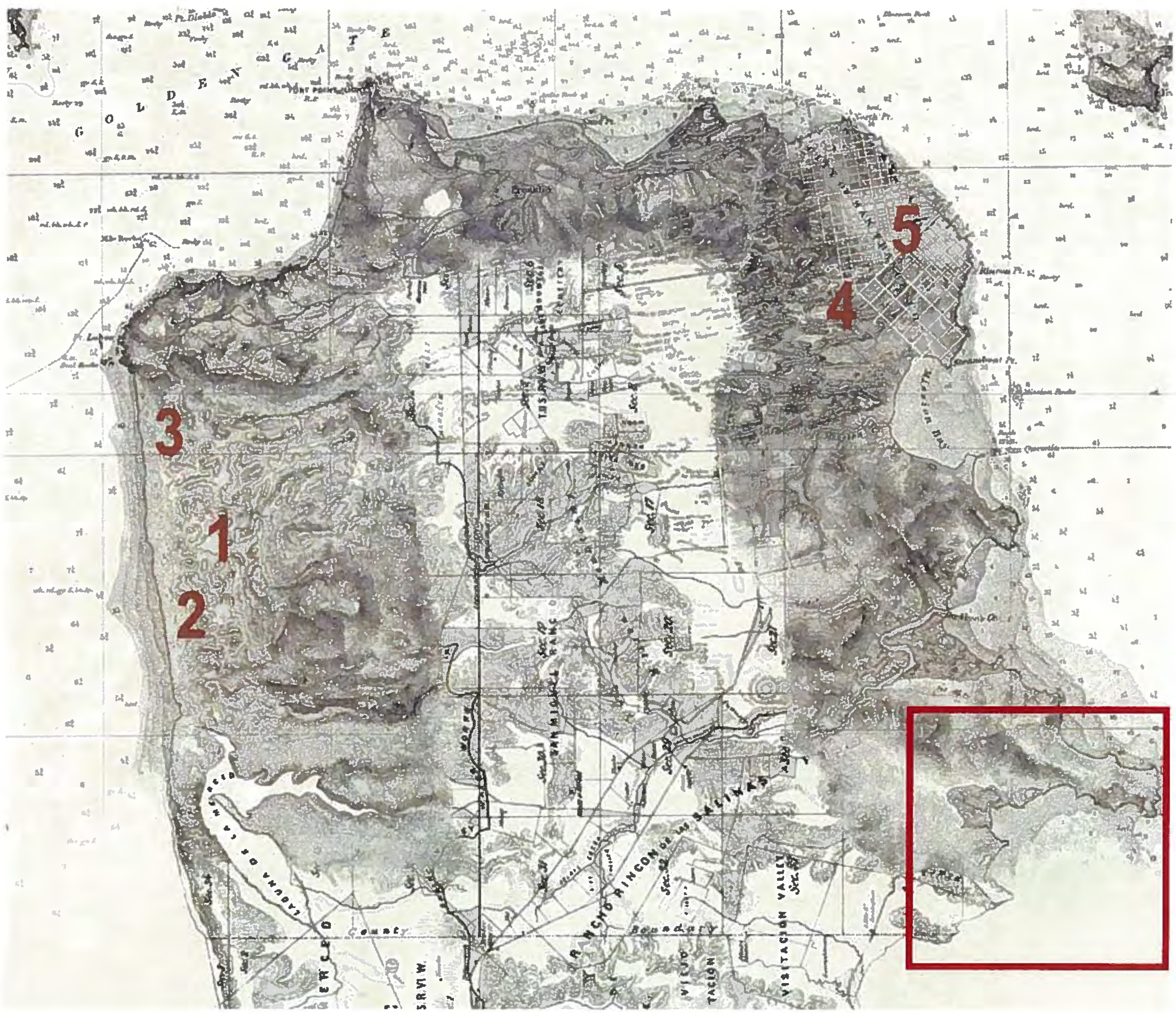
Planning Background and Development Program

The City's plan to revitalize the Hunters Point Shipyard and Candlestick Point is one of the most important development projects in the City's modern history because of both its scale and the scope of public benefits that it will deliver to a under-served community. For more than 30 years, both of these largely abandoned sites have done little to benefit the Bayview Hunters Point community or the City.

After more than a decade of planning efforts relating to these sites, in May 2007, the Mayor, the Board of Supervisors, the San Francisco Redevelopment

Agency Commission, and the two community-based advisory organizations with jurisdiction over these redevelopment project areas, the Hunters Point Shipyard Citizens Advisory Committee and the Bayview-Hunters Point Redevelopment Project Area Committee, endorsed a "Conceptual Framework" for the integrated redevelopment of Candlestick Point and the Hunters Point Shipyard. In June 2008, San Francisco voters overwhelmingly approved Proposition G, the Bayview Jobs, Parks and Housing Initiative which set forth guiding principles and an integrated development plan for the two sites, consistent with the Board and Mayor endorsed Conceptual Framework. In accordance with the Initiative, the proposed development program encompasses the following elements:

- Housing: Approximately 10,500 units throughout the site, including a mix of rental and for-sale homes, both below market-rate (about 32%) and market-rate. The affordable units will be built largely by the City's Redevelopment Agency to serve very-low to moderate-income households.
- Rebuild of the Alice Griffith Public Housing Development: This project will provide one-for-one replacement of existing units and will serve the same income levels as the current residents. This will ensure that eligible Alice Griffith occupants have the opportunity to move into new units.
- "Green" office space: Approximately 2.5 million sq. ft. of space for technology research is proposed for the Shipyard. The City intends to create a "green technology" cluster on this site. In addition, 150,000 sq. ft. of "green" office or other commercial space will be built on Candlestick Point.
- Regionally-focused retail: Approximately 635,000 sq. ft. on Candlestick Point.
- Neighborhood-focused retail: Approximately 125,000 sq. ft. on the Shipyard, including a retail town center, as well as an additional 125,000 sq. ft. on Candlestick Point.
- Hotel: 150,000 sq. ft. (220 rooms) on Candlestick Point.
- Artist studio space: Permanent new and renovated space for Shipyard artists.
- Parks: More than 330 acres of new and restored parks, open space and wildlife habitat.
- Marina: 300 slips on the Shipyard.
- Performance space: 10,000-seat venue on Candlestick Point.
- New stadium: Space for a new, 69,000-seat, world-class home for the 49ers and related "dual-use" active recreation fields and green parking areas on the Shipyard.



San Francisco Historic Map, 1860
Source: Creek & Watershed Map of San Francisco, SFPUC

Existing Resources & Setting

The places we know today as Candlestick Point and Hunters Point Shipyard have been shaped by many factors -- both natural and cultural. These existing resources inform the development plan which seizes the extraordinary opportunity for new and improved parks, open space, and habitat restoration.

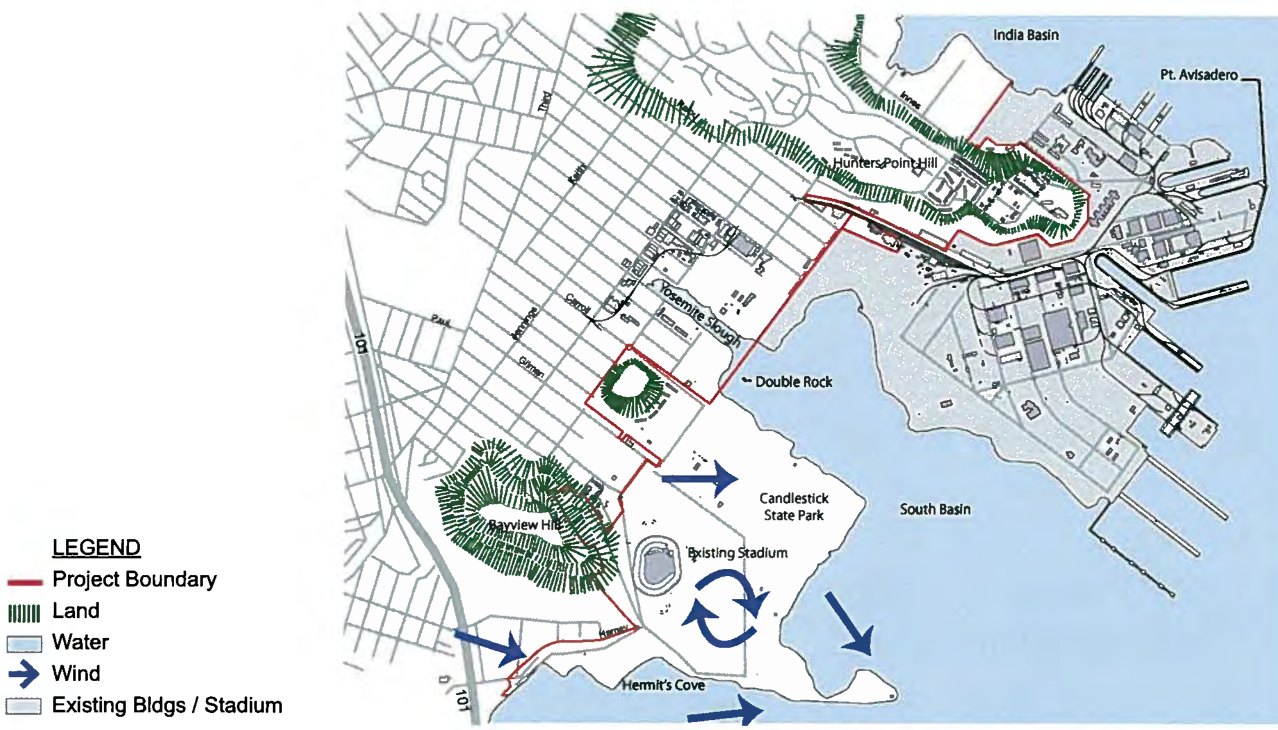
Natural & Cultural Resources

Land, Water and Climate

Geology & Groundwater Basins, circa 1850
Source: Creek & Watershed Map of San Francisco, SFPUC

Like many San Francisco neighborhoods, Candlestick Point and Hunters Point Shipyard are strongly defined by dramatic hills and the water's edge. Candlestick Point and Hunters Point are each peninsulas jutting out into the San Francisco Bay. Much of the area is bay fill surrounding the natural promontories of Bayview Hill and Hunters Point Hill. The fill areas are relatively flat and close to sea level. Bayview Hill, at over 400 above sea level is the most significant topographical feature in the southeast portion of the city. The south end of Hunters Point Hill rises to approximately 120 feet above sea level.

Between these peninsulas lies an open water area known as the South Basin. Yosemite Slough extends west of the South Basin and is the largest remnant of the extensive wetlands that existed along San Francisco's eastern shore prior to filling and urbanization. A small rock island called Double Rock sits at the southwest end of the South Basin near the mouth of Yosemite Slough.



Natural Features- land, water, & wind

The flatter lands of the site were largely constructed by filling of the Bay. The shoreline is major defining element of the site and is currently a mix of natural areas, most of which are part of the Candlestick Point State Recreation Area and industrial waterfront areas that are a remnant of the previous shipbuilding and naval activities of Hunters Point.

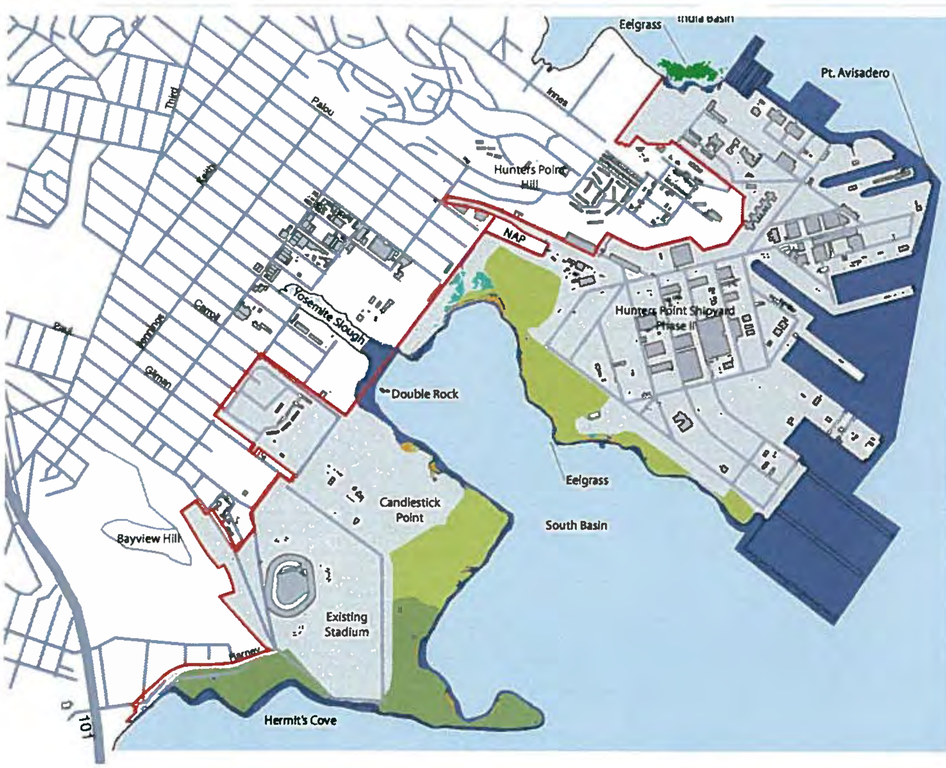
The form of the landscape contributes to the specific micro-climates – the south end of Candlestick Point is renowned for its winds which are funneled through gaps in the hills to the west. Hunters Point is more protected and is one of the warmer parts of the City.

Vegetation and Wildlife

Much of Candlestick Point and Hunters Point Shipyard are urbanized, and the areas with most natural vegetation and wildlife use are at the Candlestick Point State Recreation Area and the South Basin.

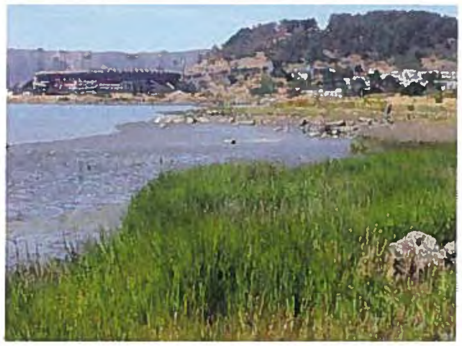
Candlestick Point State Recreation Area

Trees at the Candlestick Point State Recreation Area, mostly Monterey pine and Monterey cypress, provide nesting and foraging habitat for birds. The majority of birds nesting in these trees are common, urban-adapted species. During spring and fall, small numbers of migrant songbirds have been recorded foraging in these trees. California ground squirrels are common in the ruderal (human-disturbed) habitats at Candlestick Point, and the surrounding waters provide foraging habitat for grebes, ducks, gulls, terns, double-crested cormorants, and California brown pelicans.



- Project Boundary
- Fresh Water Wetalnd
- Nontidal Salt Marsh
- Tidal Salt Marsh
- Landscaped/Ornamental
- Non-Native Annual Grassland
- Urban
- Mudflats / Open Water
- Eelgrass
- NAP Not-a-Part

Study Area Habitats Map



South Basin

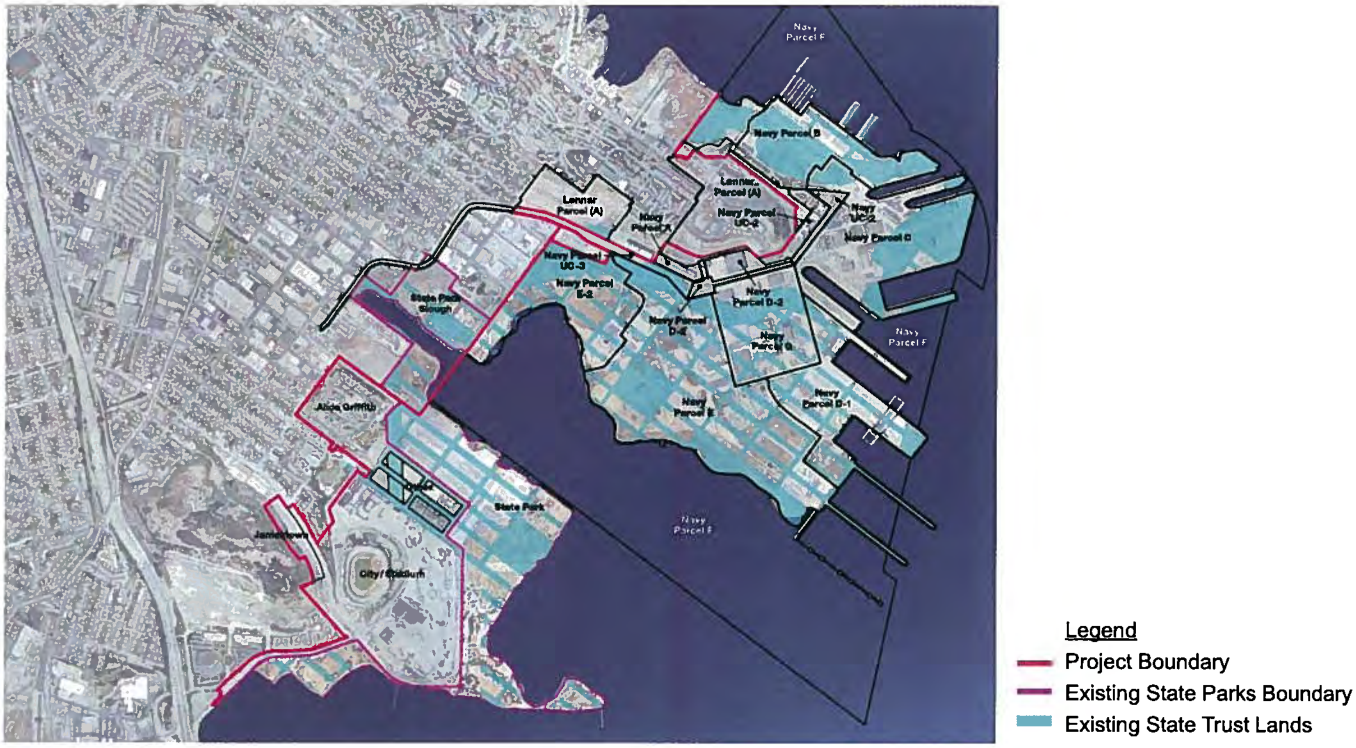
The South Basin provides aquatic foraging and loafing habitat for a number of species of waterbirds. Ducks, such as surf scoters, greater scaup, and lesser scaup, dive for shellfish and other benthic (bay-bottom) organisms, while western grebes, Clark's grebes, double-crested cormorants, California brown pelicans, and Caspian terns hunt for fish in these waters. Great blue herons and snowy egrets forage in the shallows. Intertidal mudflats are limited in extent, and occur primarily near the mouth of Yosemite Slough. These mudflats provide foraging habitat for many of the same shorebird species occurring in Yosemite Slough.

The small island known as "Double Rock" in the northwestern part of South Basin supports 10-15 pairs of nesting western gulls. Black oystercatchers forage, and may nest, on this island, and they feed on small rocky islands elsewhere along the edge of South Basin as well. Due to the presence of riprap and other debris along most of the shore of South Basin, beaches and tidal marsh are limited to small remnants. A few areas of tidal marsh, the broadest being along the Hunters Point shoreline north of the mouth of Yosemite Slough, are dominated by cordgrass, pickleweed, and marsh gumplant. These marsh remnants provide habitat for terrestrial garter snakes and foraging habitat for shorebirds and wading birds, but they are too small and isolated to support marsh-nesting species such as California clapper rails, salt marsh harvest mice, San Francisco common yellowthroats, and Alameda song sparrows.

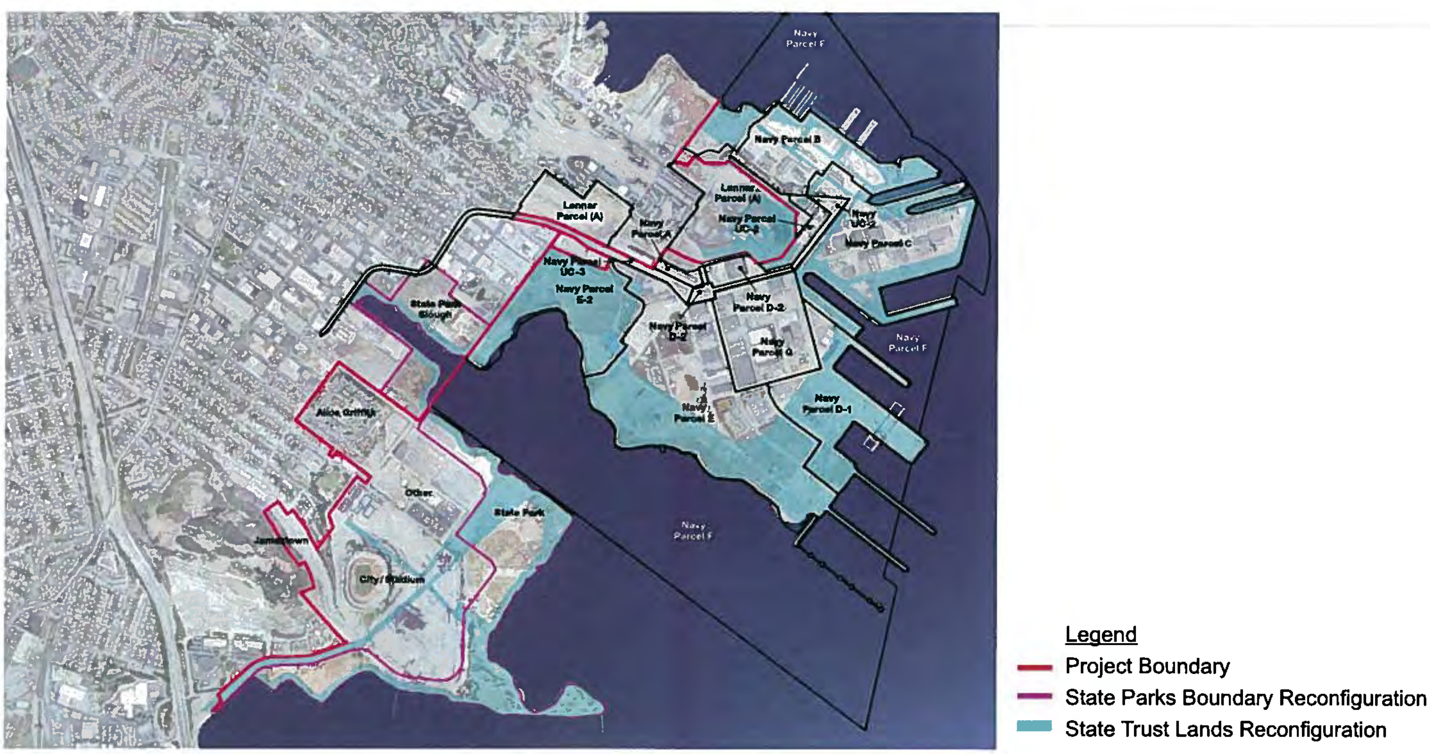
History and Culture

The Candlestick Point and Hunters Point Shipyard area has a rich history and a diversity of people have lived and worked here at the Bay's edge. The earliest known human presence in the Bay Area began nearly 12,000 years ago, and in the San Francisco area, nearly 6,000 years ago. The most common physical evidence of early indigenous culture is found in shellmounds, sites typically located at the Bay's edge near the mouth of streams where a variety of plant and animal resources were abundant. When the first Europeans arrived in the Bay Area, the project area was within the traditional territory of the indigenous Ohlone people.

When European settlement at Candlestick and Hunters Point began in the late 1840s/early 1950s the areas were primarily used as pastureland. The 1849 gold rush brought rapid growth to the City, and the City's maritime industry and boat building expanded south to India Basin. Italian and Chinese farmers moved into the Hunters Point area to farm vegetables to sell in the City center. The Chinese also established fish and shrimp farms along Hunters Point. By 1900, Hunters Point became established as a center for maritime activities and included shipyards and dry docks. The Navy's use of these facilities increased and it purchased the Bethlehem Steel dry docks in 1939. The Navy Shipyard expanded dramatically during World War II, leveling parts of Hunters Point Hill and filling the Bay to create new land between Hunters Point and Yosemite Creek. The existing African American community grew as many African Americans moved from the South to work at the shipyards. After World War II, the Shipyard became a center for the Navy's nuclear research. After it closed in 1974, the Naval Shipyard operated as a private ship-repair operation until 1986 when the Navy began current ongoing remediation efforts.



Existing Ownership Map



Existing Ownership Map with State Parks & State Trust Reconfiguration

Candlestick Point and Hunters Point Shipyard Today

Current Ownership and Land Uses

Hunters Point Shipyard (HPS)

The Hunters Point Shipyard Phase II area is currently under the jurisdiction of the US Navy, which is completing a clean-up of the site. Once complete, the Navy will convey the land to the City for development. For planning purposes, the Navy property has been sub-divided into smaller parcels (A-F), based on the time-line of the Navy clean up.

HPS includes 421 acres of dry land that contains several structures associated with World War II era uses: ship repair, storage and trucking, light manufacturing, construction, laboratories, scrap metal recycling, administrative and other former Navy uses. Several former Navy buildings are currently leased and occupied as studios by approximately 250 tenant artists. HPS Phase II also includes dry docks, piers and wharves, as well as repair berths.

Bordered by San Francisco Bay to the south, east, and north, land uses at India Basin to the west are varied. Light industry and residences adjoin Innes Avenue. To the southwest of the HPS Phase II area are neighborhoods with multi- and single-family housing. Land uses in the surrounding area—specifically the industrial uses along Crisp Road— historically provided a buffer between HPS activities and adjacent residential uses.

Candlestick Point

The 281-acres Candlestick Point Area is generally bounded by Hawes Street to the northwest, Candlestick Cove and the San Francisco Bay to the south, Jamestown Avenue to the southwest, and South Basin to the east. The site includes residences, public open space, and the Candlestick Park football stadium.

The area is bordered by two existing communities—Bayview to the north and Executive Park to the west. The Bayview community was developed during the 1950s and 1960s and is characterized by two and three-story single family and duplex dwellings west of Gilman and light industrial buildings generally east of Gilman. Gilman Park and Bayview Elementary School are located in the blocks between Gilman and Ingerson, north of Giants Drive. The Executive Park development began in 2004 and includes several office buildings and a four-story condominium project near Highway 101.

City Ownership

Several Candlestick Point parcels are currently owned and operated by departments of the City of San Francisco. The San Francisco Housing Authority owns and manages 256 units of public housing at the Alice Griffith site. The City's Department of Recreation and Parks manages the Candlestick Park Stadium. The 70,000-seat stadium and related surface parking lots are the home of the San Francisco 49ers professional football team. The facility is also used occasionally throughout the year for concerts and other performances.

Other City lands include the streets and right of ways managed by the Department of Public Works.

State Trust

Certain land and water areas within the project are "State Trust Lands." Early in its history, the California Legislature transferred tide and submerged lands in trust to cities and counties, which were then required to develop harbors to further state and national commerce. The State Lands Commission ensures that the areas held in trust by the City of San Francisco are available for the benefit of the people of California for uses that promote navigation, fisheries, waterborne commerce, natural resource protection, and water-related uses that attract the public to use and enjoy the waterfront. Recent state legislation, Senate Bill 792, provides for the reconfiguration of State Trust lands in the area.

State Parks

The 154-acre Candlestick Point State Recreation Area (CPSRA) is a part of the California State Parks System. The CPSRA contains approximately 72 developed acres along the shoreline with a network of paved and dirt paths, bathroom structures, picnic facilities, two fishing piers, paved lookout points, and a boat launch facility. The remaining acres have not been developed and are, in part, used for overflow stadium parking. Recent legislation, Senate Bill 792, authorized a reconfiguration of the CPSRA in exchange for project-provided park improvements and operating funding.

Private

Privately held lands include the Jamestown parcel and lands north of the stadium. The private parcels north of the stadium accommodate a 165-space RV site and an apartment block at Gilman Avenue and Arelious Walker Drive.

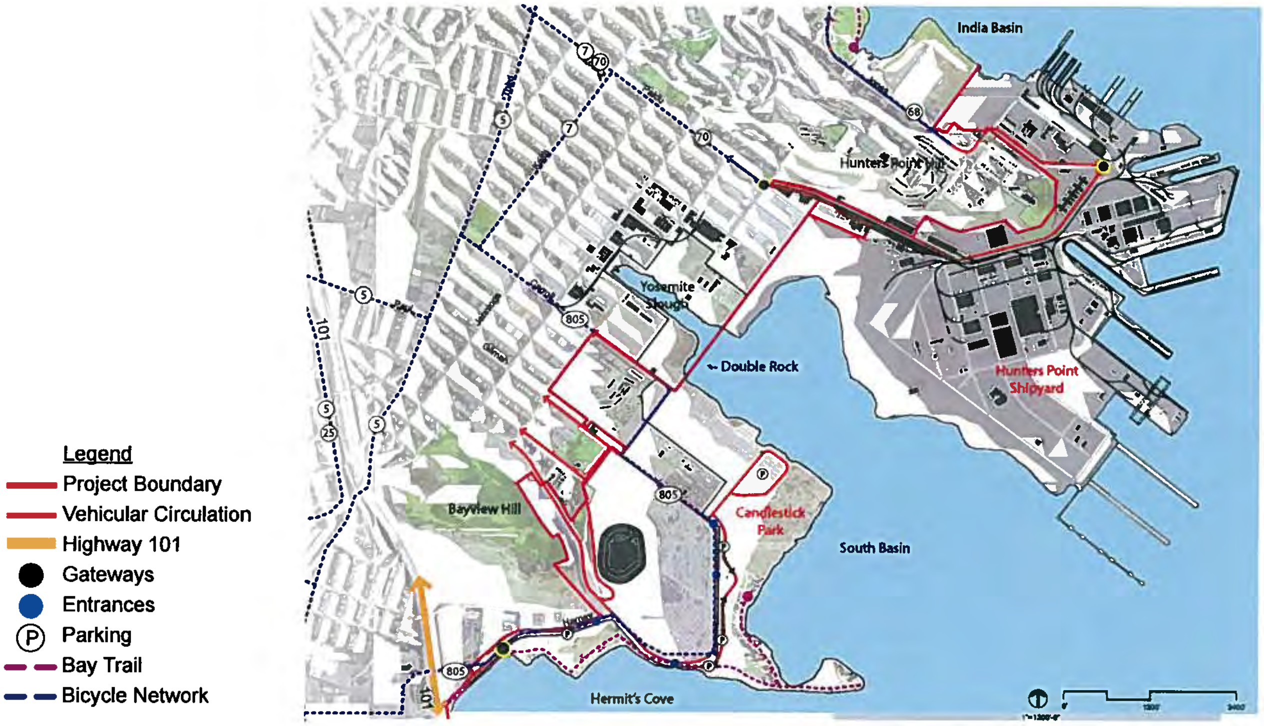
Access

Hunters Point Shipyard

Historically, access to the site was controlled for safety and security reasons, and most of the site remains fenced off, prohibiting public access from surrounding neighborhoods. Primary access to the southern portion of the site is provided by Crisp Road, Spear Avenue, and Fischer Avenue. Innes Avenue, Galvez Avenue, and Robinson Street provide access to the northern portion of the site. The HPS Phase II site lacks pedestrian amenities, such as sidewalks.

Candlestick Point

Access to most of Candlestick Point is limited to an arterial loop road (Gilman Avenue/Jamestown Avenue/Bill Walsh Way/Ingerson Avenue) that encircles the Candlestick Park stadium and parking lot. Carroll Avenue and Fitch Street provide access to the Alice Griffith housing complex. However, most non-arterial streets from the residential neighborhoods to the west of Candlestick Point reach a dead end before entering the site. Streets within the Alice Griffith housing complex are internally oriented, and for the most part, do not connect to surrounding streets. In addition, Bayview Hill creates a physical barrier to

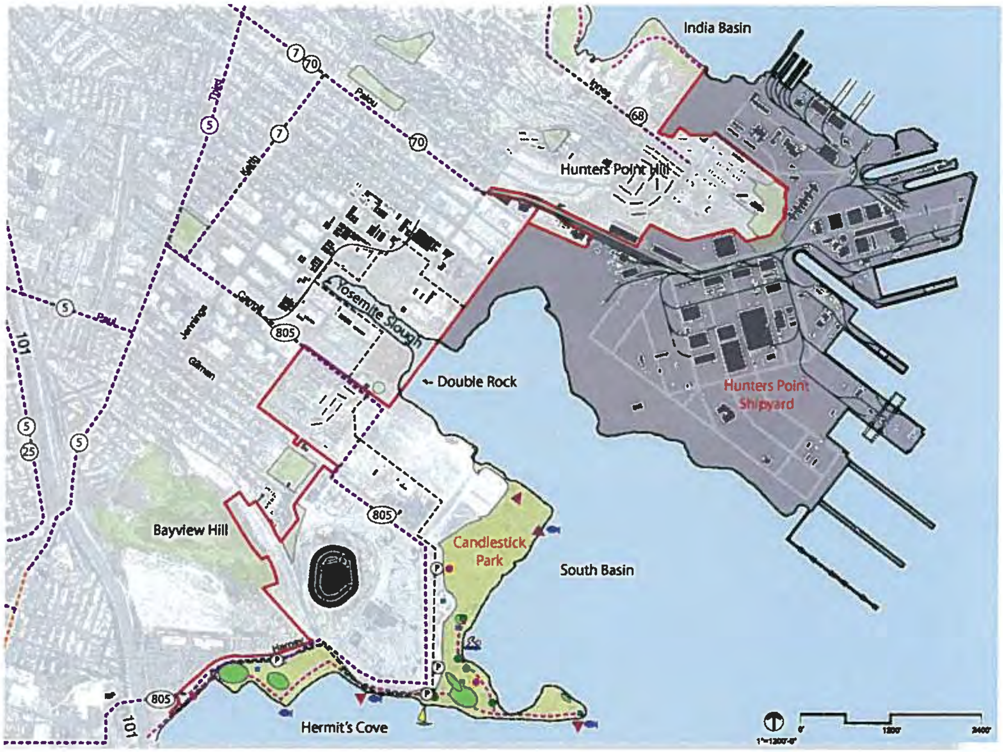


Existing Access and Circulation

the south, limiting access from this direction, except at Harney Way. The lack of street connectivity, combined with the site's large, barren parcels, lack of sidewalks, and low level of on-site activity, make Candlestick Point relatively unwelcoming to pedestrian traffic.

Parks and Recreation

In spite of its striking geographic location, much of the park acreage that exists at Candlestick Point is underutilized, un-completed, or in need of repair. Citywide, the ability to construct new parkland has been constrained by San Francisco's population density and small land area. Active recreation fields are in particularly high demand throughout the City and the City has identified a need for new fields. Give its size, the redevelopment of the Candlestick Point and Hunters Point Shipyard offers an extraordinary opportunity to contribute to new and revitalized parks that will benefit existing neighborhood residents, new residents, and larger community of San Francisco and the region.



Legend
- Project Boundary
- Lawn
- Passive Meadow
- Picnic Meadow
- Community Garden
- Restrooms
- Outlooks
- Outdoor Art
- Beach / Swimming
- Windsurf
- Fishing
- Parking
- Bay Trail
- Bicycle Network

Existing Park Uses

Legend
- Project Boundary
- Existing City Park
- Existing State Park

Existing Parks

Existing Parks

There are two existing parks within the project site – the Candlestick Point State Recreation Area (CPSRA), and the Candlestick Park Stadium. Existing users of these parks include the residents and employees in the Bayview Hunters Point neighborhood, as well as visitors from other parts of the City and the Bay Area. Recreational visitors from outside the neighborhood include 49ers football fans and other stadium event users, and windsurfers who use the CPRSA shoreline for Bay access.

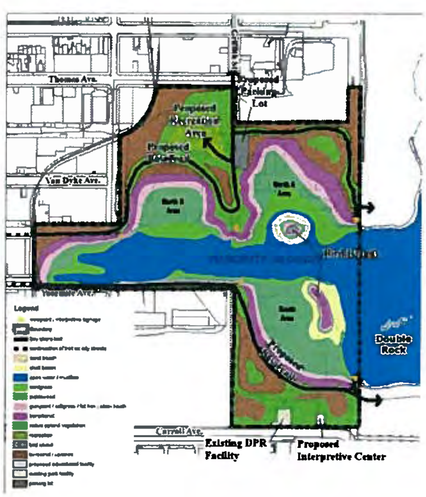
CPSRA is a former landfill on the shoreline of Candlestick Point that was purchased by the State in 1977 for development as a State recreation area. CPSRA includes picnic areas, a fitness course for seniors, a bike path, shoreline access to the Bay for water-dependent recreation, and recreational trails. The CPSRA provides neighborhood residents with access to open space along the Bay, but the recreational and aesthetic potential of this park is constrained by the industrial character of adjacent land uses and the availability of state resources. Much of the land at the CPSRA is unimproved. For example, land to the north and east of the Candlestick Park stadium are currently being used for stadium parking. Other portions of the site contain construction rubble and debris. As a result, existing CPSRA facilities are not fully utilized to their full potential as places for recreation and habitat. The community has expressed strong support for the restoration of Yosemite Slough, and design for this restoration initiative is underway. While Yosemite Slough is part of the CPSRA, it is not within the area to be improved by this project.

Hill Point Park rendering

Candlestick Park is the site of Candlestick Park stadium owned by the City Recreation and Parks Department and leased by the San Francisco 49ers National Football League team. The existing stadium, built in 1960, seats 70,000 and is used for football games and other non-football entertainment events. However, most of the year the stadium and it's parking lots are vacant and unused.

Other Parks Improvements and Initiatives

In addition to the CP-HPS Phase II improvements, a number of other projects are underway in the larger Bayview Hunters Point neighborhood and the City's southeast waterfront.



Yosemite Slough Restoration Project Plan

Hunters Point Shipyard Parcel 'A' is the first phase of improvements that is underway at the Shipyard. This project includes two sites on Hunters Point Hill, "Hilltop" and "Hillside," that will be linked with the overall CP-HPS parks system. Ramped pathways will connect Hilltop's Innes Court Park and Hillpoint Park with the HPS Phase II Boulevard Parks and Waterfront Promenade with connections to the greater parks system. At Hillside, ramped paths will descend from the neighborhood's Central Park and pocket parks, connecting with Crisp Road near the Phase II Grasslands Ecology Park.

With significant community involvement and support, the State Parks Foundations and the State Parks Department plan to restore the 34-acre Yosemite Slough area of the State Park, creating the largest contiguous wetland area in San Francisco. The project will restore wildlife habitat, improve water quality, and prevent erosion along the shoreline of the mostly urbanized bay shoreline of San Francisco. The slough restoration project also enhance shoreline access from the Bayview community, providing opportunities for nature education and viewing of wildlife habitat.

The San Francisco Bay Trail is a regional multi-use recreational trail that, when complete, will encircle San Francisco and San Pablo Bays with a continuous 400-mile network of bicycling and hiking trails. Existing segments of the San Francisco Bay Trail run from Heron's Head Park around the India Basin Shoreline, with a gap in the middle of the segment to near the north side of Hunters Point Shipyard. In addition, a segment of the trail runs from southeastern end of Candlestick Park south to Highway 101. On the southeast waterfront of San Francisco, the Neighborhood Parks Council (NPC) is promoting a "Blue Greenways" program to coordinate development of the Bay Trail and other neighborhood linkages. The Blue Greenway project envisions a trail corridor that provides an easily accessible waterfront trail for recreation, bay access, and enjoyment of public art.

Planning Issues and Concerns

There are a number of key issues related to the parks planning that have been identified by the project team and through input from public meetings, community organizations, individuals, and coordination with public agencies.

Habitat and Ecology

Although much of the site is occupied by urban land uses, and more natural areas are dominated primarily by non-native vegetation, the site is located in an ecologically important location along the San Francisco Bay shoreline, and it currently supports a number of wildlife species. The design of parks and open space needs to protect the natural qualities of the site while enhancing conditions for native plants and animals. Park and open space design can help manage pollutants in stormwater runoff, minimize the use of potable water for irrigation, restore native-dominated plant communities, and enhance habitat conditions for wildlife. Key issues include management of invasive plants, incorporation of native vegetation in restoration and landscaping, creation of a diverse array of habitats, and protection of plants, animals, and ecological processes during construction, maintenance, and increased human use of the site.

History and Culture

History

There are many stories to be told about the history of the area. These include Native American life at the Bay's edge, settlement of the area after the arrival of Europeans, and the Chinese fishing and shrimp harvesting, and maritime development. The most visible history today is that of the maritime development and the Naval Shipyard, evidenced in historic buildings, drydocks, cranes, and other structures. The parks and open space plan should be coordinated with the Navy's closure so that the sense of this history is not erased. The project will make a special effort to preserve and rehabilitate historic structures and to incorporate interpretive elements and historic markers that highlight significant, structures, events and public figures. In particular features and materials such as light standards, rail spurs, crane tracks, dry docks, bollards, and cleats may be retained and incorporated or re-used in the design of parks and open spaces.

Neighborhood Identity

Also important to the neighborhood is the expression of its African American cultural heritage. As park designs are developed there should be opportunities for the community to engage with designers to incorporate these themes into the park designs. The Northside Park at Hunters Point Shipyard will be developed with space for the International African Market Place and the park design will need to be coordinated with the operational needs of the market.

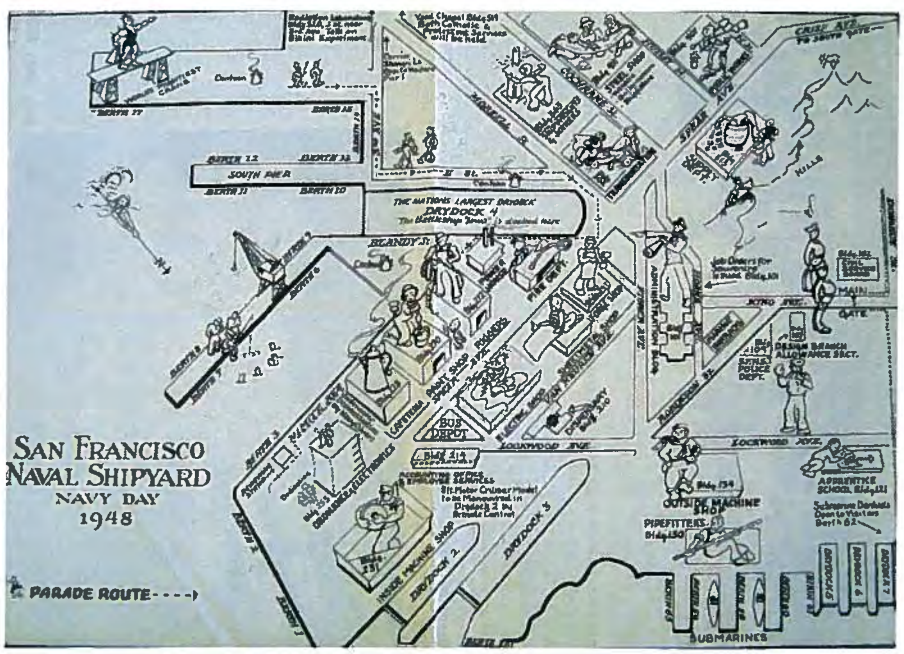
The Arts

With an outstanding landscape setting, a rich and layered history, and the thirty years presence of the Shipyard artist community, the parks and open spaces of Candlestick Point and Hunters Point Shipyard offer significant opportunities for public art. As the parks and open space plans develop, programs and opportunities for artists will be incorporated into the design of the parks. The City's Blue-Greenway Plan in particular has identified public art as a key component of the Bay Trail systems along the City's southeastern waterfront. The parks and open space design will also include spaces for outdoor performing arts such as music, dance, and theatre.

Programming and Partnerships

The development of parks, open space, and habitat areas will be enlivened by the participation of a variety of groups and organizations which may use these spaces. As park designs develop, there are opportunities for coordination and partnerships with organizations and projects such as the following:

- Community / neighborhood groups
- Outdoor field sports groups and leagues
- Marina operators
- Small boat, kayak and windsurf organizations
- Community ecology and restoration groups



- Bicyclists and skaters (rental, bike-sharing programs)
- Museums / historical societies
- Artists
- International African Marketplace
- Café / Restaurant / Cart vendors
- Community garden organizations
- Dog groups
- Local business
- Outdoor performance and event programmers

In addition to the types of community organizations listed above, the park design will also include coordination with a variety of public agencies, including the Bay Conservation and Development Commission (BCDC), the Association of Bay Area Governments Bay Trail Project, and California State Parks.

Planning for the Candlestick Point State Recreation Area will be tightly coordinated to create an interface between the State Parks system and the urban park and development that creates a synergy between them. While State Parks will produce a new master plan for the CPSRA, the development of the State Park and the other parks will be linked as part of a complete park system. For further discussion of this topic, see State Parks description under 'The Proposal' section.

Sea Level Rise

Recognizing the potential for sea level rise to impact project area in the future, a project specific study was undertaken to develop planning and design guidance through the various phases of the project. In planning for sea level rise at the park and shoreline edge, design considerations include: habitat, shoreline erosion, protection of park features, flooding, and the experiential quality of the Bay edge. The project's park sea level rise strategy is discussed in more detail in 'The Proposal' section of this document.

Hazardous Material Clean-up

The US Navy is responsible for the clean-up of its lands and state and federal regulators are responsible for making sure that the Navy's clean-up is safe for people and the environment. Coordination between the Navy's clean-up and the park programming and design will require ongoing coordination.

Relationship of this Plan with other Project Plans

There are a number of key issues and concerns that are not completely addressed in this document, but are more fully addressed in other project plans:

Sustainability

The design of the parks and open space system is closely related to many project-wide sustainability issues including: Economic Opportunity, Community Identity & Cohesion, Public Well-Being, Safety & Quality of Life, Accessibility & Transportation, Resource Efficiency, and Ecology. A framework for these issues, including goals, strategies, commitments and aspirational targets are fully discussed in the *Draft Sustainability Plan*.

Urban Design

Urban design, the form and shape and aesthetics of the development, have an important relationship to the design of the parks, open space, and habitat system. For more detail on these issues, refer to the forthcoming *Design for Development Plan*.

Transportation & Streetscape

Certain components of the park system such as bike and pedestrian trails and pathways are also a component of the transportation system. Conversely, some of the streets are designed with enhanced streetscapes which function as small linear "boulevard parks." Public transportation and automobile access are also important to the park system. A complete description of the project's transportation system is found in the *Transportation Plan*. The forthcoming *Streetscape Master Plan* will include more detail on the Boulevard Park Streets, and streetscape design features.

Utilities & Infrastructure

Some aspects of the park system are closely linked with infrastructure, for example: low-impact design stormwater treatment features and street design. More detail on the infrastructure system will be found in the forthcoming *Infrastructure Master Plan* and *Streetscape Master Plan*.

The Proposal

The Park System

Goals and Principles

The *Parks, Open Space, and Habitat Master Plan* has been developed to address the following goals and principles. These principles are organized by in relation to the by principles related to *planning*, *design*, and *process.*

Planning

These goals and principles relate to organization, size, shape, and arrangement of parks.

- **Connectivity**

  Create connections between parks and to regional open spaces including the state park and regional trail networks.

- **Walkability**

  Provide public open space within a short walking distance of all residents and employees.

- **Variety**

  Pursue opportunities to enhance existing and create new open spaces that include a variety of public plazas, courtyards and pocket parks in addition to larger public open spaces.

De sign

These goals and principles relate to the form and program of individual parks

- **Flexibility**

  Develop a park layout that allows multiple outdoor opportunities to occur within the same space.

- **Diversity**

  Provide a contrast of open space scale, design and program so each open space is unique to the character of its context.

- **Character**

  Create unique spaces that reflect the character of the community, support family and neighborhood gatherings as well as informal socializing.

- **Resource efficiency**

  Use materials and resources efficiently to minimize environmental impact and cost.

Process

These goals and principles relate to adaptation, growth, and change, and the organic evolution of the plans.

- **Community Involvement**

  Provide opportunities to involve the community in the design process for individual parks and opportunities to accommodate community-based programs and partnerships.

- **Interpretation and Education**

  Provide park facilities and opportunities that support learning about cultural history, ecology, and urban sustainability.

- **Urban ecological infrastructure**

  Integrate urban infrastructure with natural process to support urban sustainability. Parks and open spaces are a part of the city's 'green infrastructure' and will help regulate climate, control storm water, cleanse air and water, and provide habitat

- **San Francisco Bay Ecology**

  Enhance wildlife habitat to support the ecology of the San Francisco Bay, its wetlands, and the adjacent uplands.

Park & Open Space Framework

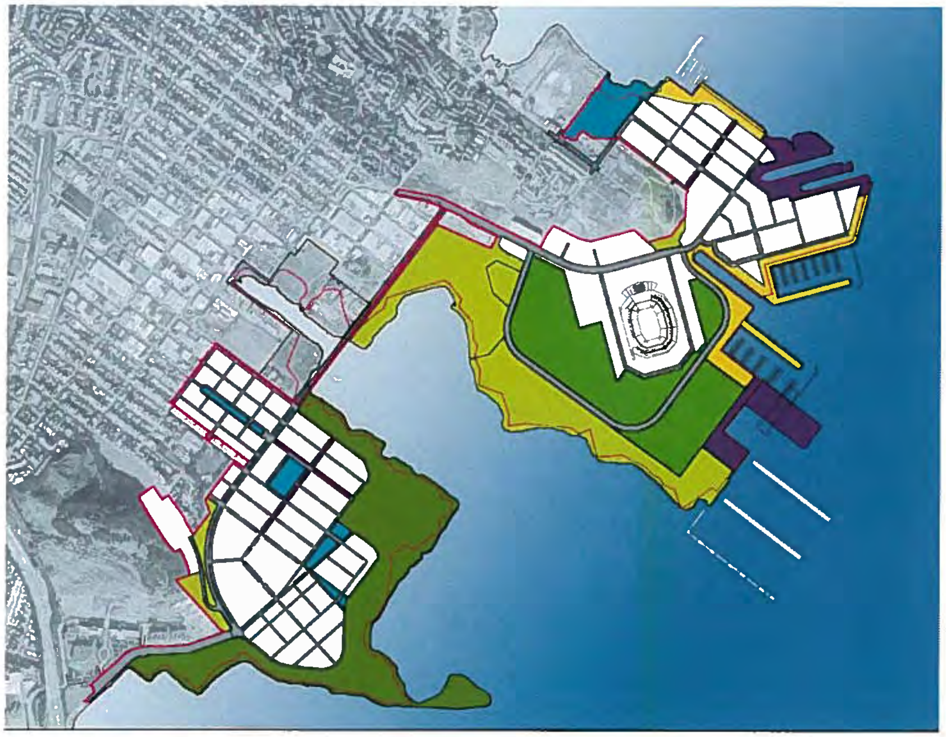
There are number of broad programmatic goals that are included in a complete park system. These include: recreation and leisure; historical remembrance, education, and celebration of culture; and stewardship and sustainability. Aspects of these broad park programs may be present in each park; however, based on opportunities, location, size, and needs, the park system has been designed to include the following eight components.

City Parks

City parks offer a mix of active and passive areas of open lawns, dog runs, play areas, community gardens, court games, and environmental education opportunities. These parks will serve the adjacent local neighborhood and will draw regular users from within a 10 minute walking radius. The City Parks adjacent to the waterfront will also attract visitors from other parts of San Francisco and beyond.

Cultural / Heritage Parks

The historical and cultural elements of these parks are designed to attract a broad range of visitors. In addition to regular neighborhood use, these parks draw visitors from throughout San Francisco, the Bay Area, and beyond.



Park & Open Space Framework

- City Parks
- Cultural / Heritage Parks
- Waterfront Promenades
- Sports & Multi-use Fields
- Habitat and Ecology Parks/Open Space
- Boulevard Parks and Streetscapes
- State Recreation Area
- Bay Trial
- Project Boudnary

Waterfront Promenades

The waterfront promenades are linear, urban spaces along the waterfront. They offer continuous waterfront access connecting to other urban areas and larger parks. They also contain features for discovery and amenities for resting and gathering. In addition to passers-through, these places attract neighborhood residents and workers.

Sports & Multi-Use Fields

The sports fields serve organized play for youth, high-school, and adult intra-mural sports. While soccer may be the most popular use the fields can accommodate other sports such as football, ultimate, and cricket. Multi-use fields are designed for informal uses such as kite-flying and picnicking, as well as accommodating larger organized festivals and events.

Habitat and Ecology Parks

These parks and open spaces facilitate the co-habitation of wildlife and humans in the city. While some areas may be designed to protect sensitive plants and wildlife, other sections may include trails, boardwalks, and overlooks, and provide facilities for nature education and picnicking.

Boulevard Parks and Streetscapes

Streets are important spaces in the life of the City. The boulevard parks are a special street type that includes expanded median or sidewalk areas that function as mini-parks -- providing spaces for neighborly socializing, games and play, and gardens. Streetscapes and boulevard parks will be described in greater detail in a separate *Streetscape Master Plan.*

State Recreation Area

Managed by the California State Parks Department, the State Recreation Area is focused on providing places for bay and nature-related outdoor recreation, education, and preservation and enhancement of natural habitats.

Bay Trail

While not a separate "park," the Bay Trail strings together the entire bayside park system, providing a linear park experience that is complete in itself; some users may experience the entire parkland mainly from the perspective of the trail. For others, the Bay Trail will provide points of entry into specific parks within the Candlestick Park and Hunters Point park system.

The Parks

The following descriptions provide a framework for and suggestion of the programmatic potential of the individual parks. It is, however, expected that the final park designs will evolve through a process of dialogue and engagement with existing and future residents. Program elements may be added or adjusted as needed, within the constraints of the individual sites.

Hunters Point Shipyard

Northside Park

Concept: Gathering of Community

Located at the north entry to the Shipyard, this park is a community meeting ground, linking the India Basin, Hilltop, and Shipyard communities with a place for sport, leisure, discovery, and sustenance. Celebrating the community's cultural heritage and promoting ethnic diversity and awareness, the theme of the African Diaspora may be expressed in stylized park structures, and interpretive feature and elements in paving, seat walls, or sculptural signage markers. The African Marketplace activates the center of the park with a "market street" promenade.

Activities & Program

The Northside Park provides a full set of active and passive uses. The most active park uses are located on stepping terraces at the southwestern side of the park. This area includes water-wise ornamental gardens, basketball, tennis, a children's playground, and restroom. The open-air African Marketplace forms and east-west promenade bringing visitors and activity into the heart of the park. A central lawn provides a flexible space multi-use space. The lower half of the park is within the State Trust lands, requiring more passive uses here. Along the Bay's edge, the park takes on a more natural character, with picnic/ barbeque areas and shade shelters and waterfront pathways.

Access & Circulation

The park has multiple entry points linking it with the adjacent neighborhoods. Extending from the intersection of the HPS neighborhood streets, a series of paths cross through the park. The Bay Trail connects the Waterfront Promenade to the south and will extend into the future India Basin Flats Park.

Connecting from Innes, pathways ramp down through gardens to the court games area. A possible future bike/pedestrian route through India Basin along the Hudson right of way may connect through the Northside Park creating another link between the India Basin and Hunters Point neighborhoods.

Sustainability Features

The park plan proposes native plantings near the bay's edge and ornamental, water-wise, demonstration gardens along the hillside.

1. Overlook Terrace with Lounge Chairs
2. Terraced Planting
3. Water-wise Ornamental Gardens
4. Seating Terrace
5. Tennis Courts
6. Basketball Courts
7. Playground
8. Restroom
9. Lawn Steps
10. Storage Pavilion
11. Information Kiosk / Pavilion
12. African Market
13. Flowering Gardens with Seating
14. Open Lawn
15. Group BBQ / Picnic Shade Pavilions
16. Picnic Meadow
17. Terraced Viewing Mound
18. Boardwalk at top of Revettment
19. City View Cafe

Northside Park
Park Area: 12.8 acres

N

0' 200' 400'

Scale: 1" = 200'

Waterfront Promenade North

Concept: Weaving Urban Neighborhoods with the Bay-front Promenade

The design of this park space weaves two primary influences: the continuity of the Bay Trail and the new Shipyard neighborhoods. This once active industrial waterfront will become a sequential landscape of outdoor urban rooms. Renovation of the existing wharf and the retention of industrial artifacts along the promenade will reinforce the historic qualities of the waterfront. Meanwhile, new landscape features such as small tree groves and native grassland and stormwater gardens will interlace a sense of the past with the present as residents and visitors walk, run, ride a bike, sit, play and reflect.

Activities & Program

In addition to the cycling, strolling or skating along the waterfront, the Northern Waterfront Promenade will provide places for rest, gathering, and leisure activities. Between the urban backdrop and the open bay, these spaces may include open lawns, gardens, seating areas, plaza spaces, and picnic/barbeque areas, and places for informal recreation and games.

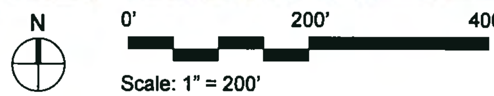
Access & Circulation

Access to the waterfront is provided at small plazas at the terminus of perpendicular streets and pedestrian mews, bringing pedestrian movement toward the waterfront. The grandest of these connections is at the Hunters Point Boulevard Parks. Extending from Galvez Street, the pedestrian paths and stormwater gardens of the Boulevard Parks terminate here at the Waterfront Park's central plaza space, and merge with the circulation of the waterfront promenade. Circulation along the promenade consists of series of main pathways running parallel to the water's edge: a Class 1 bicycle and pedestrian pathway adjacent to the urban edge, the Bay Trail closer to bay edge, and paths along the wharf.

Sustainability Features

The Northern Waterfront Promenade connects with the stormwater gardens system in the Boulevard Parks, detaining and cleansing street stormwater runoff before it reaches the Bay. The design of these features may include interpretive features that highlight the integration of urban and natural process. Reducing waste and consumption of new materials, the park design will seek to re-use and re-purpose historic materials and structures to the extent feasible. Plantings will focus on native and climate-adapted species that require minimal irrigation and provide habitat for insects and birds.

Waterfront Promenade North
Park Area: 7.1 acres

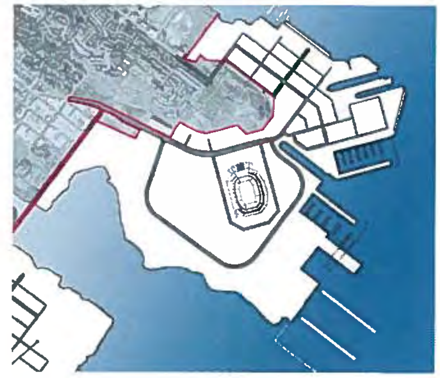


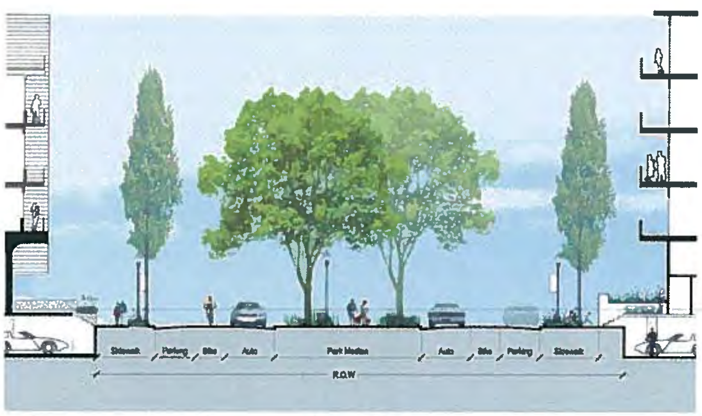
Scale: 1" = 200'

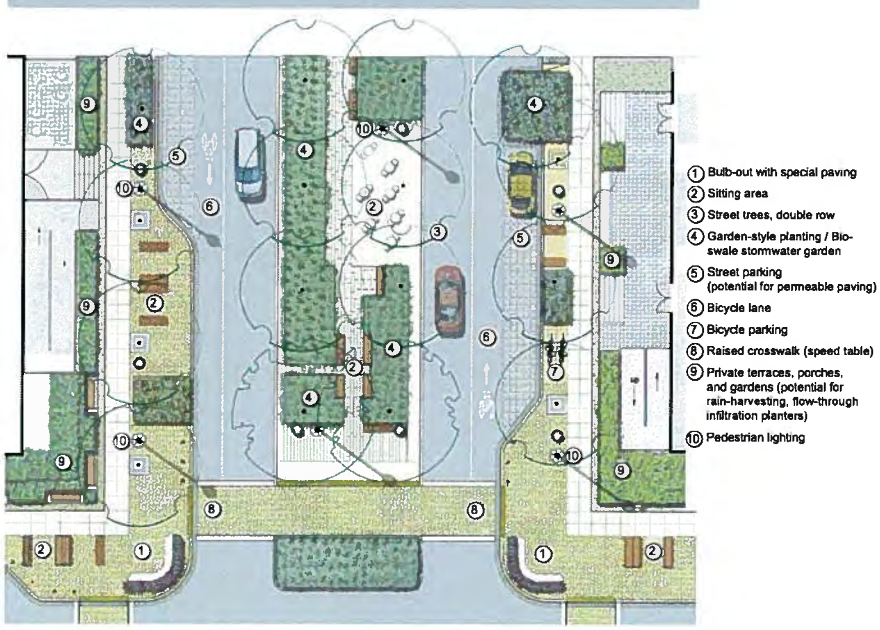
Hunters Point Boulevard Parks

Concept: The Street as a Neighborhood Living Room

A hybrid of street and park, the Boulevard Park Streets bring broad fingers of green space into the urban neighborhoods, linking interior parks with bay-front parks. The Hunters Point Boulevard Park Streets connect the Hunters Point Hilltop community with the waterfront Park. The streets has a strong pedestrian scale and quality, and serves as public 'front yards' and 'living rooms' for the neighborhood. In the center of a grand pedestrian-oriented street, large median spaces are designed as mini-parks with garden seating areas offering places for neighbors to meet and socialize. These parks also serve as 'ecological infrastructure,' bands of trees cleanse the air, while bioswales slow and cleanse storm-water before it enters the bay. The Boulevard Park Streets will be described in greater detail in the forthcoming *Streetscape Master Plan*.







Hunters Point Boulevard Parks
Park Area: 0.6 acres

N

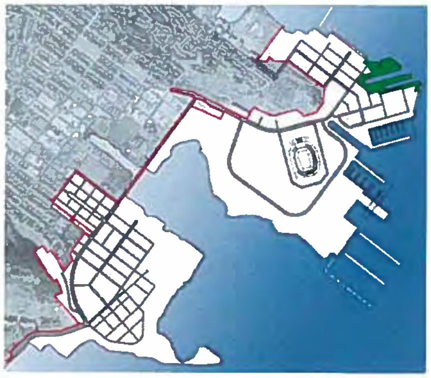
0' 200' 400'

Scale: 1" = 200'

Cultural Heritage Park

Concept: The Heart of Shipyard / Life and Work on the Waterfront

At the end of the Fisher Street neighborhood commercial corridor, and the nexus between the Hunters Point North Neighborhood and the Green Research and Development Center, the Cultural Heritage Park is the heart of the Shipyard. Here, the working history of the waterfront is evident in the historic structures and the grand scale of Drydocks 2 and 3. The park is a place to recognize the shipyard's importance to the people who worked there, and its significance to the nation, San Francisco, and the Bayview Hunters Point neighborhood. There are many stories that can be told here: stories of the Bay and its first people, the Chinese fishing communities, the shipyard and its workers, and the site's long Navy history. The design of this park will retain and reuse historic buildings, structures and materials as much as possible to preserve the spirit and essence of the place, and new design elements will have a modern, industrial character.



Activities & Program

The park's main program is for educational and cultural activity related to the site's history and the park will attract visitors from throughout the Bay Area and beyond. Users of the park can orient themselves to experience a specific historical use, scale, and aesthetic of the waterfront at the shipyard. Sculptural interpretive signage and kiosks, and other landscape elements may be used to describe this history in outdoor setting. Play areas for children will be interpretive and educational in nature. The historic buildings may be used for visitor centers, museums, or cafes, giving the park a distinct character and linking past and present uses. Space for a docked historical ship would further support the maritime experience.

Pumphouse at Drydock 3

Plaza spaces adjacent to the urban development can support a variety of outdoor event events and gatherings. A number of platform spaces support performance, gathering, informal seating and other spontaneous uses to occur simultaneously. Areas of open lawn provide flexible spaces and maintain open views to the grand scale of the dry docks which are the central feature of the park.

Historic Building between Drydock 2 & 3

Access & Circulation

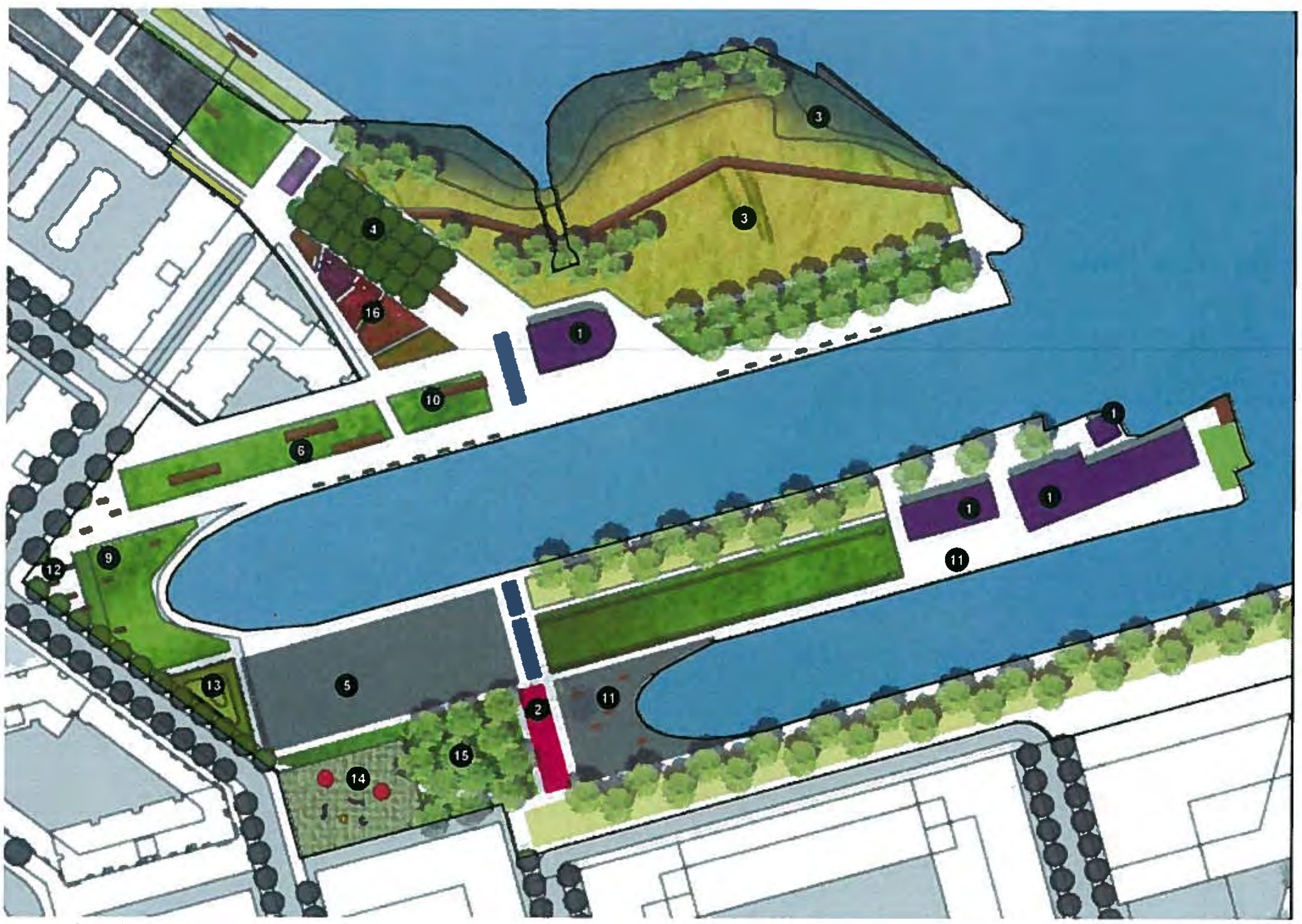
Access into the Cultural Heritage Park is multidirectional and accentuated by the meeting of two opposing city street grids at the Park's entrance. From the Bayview neighborhood, primary access to the park is by way of Crisp and Fisher, the HPS neighborhood commercial street and from Crisp and Spear through the Green Research and Development Center. Access from within HPS is possible via streets that terminate at the northeast and eastern boundaries of the park. The Bay Trail and Waterfront Promenades are integrated with the circulation of the Heritage Park and link it to other parks along the San Francisco Bay.

Precedent image

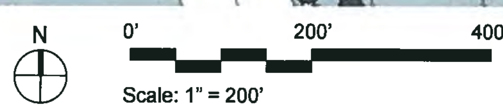
1. Historic Building/Visitor Center
2. Kiosk/Pavilion
3. Grassland / Naturalize Shoreline
4. Tree Grove
5. Multi-use event area
6. Lawn with seating plinths
9. Seating Plinth Lounging Terrace
10. Monolithic Timber Platforms
11. Interpretive Plaza
12. Entry Signage Pylon
13. Sculptural Landform
14. Playground
15. Tree Grove in Recycled Concrete and Gravel Paving
16. Gardens

Sustainability Features

The design of the park will preserve and re-use historic structures and materials such as paving and rails as much as possible. The ground plane may incorporate existing concrete slabs or recycled broken or crushed concrete. These features support the site's industrial character while diverting waste from landfills. Beyond these environmentally sustainable features, the park's central sustainable feature is about cultural sustainability – supporting the remembrance of the past with an understanding of how lives, land, and water, were shaped and reshaped here.

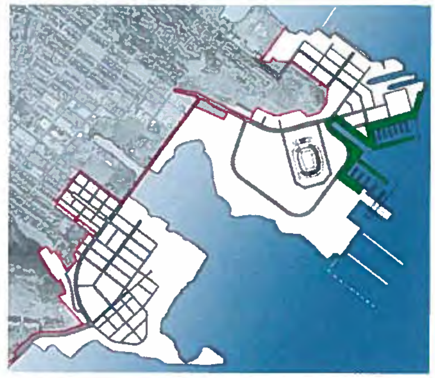


Cultural Heritage Park
Park Area: 15.6 acres



Waterfront Promenade South

Concept: Mingling and Promenade



The promenade is a place for interweaving of activities and visitors along the waterfront. The promenade is a sequential series of outdoor rooms, ecological gardens (raised planting beds emphasizing a native horticultural aesthetic and beauty), small tree groves, sculpture gardens, and sloped lawn panels for lounging and picnicking. Adjacent to the Green R&D center, the landscape program may highlight green-tech features in the landscape.

Activities & Program

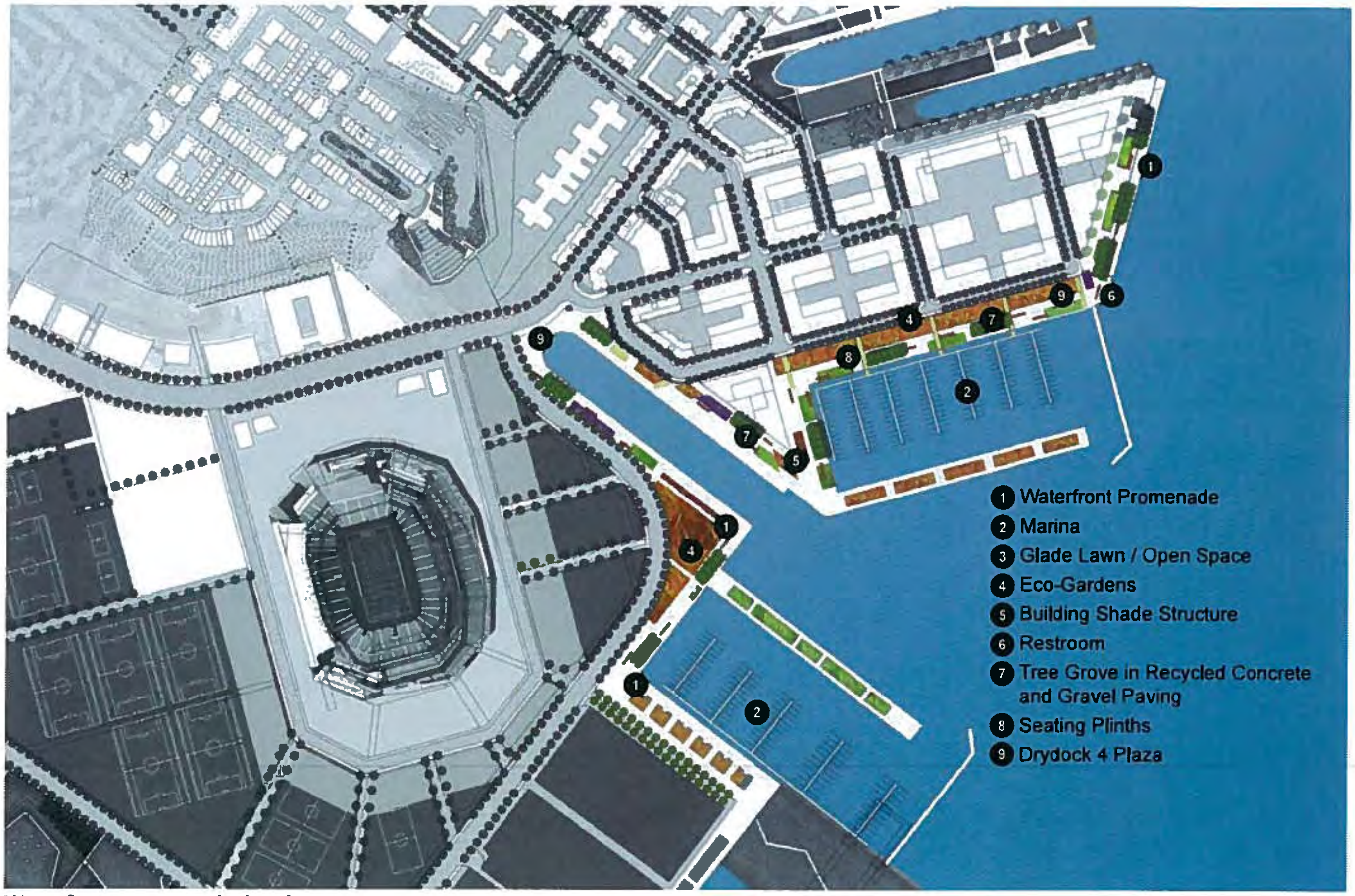
Uses and visitors in this area are diverse. Here one encounters researches from the Green R&D campus walking or sitting along promenade during lunch hours, breaks, or for inspiration, or at the start of an after-work jog. Sailors and maintenance crews socialize near entries to the marinas. Visitors, and hotel guests, exploring neighborhood streets and shopping along Fischer Avenue stroll along the Promenade or to an event at the Cultural Heritage Park. Soccer families, spectators, and those looking for a pick-up game, migrate to the Sports Field Complex along the promenade, and run into friends from the neighborhood. The variety of adjacent uses, beauty of the site, and comfortable places for seating and gathering accommodate serendipitous and spontaneous interaction among unlikely groups and friends, creating a truly successful urban place.

Access & Circulation

The Southern Waterfront Promenade creates a continuous link between the Cultural Heritage Park, Green Research & Development Campus, the Northern and Southern Marinas, the neighborhood commercial activity of Fischer Street, and the Sports Field Complex and Stadium. A main entry point onto the promenade is located at a plaza at the intersection of Spear, Fischer, and Crisp. Connections to the promenade also occur at adjacent streets and blocks. These intersections connect with that a series of pathway spaces parallel to the waterfront -- bicycle and pedestrian paths, and the Bay Trail.

Sustainability Features

Sustainable features include native plant design, stormwater gardens, and the reuse of existing materials as much as possible.



Waterfront Promenade South
Park Area: 22.4 acres

N

0' 700' 1400'

Scale: 1" = 700'

Community Sports Field Complex and Multi-Use Fields

Concept: 'Green' Stadium

Maximizing the use of limited urban land for recreation, the Sports Field Complex will provide much-needed community sports fields, while also accommodating game-day parking for the 49ers football stadium. The 'dual-use' of this area is an efficient and ecologically preferable use of land, eliminating the need for scores of acres dedicated to asphalt parking. A specially-designed soil and sub-grade will promote healthy, living grass while supporting game-day vehicular use. To prevent rutting and damage to the fields, the design will employ a fiber-reinforcement system that is incorporated into fast-draining, sandy soils. This system is commonly used to stabilize both professional and amateur football, soccer, and baseball fields, equestrian race tracks, and golf course greens.

Activities & Program

The sports fields will serve organized play for youth, high-school, and adult intra-mural sports. While soccer may be the most popular use the fields can accommodate other sports such as football, ultimate, and cricket. The facilities will also include warm-up fields, a field house, restrooms and food concessions. The multi-use fields are designed for informal uses such as kite-flying and picnicking, as well as accommodating larger organized festivals and events. The critical mass of the fields in combination with the adjacent waterfront parks, trails, picnic and barbeque areas and other leisure offerings make this an ideal sporting complex. During the 49ers football season and other major events at the stadium, the same site will host parking and tail-gating.

Murray Field Stadium, Scotland

Access & Circulation

In addition to the efficient vehicular circulation provided by its location on Crisp Avenue, the stadium site is also served by three parking structures. Circulation within the site is primarily organized around the Ring Road, which acts as a buffer between the Stadium/ Sports Complex and the Hunters Point Shipyard Parkland. On non-stadium game days, street parking is also possible along Ring Road, serving both the stadium area and the adjacent Grasslands Ecology Park sites.

Sustainability Features

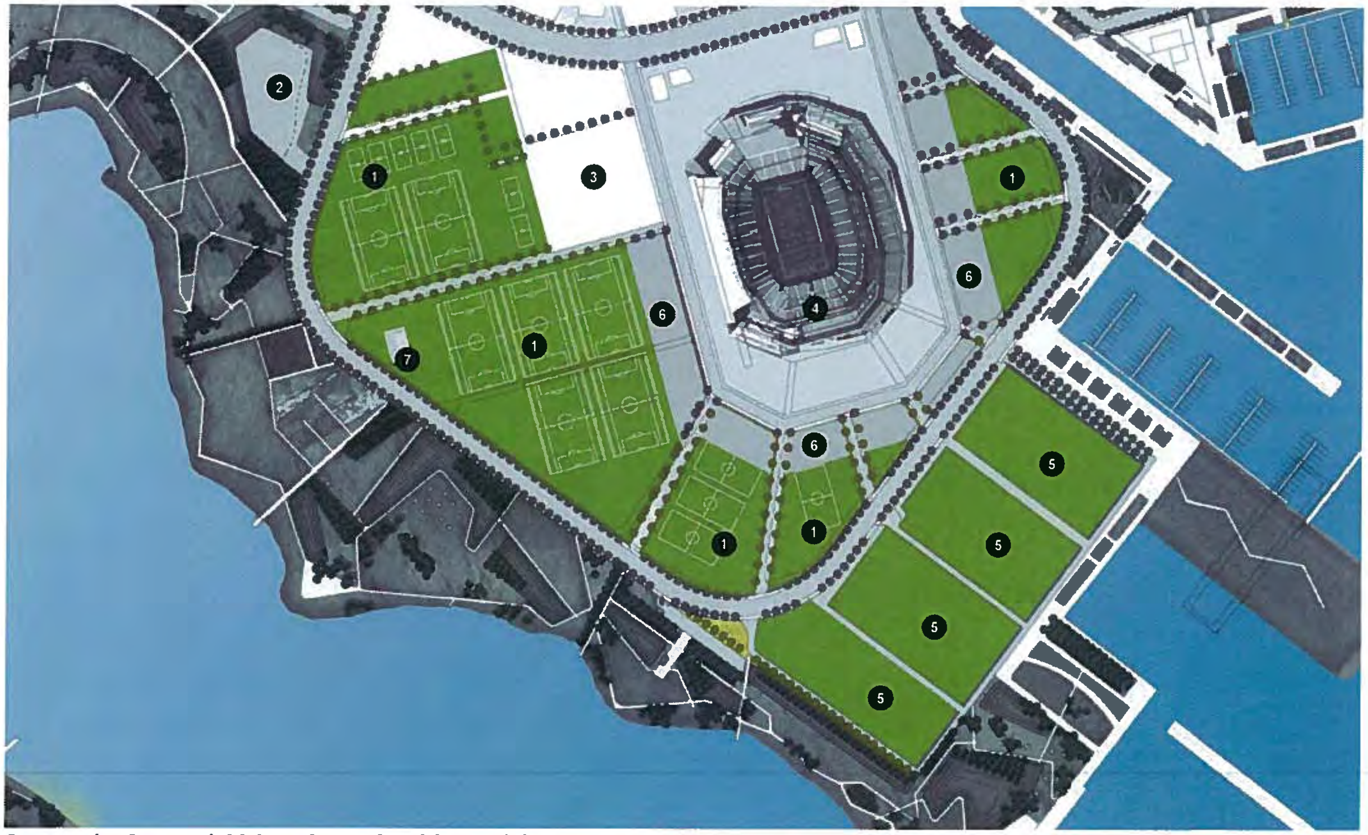
The primary sustainability feature is the efficient, dual use of the site. Additionally, the minimization of paved parking areas accomplishes the following:

Eliminates exclusive use of large spaces for vehicular-only uses.

Reduces both urban heat island effect

In addition, the site strategy provides reduces runoff, treats and detaining stormwater.

Crissy Field, San Francisco



Community Sports Field Complex and Multi-Use Fields
Park Area: 84.9 acres (59.7 acres Sports Fields Complex, 25.2 acres Multi-Use Fields)

N

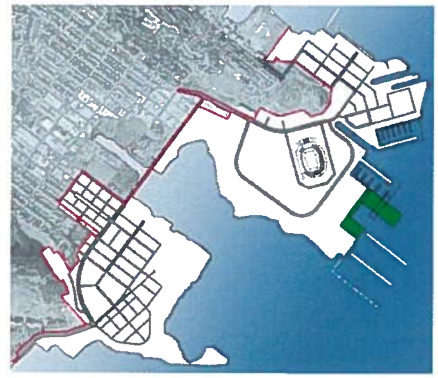
0' 700' 1400'

Scale: 1" = 700'

1. Sports fields (Game-Day Parking)
2. CP-HPS Parks Maintenance Yard
3. Parking Structure
4. Stadium
5. Multi-Use Lawn (Game-Day Parking)
6. Accessible / Permanent Parking
7. Stadium Restroom & Rec Center

Murray Field Stadium, Scotland

Waterfront Recreation and Education / Re-Gunning Crane Habitats



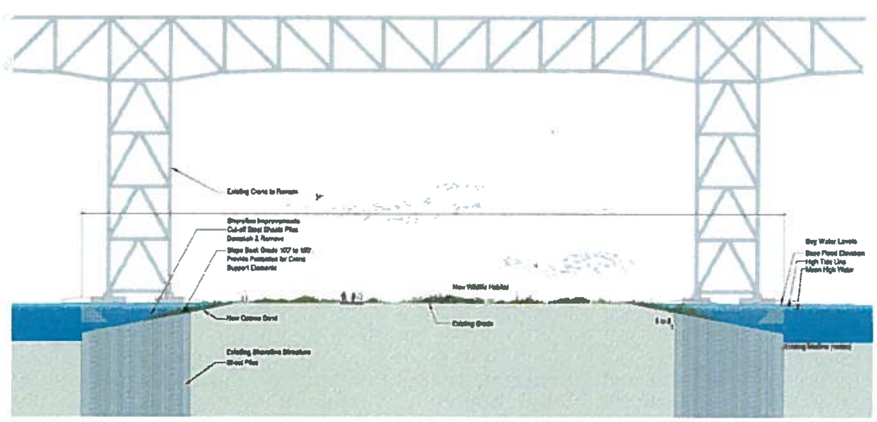
Concept: Landmark Resurgence of Nature

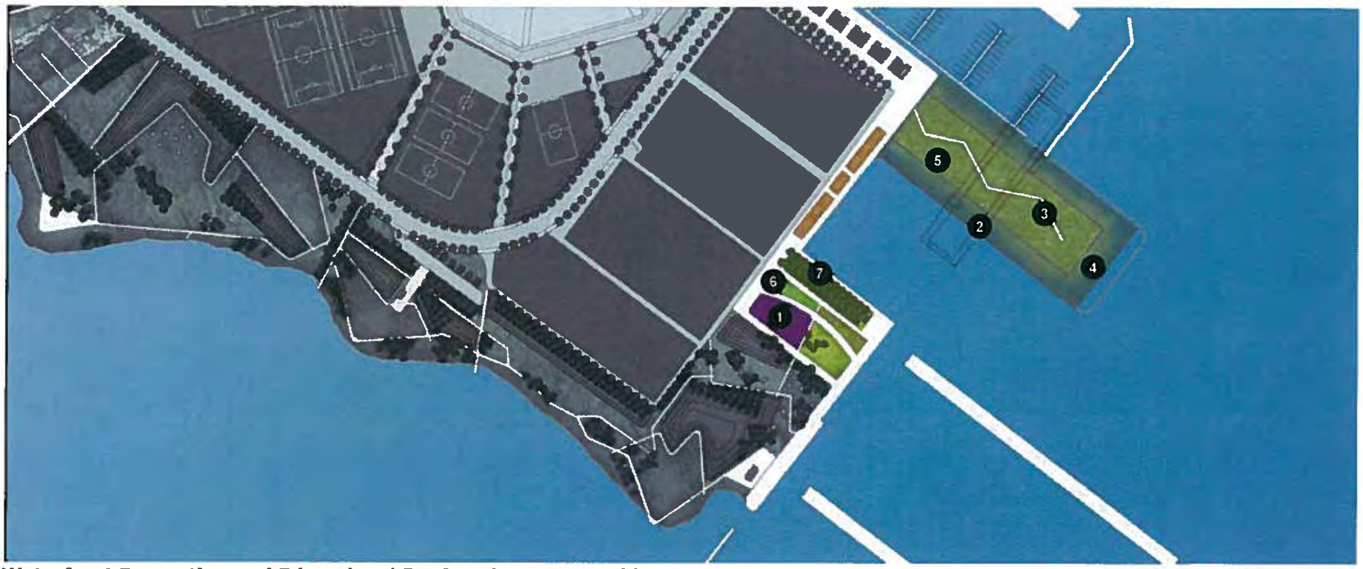
Focused on the spectacular 'Re-Gunning Crane' that forms the most powerful landmark in the cultural landscape of the shipyard, the Waterfront Recreation and Education Park is a knuckle in the park system plan. The park is designed to integrate the past industrial uses of the site, with future ecological processes that will gradually 'colonize' this area. While the Re-Gunning Crane will be left in place, the pier that surrounds it will be eroded – its walls removed and the ground will be laid back to allow water to create a fluid boundary for the former pier. As tidal wetlands and upland habitats take hold the Crane will seem to emerge from the water, and the giant machine will become a "gateway" to the bay and its ecology. The landmark Re-Gunning Crane provides a dramatic juxtaposition of the site's industrial history with the resurgence of nature at the Bay's edge.

Activities & Program

The primary activity of the site is educational. A trail will meander across the pier in a manner that off-sets the rectangular geometry of the pier, leading visitors under and through the crane to overlook points providing visitors with opportunities to view Bay wildlife. Interpretive displays will explain the history of the shipyard, and the ecology of the bay that was filled to create this man-made landmass. The site is intended to be used by small classes of students as well as introspective visitors. The waterfront educational area will also hold a small teaching marina, a boat house and classroom building where sailing and water related sports can be taught.

The re-gunning pier will be modified to produce a mixture of new open water, tidal wetlands, and upland habitats. The walls of the pier will be removed down to the existing mudline and the ground will be laid back to provide a gentle gradient consisting of open water and intertidal areas. Along portions of the shoreline protected from wind-wave action, wetland soils will be placed at appropriate elevations. Although native tidal salt marsh vegetation will likely colonize the site naturally, some planting with native salt marsh species will be





Waterfront Recreation and Education / Re-Gunning Crane Habitats
Park Area: 16.2 acres
(6.7 acres Waterfront Recreation and Education, 9.5 acres Re-Gunning Crane Habitats

1. Waterfront / Boat Learning Center
2. Re-Gunning Crane
3. Trail / Boardwalk
4. Tidal Wetlands
5. Upland Habitats
6. Open Lawn
7. Tree Grove and Seating

performed to increase the rate of marsh establishment. Portions of the pier subject to greater wave action will remain un-vegetated, providing substrate for benthic organisms such as oysters and foraging habitat for black oystercatchers and other shorebirds of rocky intertidal zones. The salt marsh/rocky intertidal zones will transition upward to a mosaic of dune sub-shrub, scrub, and grassland vegetation that will be planted on upland surfaces of the pier after appropriate soils are imported. These target plant communities consist of short-statured species that have low water use requirements to facilitate water conservation and that will provide habitat for sparrows and other landbirds, as well as some small mammals. The Re-Gunning Crane will be left in place and will continue to provide a nesting site for peregrine falcons, which have nested on the crane for several years.

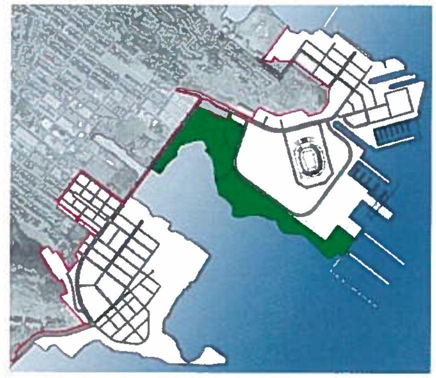
Access & Circulation

The Waterfront Recreation and Education Area will form a gateway in two directions. On one side will be the natural grasslands and wetlands of Parcel E. One the other will be the end of the Waterfront Promenades. This area will be easily accessible from the ring road surrounding the Sports Fields and Multi-use Lawn.

Sustainability Features

This Park area focuses on the use of native plants of the Bay and displays reconstructed habitats. The site's most important cultural feature – the Crane – is saved and showcased as a monument to the past uses of the land. Nearby, Piers 1, 2, and 3 will be cut off from the mainland providing a roosting place for waterbirds safe from predators.

Grasslands Ecology Park



Concept: Grasslands Ecology

Building on the planned restoration project at Yosemite Slough, the Grasslands Ecology Park will transform contaminated Navy lands on the north shore of the South Basin with vast new habitat areas, supporting biodiversity and the Bay ecosystem. Sculptural landforms, native grasslands, freshwater wetlands, shoreline mudflats and tidal wetlands, coastal scrub, and tree groves add to the diversity of habitats. The existing natural landscape is supplemented by designed landscape components such as clustered windbreaks and viewing mounds, shoreline overlooks and a sinuous network of pathways that support passive recreation uses. In addition, an interpretive eco-garden (a more formal planting of native species) designed to accommodate large outdoor classes creates a setting for the study of bayside habitats and ecology. These landscape strategies provide places from which to seek respite from the intensity of the City and connect with nature at the Bay's edge.

Activities & Program

The Grasslands Ecology Park provides overlapping environmental and programmatic benefits to the open space system at Hunters Point. Human activity here is programmed for passive recreation use: walking and bike riding along the Bay Trail, sitting aside windbreaks, and observation and study along the naturalized water edge. An area adjacent to the Stadium Ring Road may also include a large dog park, and dedicated picnic areas.

Within the Grasslands Ecology Park, at least 43 acres of native grassland will be restored by the removal of non-natives and planting of native grass and forb species. Trail setbacks, habitat fencing, screening, and signage will be used where needed to protect sensitive wildlife habitat and flora. Although trees and shrubs may be planted elsewhere within the Grasslands Ecology Park to provide a mosaic of habitats, woody plants that are planted or allowed to establish naturally within the grasslands will be limited to a few small, scattered patches of low-growing coastal scrub plants such as coyote brush, which will provide cover for wildlife that may otherwise forage in the grasslands.

Access & Circulation

Access into this park is facilitated by a parking lot on the east end of the park and ample off-street parking along the Stadium Ring Road. Another parking lot serves the west end near Crisp and the Stadium Ring Road. The multiple parking and access points allow for a variety of user scenarios: from families traveling to the Park and unloading bicycles for use along the Bay Trail to elderly visitors needing accessible waterfront connections to functional access for park maintenance crews.

The entrances to the park are informal in character, with numerous paths extending from the Ring Road sidewalk and continuing in multiple directions. Park users can choose a direct path toward the waterfront or a route that encompasses the organic layout of the Park. The Bay Trail experience is characterized by wetlands and the shoreline edge, bringing park users within close view of Bay wildlife and offering a discernibly less urban park condition.

Sustainability Features

A main focus of this park is to create new habitat areas and bring the experience nature to urban dwellers and to support nature education. Native plantings will also minimize the need for irrigation.

Grasslands Ecology Park
Park Area: 82.1 acres
(44.9 acres at Parcel E, 37.2 acres at Parcel E-2)

N

0' 700' 1400'

Scale: 1" = 700'

Candlestick Point

Alice Griffith Neighborhood Park

Concept: Neighborhood Commons

Alice Griffith Neighborhood Park serves as the community commons for the renewed Alice Griffith neighborhood. It is designed to become the outdoor living room of the community, where neighbors get to know each other, socialize and celebrate their commonalities and differences. The park's east-west orientation is purposeful – it acts as a link between the existing Bayview neighborhoods and the rebuilt Alice Griffith housing development, and it is hoped that the existing adjacent community will use this open space to connect with their new neighbors.

Access & Circulation

Centrally located to allow the neighborhood streets system to intersect the park in an even rhythm, the park is approachable and accessible from all sides. Entrances are highlighted at each intersection with invitational benches and shade groves, and a continuous E-W path links the park sections that span four blocks.

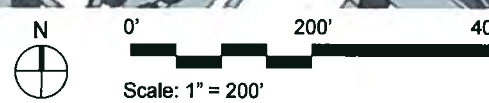
Activities & Program

Similar in width to the very successful South Park, it has a key mix of uses that will draw users of all ages and interests. The park offers a mix of active and passive uses including two multi-purpose open lawn areas, a play ground and tot lot, a fenced running area for small dogs, a shade pavilion with barbeques and picnic tables, and a basketball court.

Sustainability Features

The park also serves and ecological function for the new neighborhood. New streets are designed to drain to the park, where bio-swale storm water gardens will filter storm water before it reached the bay. These gardens have the opportunity to educate the residents about the impacts of urbanization on natural watersheds, and how designed interventions can mitigate some of that impact. Other key sustainability features at the park include a section for community gardens.

Alice Griffith Neighborhood Park
Park Area: 1.4 acres



1. Low Wall
2. Specimen Tree
3. Playground / Tot Lot
4. Flowering Tree Grove with Seating
5. Bioswale
6. Lawn
7. Pathway
8. Gardens
9. Community Gardens
10. Dog Run
11. Basketball Court
12. Tool Shed

Candlestick Point Neighborhood Park

Concept: Neighborhood Recreation

Candlestick Point Neighborhood Park is designed to become the focal point of the new Candlestick North neighborhood. It is seen as the common "backyard' of the high density development that will surround it, where recreation and socialization are key community offerings.

Access & Circulation

The park is centrally located and can be reached by a few minute walk from anywhere within the CP North neighborhood. Adjacent Boulevard Park Streets provide connections to Alice Griffith Neighborhood Park two blocks to the west, and the State Park, two blocks to the north, and also two blocks to the east.

Activities & Program

The Neighborhood Park offers a mix of active and passive areas for users of diverse ages and interests; it includes a large multipurpose open lawn, available for Frisbee, soccer, and kite flying, playgrounds for tots and school age children, community gardens, seating areas, basketball courts and garden beds. A shade pavilion with adjacent picnic tables and BBQs will also be provided. A perimeter walk with benches will also allow a more passive interaction with park, where it will be possible to enjoy the outdoors in a more introspective and quiet fashion.

Sustainability Features

A central organizing feature of the park is a storm water garden that filters on site and adjacent street water. Climate-adapted garden beds can be organized as water wise demonstration gardens. Community garden plots give urban dwellers a place to get their hands dirty and enjoy the pleasures of growing fresh food and flowers.

Candlestick Point Neighborhood Park
Park Area: 3.1 acres

1 Open Lawn
2 Bio-swale
3 Playground
4 Shade Pavilion
5 Volleyball Courts
6 Basketball Courts
7 Monolithic Wood Seating Plinths
8 Community Gardens
9 Seating Terrace under Tree Groves
10 Perimeter Garden
11 Park Entry Pylon on Each Corner

Bayview Gardens / Wedge Park

Concept: "Central Square"

The Bayview Gardens/Wedge Park is the "Central Square" for Candlestick Point. Opening up from the Harney Way retail street, it provides dramatic views of Hunters Point and the Bay and provides a strong link between the urban development and the State Park.

Access & Circulation

Located at the seam of the two urban grids of the new development the Wedge Park can be easily accessed from all directions. The park is a key feature of the urban plan that stitches the urban neighborhoods together with the state park. This interface brings urbanity to the park core, and the park to the urban heart of the new development.

Activities & Program

The parks uses are primarily meant to encourage community gathering and neighborhood socializing. While tot lots and play grounds delight the children, the park also offers a comfortable and sophisticated place for the older generations – a central square where one comes to promenade, socialize, and people watch. A café and an interactive play fountain are the pivot point of the park, while ornamental gardens, and storm water rain gardens provide a sense of enclosure on the west side. Lawn areas with edge paths allow the set up of community fairs, farmers markets, music festivals, and art and food festivals. The design is intended as a flexible canvas that will encourage a variety of programs.

Sustainability Features

All parks within the new development, including most importantly this central square, will integrate sustainability in their design and maintenance. To facilitate this, several features are provided – such as storm water gardens, drought tolerant garden beds, shaded seating areas and use of lawn only where large gatherings are to be held.

Bayview Gardens / Wedge Park
Park Area: 2.5 acres

1. Plaza
2. Cafe / Information Kiosk
3. Tot Lot
4. Lawn
5. Shade Structures
6. Ornamental Gardens

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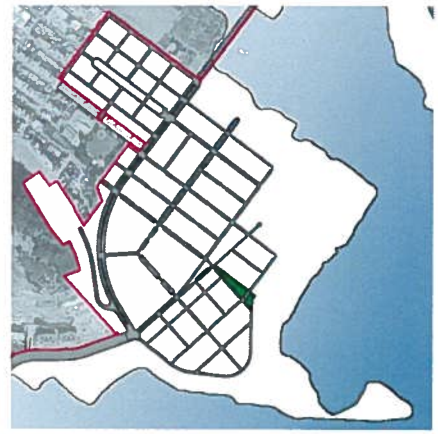
0' 200' 400'

Scale: 1" = 200'

Mini-Wedge Park



Concept: Bayfront Connection

The Mini-Wedge Park serves as a primary connection between the urban core of the new Candlestick Point and the State Park beach area. A range of programs within an intimate setting produces a space that enlivens the neighborhood while also providing a critical connection between the urban parks and the bay edge.

Access & Circulation

Long linear paths run through the center of the park and along its northern edge, and carry pedestrians from neighborhood streets to the State Park waterfront. The wedge shape opens vistas from the density of the urban neighborhood into the expansive spaces and sweeping arc of the water's edge.

Activities & Program

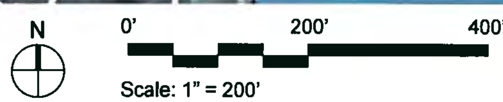
The park's program strategy is focused on generating interaction among neighbors and visitors by providing varied activities within a relatively intimate scale. The programmatic gradient flows from active to passive as users move from the urban edge toward the water. A tot lot and dog run on the northwest side provide families with program-specific spaces. As visitors move toward the southeast, a generous lawn with trees promotes gathering, conversation and picnics.

Sustainability Features

A focus on sustainable stormwater management provides both an ecological and formal organizational structure for this park. A long bioswale runs the length of the space, intercepting and cleansing of stormwater from the adjacent neighborhood street before runoff enters the State Park Beach area.

Mini-Wedge Park
Park Area: 1.1 acres

1. Bioswale
2. Tot Lot
3. Shade Structure
4. Plaza
5. Lawn
6. Grasslands
7. Dog Run



Candlestick Point Boulevard Parks

A hybrid of street and park, the Boulevard Park Streets bring broad fingers of green space into the urban neighborhoods, linking interior parks with bay-front parks. These streets have a strong pedestrian scale and quality, and serve as public 'front yards' for the neighborhoods. Broad landscaped medians or sidewalks are designed as mini-parks with gardens seating areas offering places for parents to sit outside with their children or workers to eat lunch in the sun. These parks also serve as "ecological infrastructure," bands of trees cleanse the air, while bioswales slow and cleanse storm-water before it enters the bay. At Candlestick Point, one Boulevard Park street will link the Alice Griffith Neighborhood Park with Candlestick Neighborhood Park and the state park. On this street, the park space will be a 30-40' wide expanded sidewalk space on the north (sunny) side of the street. A second, perpendicular Boulevard Park Street will link the CP Retail Center with CP Neighborhood Park and the state park. The Boulevard Park Streets will be described in greater detail in the forthcoming *Streetscape Master Plan*.

Candlestick Point Boulevard Parks
Park Area: 1.7 acres

1 Median Boulevard Parks
2 Sidwalk Boulevard Parks

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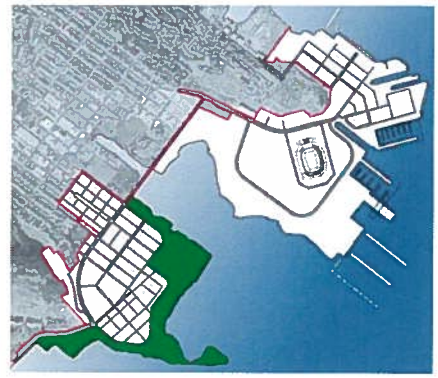
0' 200' 400'

Scale: 1" = 200'

Candlestick State Recreation Area



Vision

The Candlestick Point recreation area is a unique opportunity in the State Park system and along the San Francisco Bay Shoreline to create a model urban recreation area that links city residents and regional visitors to the diversity of estuary and upland habitats of the Bay and demonstrates integrated sustainable design principles for reclaiming fill areas for park uses.

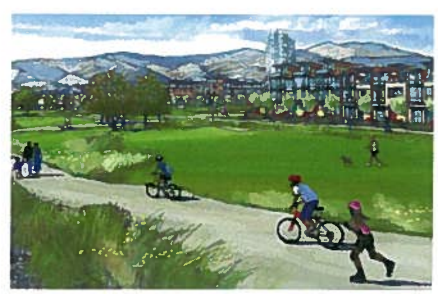
This *Concept Plan* proposes an integrated parks and open space system with improvements to the Candlestick Point State Recreation area that will support the State Park's goals of preserving and protecting the environment while encouraging urban dwellers to experience nature at the bay edge and providing opportunities for place-based outdoor recreation. With a seamless design approach, the park's existing well-used areas will be revitalized and new undeveloped bay edge parklands will be developed.

The park improvements will finally complete the original vision of Candlestick State Recreation Area – to bring the values of the State Park system to the city, to provide recreational and cultural facilities and to connect urban dwellers with the natural environment. Furthermore, the State Park is poised to be one of the state's finest urban waterfront parks, at the forefront of urban ecological design, managing urban stormwater while creating habitat and providing environmental education.

Design Coordination

While the State Parks Department will perform their own master planning process for the CPSRA, these plans will be coordinated with the City to realize the potential of this vision. The follow principles are proposed by the City of San Francisco to guide the planning and design of the park:

- Design city parks and state recreation areas to feel from a user perspective as one park system, despite potential programmatic and operational differences between jurisdictions.
- Develop a park that is programmed and designed for safe and active 18-24 hour daily use by the public.



- Design a pedestrian and bike accessible transition zone between all private development parcels and the park.
- Develop frequent routes into the park from the neighborhood aligning with the planned street network with major linkages with transit stops, bike routes and linear greenway features.
- Create a mixture of passive and active spaces that activate the open space drawing neighbors and visitors to the waterfront.
- Provide duplicative trail systems including linkage to a Class I bike and multi-use recreation trail as a transition between the neighborhood and State Park, a continuous Bay Trail close to the water, and multiple linkages between.

Candlestick Point State Recreation Area
Park Area: 96.7 acres (within project boundary)

- Install multiple human powered boat access boating including facilities for windsurfers south of Bayview Hill.
- Preserve and expand the existing pocket beach.
- Integrate stormwater treatment systems with the neighboring development to provide model/demonstration sustainability systems and habitat spaces.
- Utilize stainable design principles through park planning to expand the ecological functions of the recreation area and minimize resource consumption by park facilities, programs and users.
- Introduce limited commercial uses to provide food and recreational services for visitors.
- Balance dedicated parking facilities for the recreation area with available on and off street parking provided in the neighboring development and transit access to the area.
- Upgrade existing and install additional fishing a viewing piers into the bay.
- Provide multiple picnicking and barbecuing facilities to accommodate family and social gathering in multiple areas of the park, and consider larger scaled gathering opportunities for events.

Design Potential

The following describes the design potential for the CPSRA.

An extensive trail network, including the San Francisco Bay Trail will link areas within the park with the adjacent urban neighborhoods and the waterfront. Park visitors will enjoy open lawns and meadows, picnic areas, interpretive exhibits, outdoor classrooms, and community gardens. Overlooks, fishing piers, wetlands boardwalks, beaches, and windsurf and kayak launches invite visitors to the water's edge.

The State Parks design will feature a simple, sensitive, and expressive palette of landscape materials to allow the park to grow incrementally over time. Native grasslands, meadows, wooded groves, and more formal 'eco-gardens' will provide a system for choreographing the landscape experience. Landforms and windbreak plantings will structure the experience of place, framing views of the water, and offering refuge from wind and fog. Though identifiable as a State Park, distinct from the other city waterfront parks, the State Park has a strong role in the overall park network, linking and connecting with a variety of other city, neighborhood and community parks.

The 157-acre State Park is divided into many smaller sub-areas, described below.

Grasslands South

This area of the existing State Park is largely undeveloped and has been used for game-day stadium parking. A new Grasslands South area could be improved with native grasslands, glade lawns, and earthworks shaped to provide shelter from the wind and enhance views. Site features could include overlooks, restrooms, and parking.

Bayview Gardens North

Formerly developed as a boat launch, siltation of the South Basin has caused this use to be abandoned. The existing paved parking area is used for game-day stadium parking. Located between the bay and the proposed Bayview Gardens / Wedge Park, the Bayview Gardens North area offers the greatest integration of urban and naturalized open spaces anywhere in the open space system and will be a strong visual gateway to the State Parks and the bay. Bio-swales, storm water 'Eco-Gardens,' and a potential salt-marsh restoration are central features of this area.

The Last Rubble

Until recently, the Last Rubble area was characterized by large piles of rubble and debris, remnants of the site's previous use as a dumping ground. The California Integrated Waste Management Board completed a rubble and debris removal project in April 2009. As a result of this, the majority of the rubble and debris was either removed or crushed on site. This area of the State Parks remains underutilized and is not currently programmed for recreation, with the exception of a walking path. As the Last Rubble Area will be located adjacent to a substantial urban population, this area could be transformed into a new center for the State Park, with a wide variety of program elements.

The park ranger station/visitor's center could be located here as well as a "Great Meadow" for passive recreation and park events. Other features may include parking, picnic areas, overlook terraces, restrooms, and a restaurant/ café.

Wind Meadow

The Wind Meadow includes part of the existing State Park, including the Main Beach. This area will be reconfigured to meet the new urban development edge and interface with the Mini-Wedge neighborhood park. This area will contain a secondary entry and parking lot, and gateway entry kiosk for the State Park. Features here may include new restrooms, picnic areas, waterfront overlooks, expanded tidal wetlands, and access to the water.

Heart of the Park

The Heart of the Park is part of the existing developed State Park. New park area will be added and the existing landscape structure will be retained and enhanced. Planting and overall aesthetics will be improved, pedestrian pathways will be renewed and added, and program areas will be developed for greater use. Site features could include upgraded restrooms, overlook terraces, large and small group picnic areas, and an interpretive amphitheater.

The Point

The landscape of the Last Port will be revitalized with improvements focused on pedestrian circulation, safety and way finding; intensifying areas for increased use; improving the overall park aesthetics and landscape ecology; and reconnecting visitors to the bay shoreline. Native grasslands and shorelines will be restored and stabilized, providing areas for activities such as strolling, picnics, kite flying, and fishing.

The Neck

The existing Neck area is a narrow, eroded section of the State Park that includes a beach and pier. Park area will be added here to increase the width of the park and provide a continuous park experience along the shoreline. New features here could include a parking lot, windsurf/kayak launch, overlook, and picnic areas.

Last Port

The landscape of the Last Port will be revitalized with improvements focused on pedestrian circulation, safety and way finding; intensifying areas for increased use; improving the overall park aesthetics and landscape ecology; and reconnecting visitors to the bay shoreline. Native grasslands and shorelines will be restored and stabilized, providing areas for activities such as strolling, picnics, kite flying, fishing, and direct access to the bay for swimming, kayaking, and windsurfing.

View near Bayview Gardens / Last Rubble area of the Candlestick Point State Recreation Area


Golden-Crowned Sparrow


Checkered Skipper


Fiery Skipper

Habitat Enhancement Measures

A number of measures will be implemented to enhance wildlife habitat conditions within the Project site. Wildlife enhancements would occur primarily in open space areas such as the Grasslands Ecology Park and other parks on the site, though enhancements such as removal of non-native invasive plants and planting of trees and shrubs will occur at scattered locations throughout the park as well. These enhancement measures will focus on areas outside the CPSRA, since the Project will neither impact directly, nor have control over enhancements in, the portion of the CPSRA that is not subject to the land transfer agreement. However, these or similar measures are recommended for the CPSRA as well to enhance habitat conditions there.

- **Control of non-native invasive species:**

  Most of the Project site is currently dominated by non-native plants. Several of these species, including acacias, wild oats, black mustard, bromes, iceplant, and pampas grass, are listed on the California Invasive Plant Council's Invasive Plant Inventory Database (http://www.cal-ipc.org/ip/inventory/weedlist.php). These species are particularly invasive, having the potential to out-compete native plants, expand over large areas, and significantly reduce the ecological value of natural areas on the site. These invasive, non-native species would be removed during initial habitat enhancement efforts to provide areas for creation of higher-quality habitats and to prevent their spread into restored native habitats. Monitoring and ongoing removal/control of these species would be implemented to ensure against the re-establishment and spread of these species on the Project site.

- **Restoration of grasslands:**

  To maintain habitat for grassland-associated wildlife species on the site, grasslands extensive enough to support such species would be maintained and enhanced through the restoration of native grasses. Within the Grasslands Ecology Park, at least 43 acres of native grassland will be restored by the removal of non-natives and restoration, through seeding and/or plugs, of native grass and forb species. Such grassland habitat would not be well manicured or regularly mown (e.g., it will have the appearance of native grassland, not lawn), and signage will be erected discouraging use of this area for recreational purposes. Although trees and shrubs will be planted elsewhere within the Grasslands Ecology Park to provide a mosaic of habitats, woody plants that are planted or allowed to establish naturally within the grasslands will be limited to a few small, scattered patches of low-statured coastal scrub plants such as coyote brush, which will provide cover for wildlife that may otherwise forage in the grasslands. These grasslands would be monitored annually for evidence of the presence of undesirable levels of woody and invasive plants, which will be removed when found to maintain dominance by native grasses and forbs.

Detailed design of the grassland restoration area will be performed by a qualified restoration ecologist. The planting palette for grassland areas will be developed after the precise location of the grasslands is determined and following a thorough examination of soil conditions (which may be modified by the Navy's remediation on HPS), drainage, and other factors. Examples of native grasses and forbs that could be included in planting plans for these grasslands include the following:

Yarrow (*Achillea millefolium*)

California brome (*Bromus carinatus*)

Paintbrush (*Castilleja subinclusa*)

Blue wildrye (*Elymus glaucus*)

Golden yarrow (*Eriophyllum confertiflorum*)

California poppy (*Eschscholzia californica*)

Red fescue (*Festuca rubra*)

Purshing's lotus (*Lotus purshianus*)

Miniature lupine (*Lupinus bicolor*)

Arroyo lupine (*Lupinus succulentus*)

California melic (*Melica imperfecta*)

Purple needlegrass (*Nasella pulchra*)

One-sided bluegrass (*Poa secunda*)

Chia (*Salvia columbariae*)

Bee plant (*Scrophularia californica*)

Checkerbloom (*Sidalcea malvaeflora*)

Blue-eyed grass (*Sisyrinchium montanum*)

Goldenrod (*Solidago spathulata*)

Three weeks fescue (*Vulpia microstachys*)

- **Increase in tree/shrub cover:**

Approximately 10,000 net, new trees, or more than four times the number currently present in the Project area, will be planted throughout the Project area. While some of these trees will be planted as street trees or for ornamental purposes, a large number will be planted specifically with wildlife habitat in mind. In conjunction with tree planting, numerous shrubs, forbs, and ground cover will be planted and maintained. Within parks such as the Grasslands Ecology Park (outside of the designated grassland restoration areas), trees, shrubs, and ground cover will be planted in clusters to provide dense, multi-layered clumps of vegetation that will provide food, cover, and roosting, nesting, and foraging sites for a variety of wildlife species. Though


Red-Tailed Hawk


Western Meadowlark

Yellow Warbler

these areas are expected to be used by mammals, reptiles, amphibians, and a variety of invertebrates, these plantings will be particularly beneficial as foraging and nesting habitat for birds. Increases in foliage height diversity and vegetation volume resulting from the planting of numerous trees and shrubs on the site, most of which currently supports little woody vegetation, would result in increases in the diversity and abundance of breeding and migratory birds.

Because the majority of the Project site is located on fill material derived from a variety of sources, soil quality is not optimal for plant growth in many areas. Prior to planting, the soils in a given area will be examined by a qualified soils scientist or horticulturist, and soil amendments will be provided as needed to ensure suitable conditions for growth of the desired plant species. On portions of HPS Phase II (e.g., the former landfill), planting of deep-rooted vegetation may be constrained by capping of the landfill. The cap may physically inhibit root growth, and piercing of the cap by roots would be undesirable to maintain the integrity of the cap. If necessary, soil would be imported into such areas to provide contoured mounds and ridges which would serve as planting substrates for deeper rooted trees. Detailed design of native revegetation areas will be performed by, or in consultation with, a qualified restoration ecologist.

Native vegetation shall always be favored in determining the appropriate trees, shrubs, and other vegetation to plant in certain areas. Native plant species often require less fertilizer, irrigation, and pesticides than many non-natives, and native plant species tend to provide more of the structural and dietary resources required by native animals than do non-native plants. The planting palette for particular areas will be developed on a site-specific basis, taking into account the target wildlife species, the size of the planting area, constraints on deep-rooted plants, the desire to maintain cover for habitat connectivity purposes, and other factors. Examples of native trees and shrubs that could be included in planting plans on the Project site include the following:

Gopher Snake

Big-leaf maple (*Acer macrophyllum*)

California buckeye (*Aesculus californica*)

Western redbud (*Cercis occidentalis*)

Coast live oak (*Quercus agrifolia*)

Valley oak (*Quercus lobata*)

Coast redwood (*Sequoia sempervirens*)

Toyon (*Heteromeles arbutifolia*)

Blue elderberry (*Sambucus mexicana*)

Chamise (*Adenostoma fasciculatum*)

California sagebrush (*Artemisia californica*)

Coyote brush (*Baccharis pilularis*)

California lilac (*Ceanothus thyrsiflorus*)

Buckwheat (*Eriogonum fasciculatum*)

Silk tassel (*Garrya elliptica*)

Silver bush lupine (*Lupinus albifrons*)

Sticky monkey-flower (*Mimulus aurantiacus*)

California wax myrtle (*Myrica californica*)

Coffeeberry (*Rhamnus californica*)

Lemonade berry (*Rhus trilobata*)

Fuchsia-flowering gooseberry (*Ribes speciosum*)

Black sage (*Salvia mellifera*)

However, site-appropriate non-native species that provide food or structural resources that are particularly valuable to native wildlife may also be considered. For example, flowers of eucalyptus trees and bottlebrush shrubs provide abundant nectar that is used by a variety of native birds, and that attracts insects that in turn serve as food for birds. Palm trees provide cavities (between the petioles of old fronds) that can serve as nesting sites for species such as barn owls and American kestrels. Monterey pine and Monterey cypress are not native to San Francisco, but both are native to limited areas along the Central California Coast. These hardy species are thus well adapted to climatic conditions on the Project site. Judicious incorporation of specific non-native plants within the native-dominated planting palette will allow for wildlife diversity to be maximized within the new planting areas. Non-native species used in landscaping will be species that are adapted to local conditions so that they also will require minimal irrigation, fertilizers, and pesticides.

- **Maintenance of habitat connectivity:**

  To help maintain habitat connectivity through the site, at least along the southern edge of HPS Phase II, in light of the roads, trails, and buildings that will be constructed in the Project area, vegetated areas providing cover for dispersing mammals, reptiles, and amphibians would be provided. In some areas, restored tidal marsh will provide some habitat connectivity along the shoreline. "Hardened" shoreline treatments, such as rock, will provide interstitial spaces that provide cover for these small animals as well. In addition, landscaping along the landward side of the shoreline treatments will provide vegetation that can serve as cover for these animals. To the extent feasible, potential obstacles to movement of small animals, such as fences, walls, curbs, and roads will be designed to allow for passage of animals across or through these features. On Candlestick Point, the SRA will be widened along the southwestern shoreline at an existing "pinch point". Revegetation of this area, and maintaining vegetation all along the CPRSA shoreline, would maintain habitat connectivity along the Candlestick Point shoreline as well.

- **Maintenance of refugia for waterbirds:**

  Waterbirds such as egrets, herons, and shorebirds forage along the Candlestick Point shoreline and along the southern shore of HPS Phase II. At low tide, these birds forage on exposed mudflats and beaches, while at high tide, they may congregate in areas providing high-tide roosting and/or foraging habitat. In planning for future trails, vistas, and other features/facilities that might concentrate human activities along the waterfront, it is important that human access to shoreline areas is not so pervasive that there are no undisturbed high-tide roosting areas for these birds. Therefore, at least one shoreline area where waterbirds can roost at high tide would be provided that is at least 200 feet from the nearest formal trail or shoreline observation area. Here, waterbirds would be able to roost on riprap, beach, or some other open area removed from concentrated human activity.

  In addition, the bases of the three piers in the southeastern corner of HPS Phase II will be removed to prevent mammals from accessing these piers. The remainder of each of these three piers will be left in place to provide roosting sites for gulls, cormorants, pelicans, and terns. Shorebirds and herons may roost on these structures as well. While waterbirds currently use these piers for roosting, the number of birds using these piers, particularly at night when mammalian predators such as raccoons are most active, may be limited by the ability of mammalian predators to access these piers. Removal of the bases of these piers will prevent the ability of mammals to access roosting birds. The increased security of the piers may also encourage some waterbirds to begin nesting on the piers. If birds show interest in using these piers as nesting sites, addition of nesting substrate such as gravel or shells in certain areas could further encourage nesting by waterbirds.

- **Provision of nest boxes:**

  Nest boxes for birds will be placed in appropriate locations throughout parks and open space areas. Nest boxes will range in size from larger boxes that will be suitable for use by barn owls and American kestrels to smaller boxes that would provide nest sites for chestnut-backed chickadees, tree swallows, and other birds.

Sanderling, Western Sandpipers

- **Creation of tidal marsh and high beach habitat**

  There are several opportunities for creating tidal marsh or high beach/dune habitat in the project area. Along the southern shoreline of HPS Phase II and portions of the shoreline of Candlestick Point that are not subject to high wave action, marsh soils will be placed on the outboard side of shoreline revetments that will be constructed to protect the shoreline. With limited planting of native salt marsh plants, but primarily through natural recruitment, narrow bands of tidal salt marsh will be created in these areas. More extensive tidal marsh could be created in a few "pockets" along the northern and eastern shores of Candlestick Point, where laying back the slope along the shoreline could allow for the creation of broader marsh that would transition upslope to dune scrub and upland habitats. These habitats will contribute organic matter to intertidal and subtidal habitats nearby, enhancing benthic animal populations and so improving foraging habitat for fish, shorebirds, and diving ducks. These vegetated bands would also provide foraging habitat for some small birds and cover for mammals.

- **Increase in open water habitat**

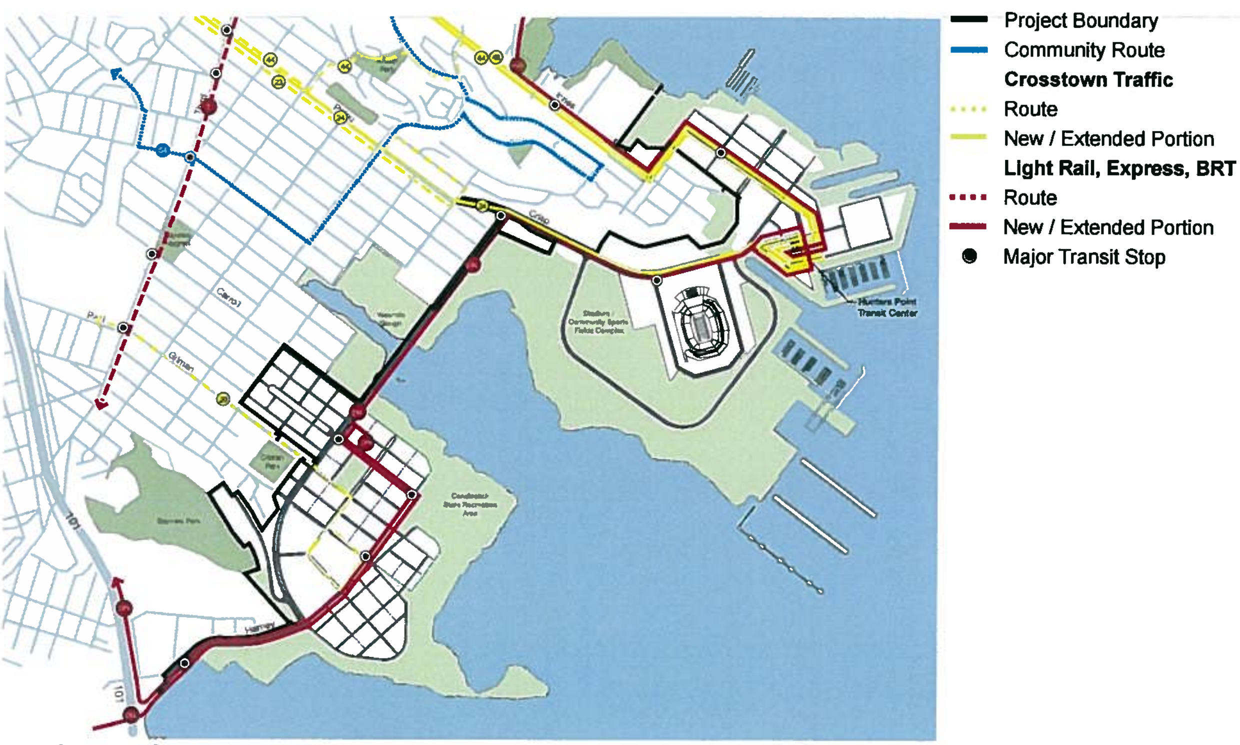
  Although the project includes the placement of fill in some wetlands and aquatic habitats for the purpose of constructing shoreline improvements, the Yosemite Slough bridge, and a marina, the project also includes the removal of fill and structures that currently exist in some locations. For example, along much of the eastern shoreline of HPS Phase II, existing pier walls will be removed and the edges of the existing shoreline "laid back". As a result, new subtidal and intertidal habitat will be created along portions of the shoreline currently occupied by fill, and the project as a whole will result in a net increase of 8 acres of open water that can serve as habitat for fish and benthic organisms.

Park and Shoreline Access Improvements

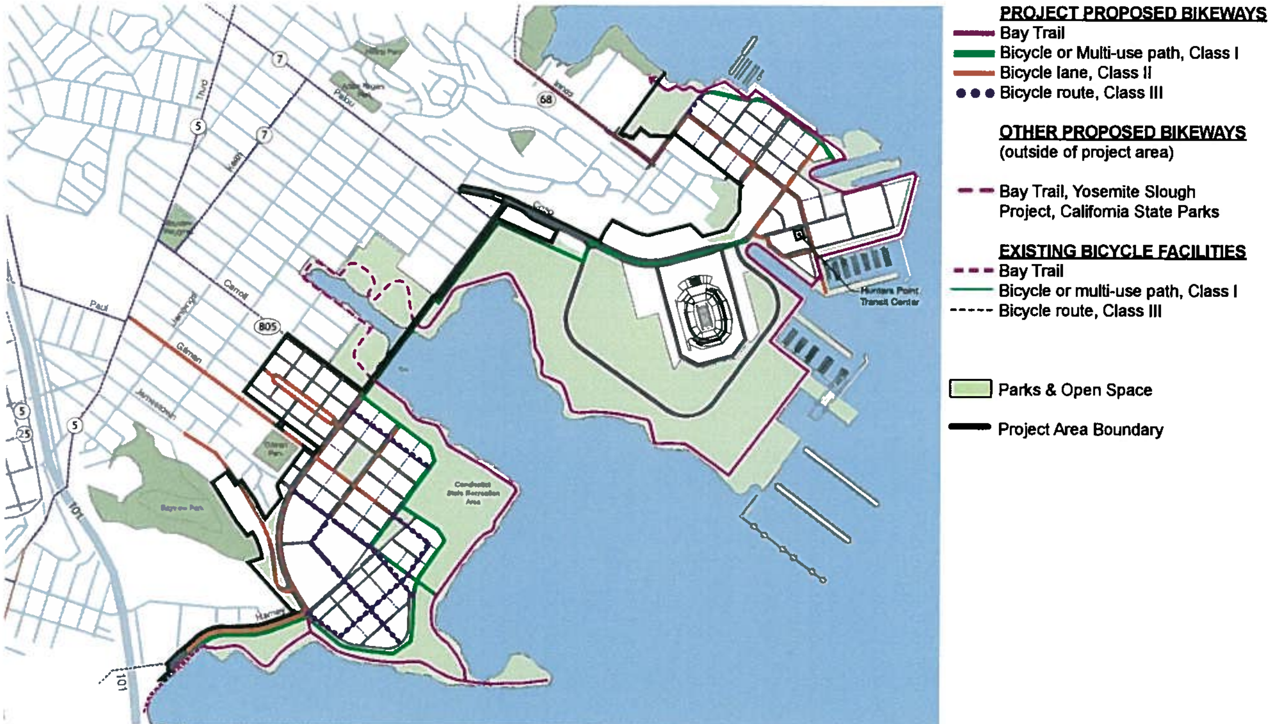
New parks and public spaces will be easily accessible to existing neighborhoods and visitors from other parts of the City and beyond. New pedestrian, bicycle, and transit improvements will provide healthy and sustainable modes of park access. Bike and pedestrian access throughout and between park areas will be coordinated to provide seamless connections. Note that in some places, such as Bayview Hill, extreme topographic challenges prevent direct bike and pedestrian trail connections.

Parking facilities at the State Park, Sports Field Complex, and Marina will be provide for visitors arriving from more distant areas with large groups, and recreational gear and supplies.

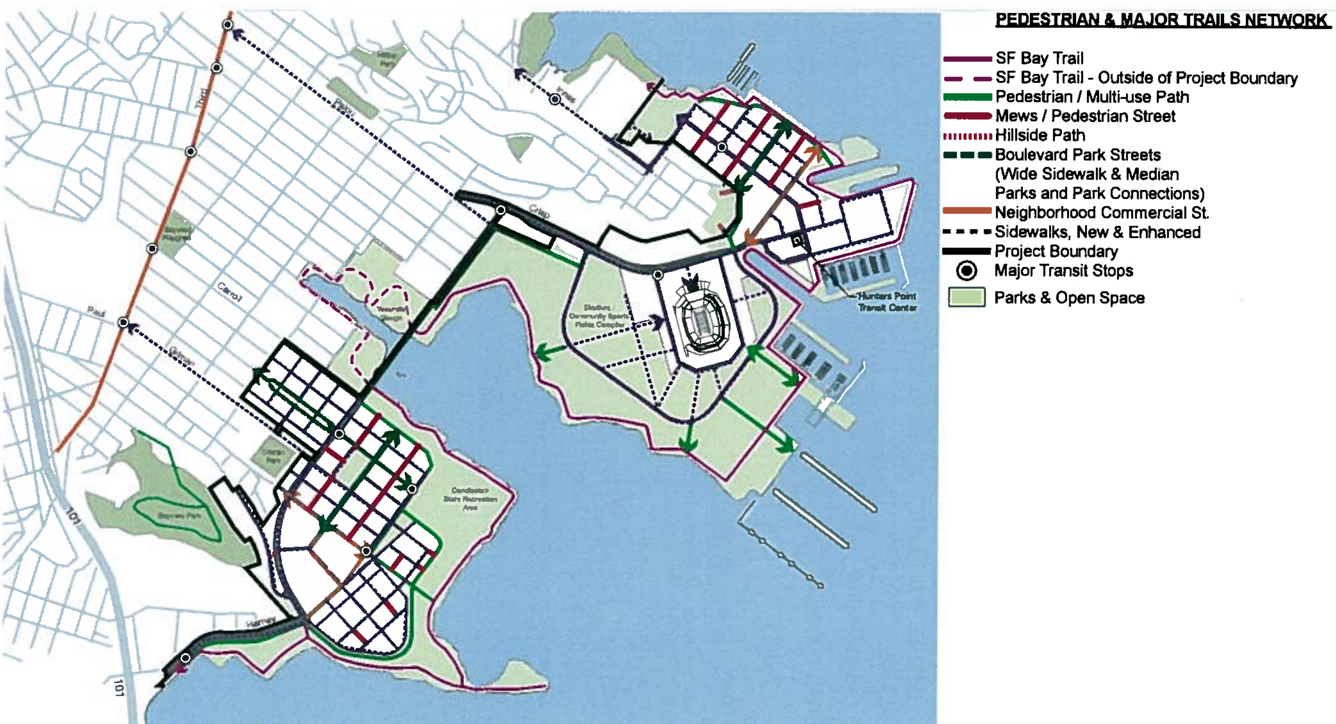
As one means of creating a quieter, healthier and more sustainable city, in some places there will be no automobile roadways between public and private property. In these places, the design of this edge will be carefully designed to create a clear delineation of public and private space, while encouraging full access and use of the public space.



Transit Network



Bikeways Network



Pedestrian & Major Trails Network

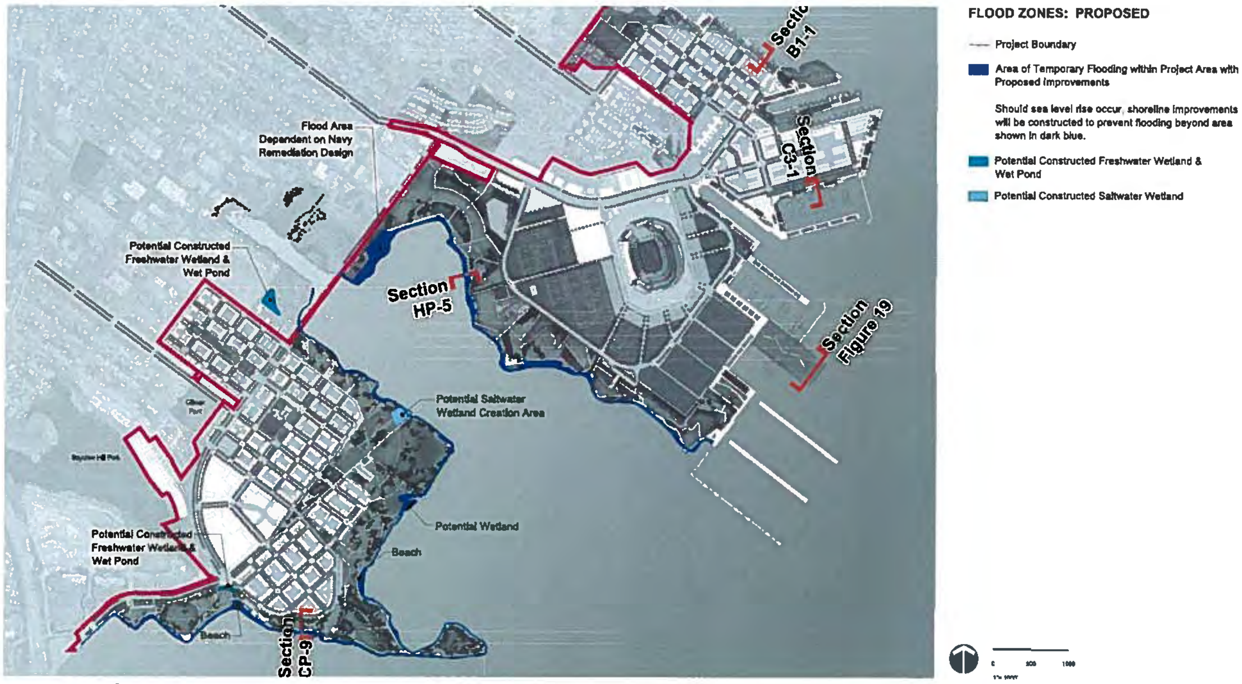
Sea Level Rise Strategy

A project-specific study was undertaken to develop a comprehensive approach to address future sea level rise. The study was based on an exhaustive review of the literature, recent guidance from regional agencies, and knowledge of coastal processes of San Francisco Bay. In almost all of the science reports reviewed, a 36-inch sea level rise increase would not be reached until after 2100. Even with the most aggressive projection of SLR that includes ice cap melt, the increase in sea level would reach 36 inches between the year 2075 and 2080.

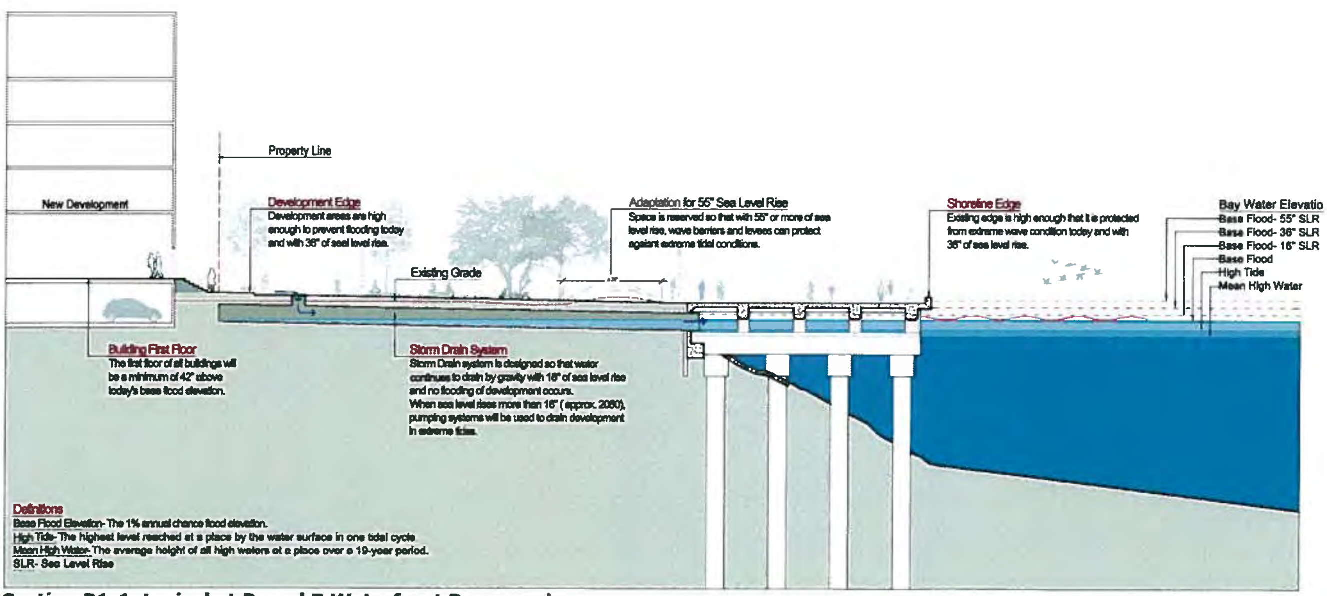
An allowance of 36 inches of sea level rise for establishing development grades was selected as an appropriate planning number for the project. All parking lots and streets will be at an elevation that is 36-inches higher than the present day base flood elevation (the 1% annual chance flood elevation).

In many areas of the existing shoreline, grades are already higher than the existing base flood elevation and would also be above the base flood elevation after 36 inches of sea level rise. The locations where grades are lower and where flooding would occur are the narrow State Parks Area just south of Hunters Point Expressway and the shoreline areas of Hunters Point Parcel E and E-2.

Existing Flood Map - 1% annual chance flood today and with 36" sea level rise without improvements

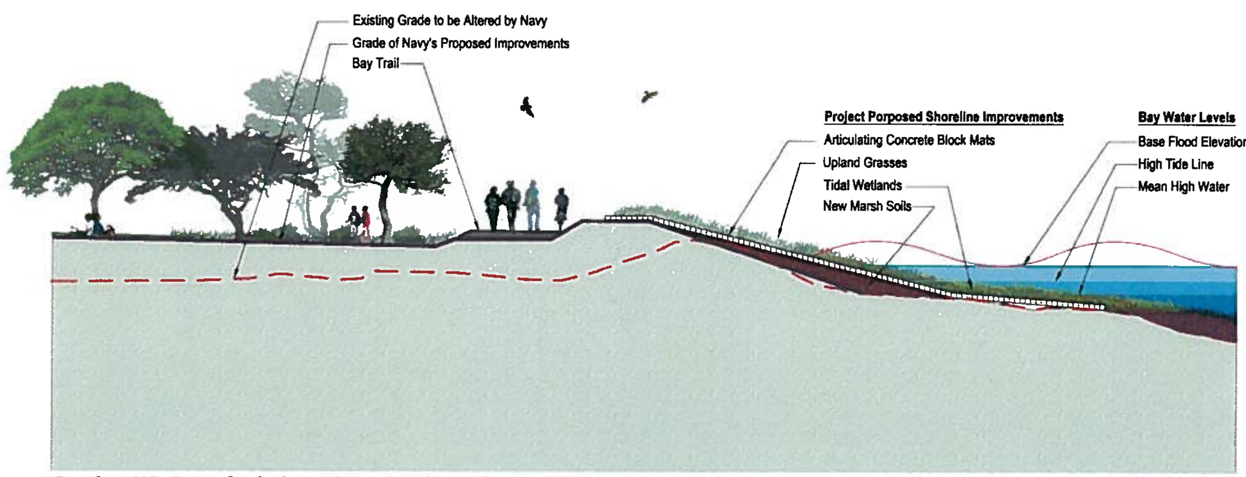


Proposed Flood Map - 1% annual chance flood at today's sea level, and 36" sea level rise



Section B1-1, typical at Parcel B Waterfront Promenade

The design of the park system will respond to future rising sea level by reserving an adaptive management zone in low shoreline areas. In some places this zone will allow for waters to rise and new wetland habitats to form. In other areas the zone will allow for mounding up to create protective embankments.



Section HP-8, typical along Grasslands Ecology Park, Parcel E / E-2

Materials & Elements

Planting

Plant selection will be specific to each location, based on microclimate and soil conditions and the program of the park. In general, park and open space plant selection will focus on native and climate-adapted species that require minimal water use and maintenance. Other factors that may influence plant selection include aesthetics, cultural significance, and habitat value.

Materials

Materials for paving, pathways, and park structures will be selected to reinforce and height the sense of place, minimize environmental impact, maximize durability, longevity and ease of maintenance. These materials may include recycled and salvaged materials such as reclaimed crushed or slab concrete, reclaimed wood, and re-purposed steel bollards and rails. New may include concrete, asphalt, decomposed granite, corten steel, stainless steel.

Furnishings

Park furnishings include elements such as site lighting, trash receptacles, bicycle racks, drinking fountains, signage, and benches. The set of furnishings may vary by park type (City Park, State Park, Ecology Park, Waterfront Promenade) as appropriate to heightening the sense of place. In general, furnishing will reflect a simple, modern, and timeless style. Like other materials, they will also be selected to minimize environmental impact, and maximize durability, longevity, and ease of maintenance.


Litter

Acknowledgements

Lennar Urban

Royston Hanamoto Alley & Abey

IBI Group

Thomas Balsley Associates

HT Harvey & Associates

Moffatt & Nichol

ARUP

LENNAR URBAN

R|H|A|A

Appendix N4 H.T. Harvey & Associates Candlestick Point/Hunters Point Shipyard Tree Survey, October 16, 2009

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

CANDLESTICK POINT/HUNTERS POINT SHIPYARD TREE SURVEY

Prepared by

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Prepared for

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16 October 2009 Project Number 2943-02

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EXECUTIVE SUMMARY

The City of San Francisco provides protection for trees by way of its Urban Forestry Ordinance (Ord. 165-95, App. 5/19/95), Article 16, Sections 806 (Planting and Removal of Street Trees) through 810 (Significant Trees) of the *Public Works Code*. The City's ordinances protect "landmark trees", "significant trees", and "street trees". Landmark trees are trees that are so designated by the City Board of Supervisors, based on a recommendation from the Urban Forestry Council, on the basis of their age, size, shape, species, location, historical association, visual quality, and other contribution to the City's character. Significant trees are defined as trees within 10 feet of a public right-of-way that also meet one of the following size requirements: 20 feet or greater in height; 15 feet or greater in canopy width; or 12 inches or greater diameter of trunk measured at 4.5 feet above grade. Street trees are defined as any tree growing within the public right-of-way, including unimproved public streets and sidewalks, and any tree growing on land under the jurisdiction of the Department of Public Works.

In October 2009, H. T. Harvey & Associates plant ecologists surveyed the Candlestick Point/Hunters Point Shipyard Phase II (CP/HPS) project area for trees protected by the City's ordinances. The survey covered the entire CP/HPS project area except for the portion of Candlestick Point State Recreation Area that is not subject to a land transfer associated with the project and that is thus not expected to be substantially modified by project activities. For the purpose of this survey, a "tree" was defined as any stem of a woody plant with a tree-like (as opposed to shrubby) growth habit measuring at least 2 inches in diameter at breast height (dbh; a height of 4.5 feet above the ground). As a result, single trees with multiple stems measuring at least 2 inches dbh were represented as multiple "trees".

For each woody stem at least 2 inches dbh, the diameter was measured with a Biltmore stick. Those stems with a dbh of 12 inches or greater automatically met one of the size criteria for a significant tree. For other stems for which the dbh was less than 12 inches, but the height was at least 20 feet (ft) or the crown width was at least 15 ft, these parameters were also recorded. Each individual tree was GPS-located.

The tree survey recorded 1,976 tree stems at least 2 inches dbh on 1,068 individual plants on Candlestick Point and 854 tree stems at least 2 inches dbh on 328 individual plants on Hunters Point Shipyard Phase II. Because single trees with multiple stems measuring at least 2 inches dbh were represented as multiple "trees," the high number of trees recorded during this survey was driven largely by such multi-stemmed individuals. Of these, 1,079 stems on Candlestick Point and 400 stems on Hunters Point Shipyard Phase II meet the size criteria for significant trees. Determination of which trees actually meet the criteria for significant trees and street trees will require a determination of which trees are on or within 10 feet of a public right-of-way or on other land under the jurisdiction of the Department of Public Works. No landmark trees are present on the project site.

INTRODUCTION

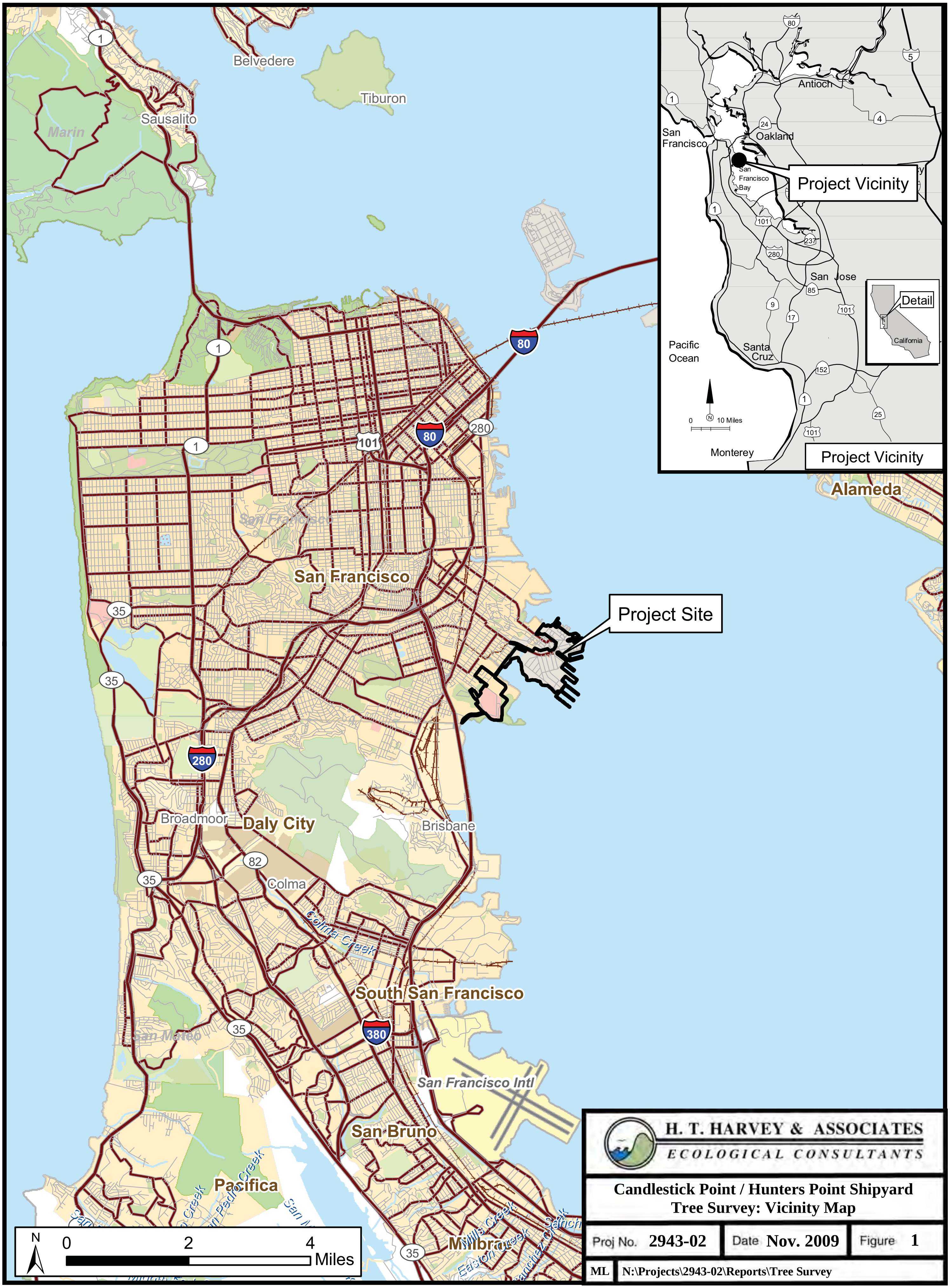
PROJECT AREA DESCRIPTION

The Candlestick Point/Hunters Point Shipyard Phase II (CP/HPS) project area is located within the City and County of San Francisco, California (Figure 1). The land areas are situated in southeastern San Francisco within the Bayview District directly adjacent to San Francisco Bay, east of Highway 101. The CP/HPS project area includes the Candlestick Point State Recreation Area (CPSRA).

SURVEY PURPOSE

The City of San Francisco provides protection for trees by way of its Urban Forestry Ordinance (Ord. 165-95, App. 5/19/95), Article 16, Sections 806 (Planting and Removal of Street Trees) through 810 (Significant Trees) of the *Public Works Code*. The City's ordinances protect "landmark trees", "significant trees", and "street trees". Landmark trees are trees that are so designated by the City Board of Supervisors, based on a recommendation from the Urban Forestry Council, on the basis of their age, size, shape, species, location, historical association, visual quality, and other contribution to the City's character. Significant trees are defined as trees within 10 feet of a public right-of-way that also meet one of the following size requirements: 20 feet or greater in height; 15 feet or greater in canopy width; or 12 inches or greater diameter of trunk measured at 4.5 feet above grade. Street trees are defined as any tree growing within the public right-of-way, including unimproved public streets and sidewalks, and any tree growing on land under the jurisdiction of the Department of Public Works.

The CP/HPS project is expected to result in impacts to some of the trees on the site that are subject to the City's Urban Forestry Ordinance. As a result, a tree survey is necessary to determine the number and location of trees on the site so that impacts to these trees can be avoided and minimized to the extent practicable during project planning, design, and construction, and so that the appropriate approvals can be obtained from the City to allow for the removal of trees that cannot be avoided. Thus, H. T. Harvey & Associates conducted a tree survey for all areas that could potentially be impacted by the project.



H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Candlestick Point / Hunters Point Shipyard
Tree Survey: Vicinity Map

Proj No. 2943-02	Date Nov. 2009	Figure 1
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SURVEY METHODS

In October 2009, H. T. Harvey & Associates plant ecologists surveyed the Candlestick Point/Hunters Point Shipyard Phase II (CP/HPS) project area for trees protected by the City's ordinances. The survey covered the entire CP/HPS project area except for the portion of Candlestick Point State Recreation Area that is not subject to a land transfer associated with the project and that is thus not expected to be substantially modified by project activities.

The City maintains a registry of designated landmark trees. H. T. Harvey & Associates contacted the City's Bureau of Urban Forestry to determine whether any such trees are present within the CP/HPS project area, and confirmed the response by viewing the map of landmark trees at http://www.sfenvironment.org/our_programs/interests.html?ssi=4&ti=8&ii=131.

The City's Urban Forestry Ordinance identifies size criteria for "significant trees", but no size criteria are given for "street trees". However, City Planning Code Sec. 143 states that trees planted as street trees within certain planning districts must be a minimum of 2-inch caliper. Therefore, for the purpose of this survey, a "tree" was defined as any stem of a woody plant with a tree-like (as opposed to shrubby) growth habit measuring at least 2 inches in diameter at breast height (dbh; a height of 4.5 feet above the ground). The City's Urban Forestry Ordinance does not indicate whether each stem of a multi-stemmed tree counts as a separate "tree"; to ensure that the appropriate data were collected, we considered each stem measuring at least 2 inches dbh to represent an individual "tree", even if multiple stems derived from a single plant.

For each woody stem at least 2 inches dbh, the diameter was measured with a Biltmore stick. Those stems with a dbh of 12 inches or greater automatically met one of the size criteria for a significant tree, and thus height and crown width were not estimated for such stems. For stems for which the dbh was less than 12 inches, but the height was at least 20 feet (ft) or the crown width was at least 15 ft, these parameters were also recorded. Each stem measuring at least 2 inches dbh on a tree that, in total, was at least 20 ft tall or had a crown width of at least 15 ft was considered a significant tree; thus, a single tree with five stems of 2 inches or greater dbh, and with a total crown width (from all stems) of at least 15 ft, was considered five separate significant trees for the sake of this survey.

Each individual tree was identified to species or genus where possible, though a few ornamentals could not be identified. Each tree was also GPS-located.

SURVEY RESULTS

The tree survey recorded 1,976 stems at least 2 inches dbh on 1,068 individual plants on Candlestick Point and 854 stems at least 2 inches dbh on 328 individual plants on Hunters Point Shipyard Phase II. Of these, 1,079 stems on Candlestick Point and 400 stems on Hunters Point Shipyard Phase II meet the size criteria for significant trees. Data for Candlestick Point and Hunters Point Shipyard Phase II are presented in Appendices A and B and summarized in Tables 1 and 2, respectively. The locations of individual trees are shown on Figures 2a and 2b.

Table 1. Trees species recorded on Candlestick Point.

Common Name	Scientific Name	No. of Individuals[1]	No. of Stems[2]	No. Potentially Significant Stems[3]
Acacia	*Acacia* sp.	57	97	67
White alder	*Alnus rhombifolia*	1	2	2
Pacific madrone	*Arbutus menziesii*	3	3	0
California buckeye	*Aesculus californica*	1	8	0
Bottlebrush	*Callistemon* sp.	1	5	5
Camphor tree	*Cinnamomum camphorum*	7	7	2
Australian pine	*Casuarina* sp.	22	22	18
Catalpa	*Catalpa* sp.	1	1	0
Blue blossom	*Ceanothus thrysiflorus*	8	23	0
Cypress	*Cupressus* sp.	3	6	2
Eucalyptus	*Eucalyptus* sp.	261	394	294
Common fig	*Ficus carica*	2	2	0
California flannelbush	*Fremontodentron californicum*	2	10	0
Ginkgo	*Ginkgo biloba*	1	1	0
Toyon	*Heteromeles arbutifolia*	3	7	0
Juniper	*Juniperus* sp.	4	6	5
Sweetgum	*Liquidambar styraciflua*	6	6	0
Apple	*Malus* sp.	2	5	0
Myoporum	*Myoporum laetum*	144	498	109
Wax myrtle	*Myrica* sp.	1	1	0
Olive	*Olea europaea*	147	327	238
Pine	*Pinus* sp.	228	288	235
Podocarpus	*Podocarpus* sp.	2	2	2
Poplar	*Populus* sp.	3	5	3
Coast live oak	*Quercus agrifolia*	10	39	7
Coffeeberry	*Rhamnus californica*	1	4	0
Red willow	*Salix laevigata*	19	53	28
Coast redwood	*Sequoia sempervirens*	11	11	10
Giant sequoia	*Sequoiadendron giganteum*	1	1	0
Chinese elm	*Ulmus parviflora*	5	6	5
Bay laurel	*Umbellularia californica*	1	4	0
Fan palm	*Washingtonia* sp.	2	6	6
Unknown tree		108	126	41
Total		**1,068**	**1,976**	**1,079**

[1] Number of individual trees/plants (some with multiple stems)
[2] Number of stems at least 2 inches dbh
[3] Based on the size criteria described previously

Table 2. Trees species recorded on Hunters Point Shipyard Phase II.

Common Name	Scientific Name	No. of Individuals[1]	No. of Stems[2]	No. Potentially Significant Stems[3]
Acacia	*Acacia* sp.	30	85	37
Birch	*Betula* sp.	2	4	2
Cedar	*Cedrus* sp.	4	9	4
Cypress	*Cupressus* sp.	2	2	2
Eucalyptus	*Eucalyptus* sp.	7	18	13
Toyon	*Heteromeles arbutifolia*	107	399	114
California black walnut	*Juglans californica*	2	3	3
Juniper	*Juniperus* sp.	18	53	40
Apple	*Malus domesticus*	3	14	0
Myoporum	*Myoporum laetum*	9	13	0
Spruce	*Picea* sp.	1	1	1
Pine	*Pinus* sp.	15	23	20
London planetree	*Platanus x acerifolia*	37	42	23
Hardy orange	*Poncirus* sp.	2	9	0
Poplar	*Populus* sp.	31	33	32
Cherry	*Prunus* sp.	2	15	4
Douglas-fir	*Pseudotsuga menziesii*	1	1	0
Coast live oak	*Quercus agrifolia*	1	1	0
Willow	*Salix* sp.	3	19	18
Coast redwood	*Sequoia sempervirens*	9	14	13
Elm	*Ulmus* sp.	13	14	3
Fan palm	*Washingtonia* sp.	12	12	11
Unknown tree		17	70	60
Total		**328**	**854**	**400**

[1] Number of individual trees/plants (some with multiple stems)
[2] Number of stems at least 2 inches dbh
[3] Based on the size criteria described previously

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Candlestick Point Tree Survey Results

Proj No.	2943-02	Date	Nov. 2009	Figure	2a
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H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Hunters Point Shipyard Tree Survey Results

Proj No. 2943-02	Date Nov. 2009	Figure 2b

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Because single trees with multiple stems measuring at least 2 inches dbh were represented as multiple "trees," the high number of trees recorded during this survey was influenced substantially by the number of multi-stemmed individuals. On Figures 2a and 2b, and in Appendices A and B, tree numbers correspond to individual plants, with some having multiple stems as detailed in Appendices A and B.

The large number of trees considered "significant" was largely the result of the way in which significant trees were defined for this survey; multiple stems of trees with a combined canopy width of 15 ft, or with at least one stem 20 ft tall, were all considered significant trees. Determination of which trees actually meet the criteria for significant trees and street trees will require a determination of which trees are on or within 10 feet of a public right-of-way or otherwise on land under the jurisdiction of the Department of Public Works.

According to the Bureau of Urban Forestry and review of the map on the City's landmark tree website (http://www.sfenvironment.org/our_programs/interests.html?ssi=4&ti=8&ii=131), no landmark trees are present on the project site.

APPENDIX A.
CANDLESTICK POINT
TREE SURVEY DATA

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
40	Acacia sp.	24			Y
40	Acacia sp.	13			Y
42	Acacia sp.	4	21	8	Y
42	Acacia sp.	4	21	8	Y
42	Acacia sp.	2	21	8	Y
42	Acacia sp.	2	21	8	Y
43	Acacia sp.	4	21	6	Y
43	Acacia sp.	3	21	6	Y
44	Acacia sp.	6	21	6	Y
44	Acacia sp.	5	21	6	Y
44	Acacia sp.	3	21	6	Y
66	Acacia sp.	18			Y
243	Acacia sp.	5	20	8	Y
253	Acacia sp.	3	15	15	Y
254	Acacia sp.	2	20	10	Y
258	Acacia sp.	10	30	20	Y
281	Acacia sp.	4	20	8	Y
338	Acacia sp.	7	40	20	Y
338	Acacia sp.	6	40	20	Y
338	Acacia sp.	4	40	20	Y
339	Acacia sp.	13			Y
339	Acacia sp.	13			Y
339	Acacia sp.	12			Y
348	Acacia sp.	29			Y
349	Acacia sp.	32			Y
349	Acacia sp.	13			Y
350	Acacia sp.	20			Y
366	Acacia sp.	20			Y
586	Acacia sp.	12			Y
612	Acacia sp.	12			Y
613	Acacia sp.	13			Y
614	Acacia sp.	10		15	Y
636	Acacia sp.	16			Y
665	Acacia sp.	10	20		Y
677	Acacia sp.	24			Y
680	Acacia sp.	28			Y
680	Acacia sp.	17			Y
681	Acacia sp.	14			Y
682	Acacia sp.	15			Y
685	Acacia sp.	14			Y
690	Acacia sp.	10	25		Y
695	Acacia sp.	19			Y
696	Acacia sp.	7	20		Y
696	Acacia sp.	6	20		Y
696	Acacia sp.	5	20		Y
696	Acacia sp.	4			Y
708	Acacia sp.	14			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
709	Acacia sp.	14			Y
710	Acacia sp.	6		18	Y
710	Acacia sp.	6		18	Y
710	Acacia sp.	2		18	Y
719	Acacia sp.	10	28		Y
719	Acacia sp.	8	28		Y
720	Acacia sp.	20			Y
720	Acacia sp.	16			Y
759	Acacia sp.	10		17	Y
768	Acacia sp.	8		16	Y
769	Acacia sp.	12			Y
770	Acacia sp.	12			Y
781	Acacia sp.	14			Y
782	Acacia sp.	14			Y
783	Acacia sp.	13			Y
788	Acacia sp.	16			Y
789	Acacia sp.	13			Y
793	Acacia sp.	15			Y
793	Acacia sp.	13			Y
794	Acacia sp.	18			Y
41	Acacia sp.	3	10	5	
194	Acacia sp.	7	12	10	
194	Acacia sp.	4	12	10	
194	Acacia sp.	4	12	10	
247	Acacia sp.	5	15	8	
249	Acacia sp.	7	15	10	
249	Acacia sp.	6	15	10	
249	Acacia sp.	2	15	10	
261	Acacia sp.	3	12	10	
261	Acacia sp.	2	12	10	
261	Acacia sp.	2	12	10	
339	Acacia sp.	10			
339	Acacia sp.	9			
339	Acacia sp.	7			
349	Acacia sp.	8			
349	Acacia sp.	8			
349	Acacia sp.	3			
351	Acacia sp.	10			
351	Acacia sp.	9			
363	Acacia sp.	3	15	8	
363	Acacia sp.	3	15	8	
364	Acacia sp.	3	15	10	
364	Acacia sp.	2	15	10	
688	Acacia sp.	6			
710	Acacia sp.	8			
711	Acacia sp.	4			
711	Acacia sp.	4			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
787	Acacia sp.	5			
793	Acacia sp.	7			
793	Acacia sp.	7			
130	Aesculus californica	5	10	8	
105	Alnus rhombifolia	13			Y
105	Alnus rhombifolia	12			Y
597	Arbutus menziesii	7			
599	Arbutus menziesii	4			
600	Arbutus menziesii	5			
130	Aseculus californica	5	10	8	
130	Aseculus californica	4	10	8	
130	Aseculus californica	3	10	8	
130	Aseculus californica	3	10	8	
130	Aseculus californica	2	10	8	
130	Aseculus californica	2	10	8	
130	Aseculus californica	2	10	8	
168	Callistemon sp.	2	18	15	Y
168	Callistemon sp.	2	18	15	Y
168	Callistemon sp.	2	18	15	Y
168	Callistemon sp.	2	18	15	Y
168	Callistemon sp.	2	18	15	Y
611	Casuarina sp.	10	30		Y
626	Casuarina sp.	20			Y
660	Casuarina sp.	10		22	Y
662	Casuarina sp.	12			Y
663	Casuarina sp.	12			Y
667	Casuarina sp.	22			Y
668	Casuarina sp.	14			Y
669	Casuarina sp.	19			Y
670	Casuarina sp.	12			Y
671	Casuarina sp.	19			Y
672	Casuarina sp.	18			Y
716	Casuarina sp.	17			Y
741	Casuarina sp.	10	20		Y
749	Casuarina sp.	12			Y
750	Casuarina sp.	16			Y
754	Casuarina sp.	14			Y
755	Casuarina sp.	16			Y
765	Casuarina sp.	17			Y
609	Casuarina sp.	8			
610	Casuarina sp.	8			
659	Casuarina sp.	10			
661	Casuarina sp.	10			
901	Catalpa sp.	3			
54	Ceanothus thyrsiflorus	4	16	12	
54	Ceanothus thyrsiflorus	4	16	12	
54	Ceanothus thyrsiflorus	3	16	12	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
54	Ceanothus thyrsiflorus	2	16	12	
54	Ceanothus thyrsiflorus	2	16	12	
54	Ceanothus thyrsiflorus	2	16	12	
210	Ceanothus thyrsiflorus	2	12	8	
211	Ceanothus thyrsiflorus	3	11	6	
212	Ceanothus thyrsiflorus	3	12	8	
213	Ceanothus thyrsiflorus	4	12	10	
213	Ceanothus thyrsiflorus	2	12	10	
230	Ceanothus thyrsiflorus	4	15	8	
230	Ceanothus thyrsiflorus	3	15	8	
230	Ceanothus thyrsiflorus	3	15	8	
230	Ceanothus thyrsiflorus	3	15	8	
233	Ceanothus thyrsiflorus	3	12	10	
233	Ceanothus thyrsiflorus	3	12	10	
233	Ceanothus thyrsiflorus	3	12	10	
233	Ceanothus thyrsiflorus	2	12	10	
234	Ceanothus thyrsiflorus	3	10	8	
234	Ceanothus thyrsiflorus	2	10	8	
234	Ceanothus thyrsiflorus	2	10	8	
234	Ceanothus thyrsiflorus	2	10	8	
727	Cinnamonum camphorum	9		16	Y
738	Cinnamonum camphorum	10		18	Y
737	Cinnamonum camphorum	4			
889	Cinnamonum camphorum	4			
896	Cinnamonum camphorum	8			
908	Cinnamonum camphorum	10			
909	Cinnamonum camphorum	7			
683	Cupressus sp.	13			Y
1011	Cupressus sp.	23			Y
565	Cupressus sp.	7			
565	Cupressus sp.	4			
565	Cupressus sp.	3			
565	Cupressus sp.	2			
252	Eucalyptus globulus	14			Y
255	Eucalyptus globulus	12			Y
257	Eucalyptus globulus	25			Y
259	Eucalyptus globulus	11	30	20	Y
260	Eucalyptus globulus	11	30	20	Y
262	Eucalyptus globulus	12			Y
263	Eucalyptus globulus	10	30	15	Y
296	Eucalyptus globulus	12			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
297	Eucalyptus globulus	94			Y
314	Eucalyptus globulus	12			Y
315	Eucalyptus globulus	12			Y
316	Eucalyptus globulus	15			Y
318	Eucalyptus globulus		20		Y
319	Eucalyptus globulus	16			Y
320	Eucalyptus globulus	20			Y
321	Eucalyptus globulus	17			Y
322	Eucalyptus globulus	20			Y
323	Eucalyptus globulus	17			Y
324	Eucalyptus globulus	14			Y
325	Eucalyptus globulus	23			Y
326	Eucalyptus globulus	18			Y
327	Eucalyptus globulus	18			Y
328	Eucalyptus globulus	17			Y
329	Eucalyptus globulus	13			Y
330	Eucalyptus globulus	14			Y
331	Eucalyptus globulus	12			Y
332	Eucalyptus globulus	10	30	15	Y
336	Eucalyptus globulus	17			Y
341	Eucalyptus globulus	12			Y
342	Eucalyptus globulus	18			Y
343	Eucalyptus globulus	17			Y
344	Eucalyptus globulus	21			Y
345	Eucalyptus globulus	14			Y
346	Eucalyptus globulus	36			Y
373	Eucalyptus globulus	34			Y
374	Eucalyptus globulus	32			Y
375	Eucalyptus globulus	36			Y
376	Eucalyptus globulus	26			Y
377	Eucalyptus globulus	22			Y
378	Eucalyptus globulus	32			Y
379	Eucalyptus globulus	15			Y
380	Eucalyptus globulus	16			Y
381	Eucalyptus globulus	19			Y
382	Eucalyptus globulus	19			Y
383	Eucalyptus globulus	19			Y
384	Eucalyptus globulus	22			Y
385	Eucalyptus globulus	13			Y
386	Eucalyptus globulus	18			Y
387	Eucalyptus globulus	16			Y
388	Eucalyptus globulus	17			Y
389	Eucalyptus globulus	20			Y
390	Eucalyptus globulus	17			Y
391	Eucalyptus globulus	15			Y
392	Eucalyptus globulus	20			Y
393	Eucalyptus globulus	21			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
394	Eucalyptus globulus	34			Y
395	Eucalyptus globulus	20			Y
396	Eucalyptus globulus	5	20	6	Y
397	Eucalyptus globulus	21			Y
398	Eucalyptus globulus	18			Y
399	Eucalyptus globulus	20			Y
401	Eucalyptus globulus	12			Y
402	Eucalyptus globulus	17			Y
403	Eucalyptus globulus	18			Y
404	Eucalyptus globulus	4	30	15	Y
405	Eucalyptus globulus	18			Y
406	Eucalyptus globulus	14			Y
407	Eucalyptus globulus	6	30	15	Y
408	Eucalyptus globulus	16			Y
409	Eucalyptus globulus	19			Y
410	Eucalyptus globulus	9	30	15	Y
411	Eucalyptus globulus	13			Y
412	Eucalyptus globulus	12			Y
413	Eucalyptus globulus	18			Y
414	Eucalyptus globulus	11	30	15	Y
415	Eucalyptus globulus	15			Y
416	Eucalyptus globulus	14			Y
417	Eucalyptus globulus	18			Y
418	Eucalyptus globulus	20			Y
420	Eucalyptus globulus	29			Y
421	Eucalyptus globulus	15			Y
422	Eucalyptus globulus	15			Y
423	Eucalyptus globulus	22			Y
424	Eucalyptus globulus	21			Y
425	Eucalyptus globulus	19			Y
426	Eucalyptus globulus	20			Y
428	Eucalyptus globulus	17			Y
429	Eucalyptus globulus	12			Y
431	Eucalyptus globulus	12			Y
432	Eucalyptus globulus	13			Y
433	Eucalyptus globulus	16			Y
434	Eucalyptus globulus	17			Y
435	Eucalyptus globulus	14			Y
436	Eucalyptus globulus	13			Y
438	Eucalyptus globulus	16			Y
439	Eucalyptus globulus	17			Y
440	Eucalyptus globulus	16			Y
441	Eucalyptus globulus	25			Y
442	Eucalyptus globulus	18			Y
443	Eucalyptus globulus	14			Y
444	Eucalyptus globulus	20			Y
445	Eucalyptus globulus	12			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
447	Eucalyptus globulus	22			Y
448	Eucalyptus globulus	14			Y
449	Eucalyptus globulus	24			Y
449	Eucalyptus globulus	20			Y
449	Eucalyptus globulus	17			Y
450	Eucalyptus globulus	18			Y
1041	Eucalyptus globulus	26			Y
1043	Eucalyptus globulus	17			Y
1043	Eucalyptus globulus	14			Y
1043	Eucalyptus globulus	12			Y
1044	Eucalyptus globulus	32			Y
1045	Eucalyptus globulus	6	20	10	Y
1046	Eucalyptus globulus	34			Y
1047	Eucalyptus globulus	25			Y
1047	Eucalyptus globulus	14			Y
1048	Eucalyptus globulus	22			Y
1048	Eucalyptus globulus	16			Y
1049	Eucalyptus globulus	15			Y
1050	Eucalyptus globulus	22			Y
1052	Eucalyptus globulus	14			Y
1053	Eucalyptus globulus	84			Y
1053	Eucalyptus globulus	24			Y
1055	Eucalyptus globulus	8	60	20	Y
1055	Eucalyptus globulus	6	60	20	Y
1055	Eucalyptus globulus	5	60	20	Y
1055	Eucalyptus globulus	4	60	20	Y
1055	Eucalyptus globulus	4	60	20	Y
1057	Eucalyptus globulus	4	30	15	Y
1057	Eucalyptus globulus	2	30	15	Y
1057	Eucalyptus globulus	2	30	15	Y
1058	Eucalyptus globulus	25			Y
1058	Eucalyptus globulus	14			Y
1059	Eucalyptus globulus	22			Y
1061	Eucalyptus globulus	26			Y
1061	Eucalyptus globulus	24			Y
1062	Eucalyptus globulus	24			Y
1063	Eucalyptus globulus	18			Y
1064	Eucalyptus globulus	18			Y
1064	Eucalyptus globulus	16			Y
1064	Eucalyptus globulus	12			Y
1064	Eucalyptus globulus	12			Y
1065	Eucalyptus globulus	24			Y
1066	Eucalyptus globulus	26			Y
1066	Eucalyptus globulus	14			Y
1067	Eucalyptus globulus	26			Y
1068	Eucalyptus globulus	46			Y
296	Eucalyptus globulus	7			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
400	Eucalyptus globulus	10			
419	Eucalyptus globulus	5	15	8	
419	Eucalyptus globulus	4	15	8	
427	Eucalyptus globulus	11			
430	Eucalyptus globulus	3			
437	Eucalyptus globulus	9			
446	Eucalyptus globulus	10	15	8	
1043	Eucalyptus globulus	6			
1043	Eucalyptus globulus	5			
1047	Eucalyptus globulus	7			
1048	Eucalyptus globulus	4			
1048	Eucalyptus globulus	2			
1049	Eucalyptus globulus	6			
1050	Eucalyptus globulus	11			
1050	Eucalyptus globulus	3			
1050	Eucalyptus globulus	2			
1050	Eucalyptus globulus	2			
1050	Eucalyptus globulus	2			
1051	Eucalyptus globulus	10			
1051	Eucalyptus globulus	3			
1051	Eucalyptus globulus	3			
1051	Eucalyptus globulus	2			
1051	Eucalyptus globulus	2			
1052	Eucalyptus globulus	3			
1052	Eucalyptus globulus	2			
1052	Eucalyptus globulus	2			
1052	Eucalyptus globulus	2			
1054	Eucalyptus globulus	4			
1054	Eucalyptus globulus	3			
1056	Eucalyptus globulus	10	15	8	
1056	Eucalyptus globulus	4	15	8	
1058	Eucalyptus globulus	10			
1059	Eucalyptus globulus	9			
1059	Eucalyptus globulus	5			
1059	Eucalyptus globulus	2			
1060	Eucalyptus globulus	7	15	8	
1060	Eucalyptus globulus	5	15	8	
1061	Eucalyptus globulus	6			
1062	Eucalyptus globulus	6			
1062	Eucalyptus globulus	6			
1062	Eucalyptus globulus	3			
1064	Eucalyptus globulus	8			
1065	Eucalyptus globulus	10			
1066	Eucalyptus globulus	3			
1066	Eucalyptus globulus	2			
1066	Eucalyptus globulus	2			
1066	Eucalyptus globulus	2			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
1066	Eucalyptus globulus	2			
1	Eucalyptus sp.	23			Y
1	Eucalyptus sp.	19			Y
1	Eucalyptus sp.	18			Y
2	Eucalyptus sp.	15			Y
2	Eucalyptus sp.	14			Y
2	Eucalyptus sp.	13			Y
3	Eucalyptus sp.	15			Y
4	Eucalyptus sp.	25			Y
11	Eucalyptus sp.	25			Y
14	Eucalyptus sp.	20			Y
15	Eucalyptus sp.	21			Y
18	Eucalyptus sp.	17			Y
19	Eucalyptus sp.	14			Y
30	Eucalyptus sp.	12	11	10	Y
73	Eucalyptus sp.	17			Y
73	Eucalyptus sp.	15			Y
74	Eucalyptus sp.	14			Y
74	Eucalyptus sp.	12			Y
92	Eucalyptus sp.	18			Y
92	Eucalyptus sp.	15			Y
92	Eucalyptus sp.	12			Y
152	Eucalyptus sp.	5	22	8	Y
152	Eucalyptus sp.	5	22	8	Y
152	Eucalyptus sp.	4	22	8	Y
152	Eucalyptus sp.	3	22	8	Y
153	Eucalyptus sp.	13			Y
154	Eucalyptus sp.	20			Y
545	Eucalyptus sp.	12			Y
546	Eucalyptus sp.	14			Y
547	Eucalyptus sp.	15			Y
548	Eucalyptus sp.	15			Y
549	Eucalyptus sp.	15			Y
550	Eucalyptus sp.	12			Y
571	Eucalyptus sp.	11	40		Y
673	Eucalyptus sp.	12			Y
674	Eucalyptus sp.	10	20		Y
706	Eucalyptus sp.	6		18	Y
707	Eucalyptus sp.	12			Y
734	Eucalyptus sp.	13			Y
735	Eucalyptus sp.	13			Y
736	Eucalyptus sp.	11	22		Y
780	Eucalyptus sp.	20			Y
784	Eucalyptus sp.	13			Y
785	Eucalyptus sp.	18			Y
786	Eucalyptus sp.	24			Y
791	Eucalyptus sp.	7		15	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
791	Eucalyptus sp.	7		15	Y
791	Eucalyptus sp.	7		15	Y
791	Eucalyptus sp.	6		15	Y
791	Eucalyptus sp.	4		15	Y
791	Eucalyptus sp.	4		15	Y
791	Eucalyptus sp.	4		15	Y
791	Eucalyptus sp.	3.5		15	Y
795	Eucalyptus sp.	29		16	Y
795	Eucalyptus sp.	6		16	Y
796	Eucalyptus sp.	14			Y
797	Eucalyptus sp.	16			Y
797	Eucalyptus sp.	15			Y
798	Eucalyptus sp.	14			Y
799	Eucalyptus sp.	17			Y
799	Eucalyptus sp.	16			Y
800	Eucalyptus sp.	14			Y
801	Eucalyptus sp.	14			Y
802	Eucalyptus sp.	15			Y
803	Eucalyptus sp.	22			Y
804	Eucalyptus sp.	18			Y
805	Eucalyptus sp.	18			Y
805	Eucalyptus sp.	18			Y
807	Eucalyptus sp.	18			Y
808	Eucalyptus sp.	18			Y
809	Eucalyptus sp.	22			Y
810	Eucalyptus sp.	50			Y
811	Eucalyptus sp.	26			Y
812	Eucalyptus sp.	14			Y
813	Eucalyptus sp.	18			Y
814	Eucalyptus sp.	15			Y
815	Eucalyptus sp.	22			Y
818	Eucalyptus sp.	16			Y
819	Eucalyptus sp.	13			Y
820	Eucalyptus sp.	10		20	Y
821	Eucalyptus sp.	16			Y
823	Eucalyptus sp.	7	20		Y
823	Eucalyptus sp.	7	20		Y
824	Eucalyptus sp.	6	20		Y
825	Eucalyptus sp.	24			Y
826	Eucalyptus sp.	32			Y
827	Eucalyptus sp.	16			Y
828	Eucalyptus sp.	20			Y
829	Eucalyptus sp.	14			Y
830	Eucalyptus sp.	18			Y
831	Eucalyptus sp.	20			Y
832	Eucalyptus sp.	22			Y
833	Eucalyptus sp.	11	30		Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
834	Eucalyptus sp.	16			Y
835	Eucalyptus sp.	12			Y
836	Eucalyptus sp.	13			Y
837	Eucalyptus sp.	9		22	Y
837	Eucalyptus sp.	6		22	Y
838	Eucalyptus sp.	13			Y
839	Eucalyptus sp.	22			Y
840	Eucalyptus sp.	22			Y
841	Eucalyptus sp.	18			Y
842	Eucalyptus sp.	22			Y
843	Eucalyptus sp.	25			Y
844	Eucalyptus sp.	15			Y
845	Eucalyptus sp.	12			Y
846	Eucalyptus sp.	13			Y
847	Eucalyptus sp.	14			Y
849	Eucalyptus sp.	17			Y
850	Eucalyptus sp.	16			Y
853	Eucalyptus sp.	16			Y
854	Eucalyptus sp.	7		35	Y
854	Eucalyptus sp.	6		35	Y
854	Eucalyptus sp.	4		35	Y
854	Eucalyptus sp.	4		35	Y
855	Eucalyptus sp.	24			Y
856	Eucalyptus sp.	20			Y
961	Eucalyptus sp.	48			Y
961	Eucalyptus sp.	25			Y
962	Eucalyptus sp.	30			Y
965	Eucalyptus sp.	8		20	Y
965	Eucalyptus sp.	8		20	Y
965	Eucalyptus sp.	7		20	Y
966	Eucalyptus sp.	34			Y
966	Eucalyptus sp.	16			Y
967	Eucalyptus sp.	12			Y
1012	Eucalyptus sp.	10	30		Y
1012	Eucalyptus sp.	8	30		Y
1012	Eucalyptus sp.	4	30		Y
1012	Eucalyptus sp.	4	30		Y
1013	Eucalyptus sp.	12			Y
1014	Eucalyptus sp.	16			Y
1015	Eucalyptus sp.	16			Y
1016	Eucalyptus sp.	12			Y
1017	Eucalyptus sp.	12			Y
1018	Eucalyptus sp.	12			Y
1019	Eucalyptus sp.	12			Y
1020	Eucalyptus sp.	16			Y
1021	Eucalyptus sp.	8	30		Y
1021	Eucalyptus sp.	6	30		Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
1022	Eucalyptus sp.	6	28		Y
1023	Eucalyptus sp.	6	28		Y
1024	Eucalyptus sp.	18			Y
1025	Eucalyptus sp.	18			Y
1026	Eucalyptus sp.	20			Y
1027	Eucalyptus sp.	16			Y
3	Eucalyptus sp.	11			
11	Eucalyptus sp.	10			
11	Eucalyptus sp.	7			
18	Eucalyptus sp.	11			
74	Eucalyptus sp.	11			
92	Eucalyptus sp.	7			
153	Eucalyptus sp.	11			
153	Eucalyptus sp.	8			
153	Eucalyptus sp.	4			
544	Eucalyptus sp.	3	15	12	
544	Eucalyptus sp.	3	15	12	
544	Eucalyptus sp.	2	15	12	
544	Eucalyptus sp.	2	15	12	
544	Eucalyptus sp.	2	15	12	
705	Eucalyptus sp.	8			
790	Eucalyptus sp.	8			
792	Eucalyptus sp.	5			
792	Eucalyptus sp.	4			
792	Eucalyptus sp.	4			
800	Eucalyptus sp.	9			
801	Eucalyptus sp.	10			
806	Eucalyptus sp.	4			
812	Eucalyptus sp.	11			
816	Eucalyptus sp.	10			
817	Eucalyptus sp.	4			
822	Eucalyptus sp.	6			
830	Eucalyptus sp.	10			
846	Eucalyptus sp.	6			
846	Eucalyptus sp.	10			
846	Eucalyptus sp.	6			
848	Eucalyptus sp.	4			
851	Eucalyptus sp.	7			
851	Eucalyptus sp.	5			
851	Eucalyptus sp.	4			
851	Eucalyptus sp.	4			
852	Eucalyptus sp.	11			
853	Eucalyptus sp.	10			
853	Eucalyptus sp.	10			
1013	Eucalyptus sp.	4			
1017	Eucalyptus sp.	6			
1017	Eucalyptus sp.	11			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
1017	Eucalyptus sp.	8			
1017	Eucalyptus sp.	6			
1017	Eucalyptus sp.	6			
1017	Eucalyptus sp.	4			
1017	Eucalyptus sp.	4			
1017	Eucalyptus sp.	4			
1018	Eucalyptus sp.	10			
1018	Eucalyptus sp.	5			
1019	Eucalyptus sp.	6			
1025	Eucalyptus sp.	5			
887	Ficus carica	10			
900	Ficus carica	4			
7	Fremontodendron californicum	5	12	12	
7	Fremontodendron californicum	4	12	12	
7	Fremontodendron californicum	3	12	12	
7	Fremontodendron californicum	2	12	12	
7	Fremontodendron californicum	2	12	12	
27	Fremontodendron californicum	4	10	8	
27	Fremontodendron californicum	3	10	8	
27	Fremontodendron californicum	2	10	8	
27	Fremontodendron californicum	2	10	8	
27	Fremontodendron californicum	2	10	8	
885	Ginkgo biloba	4			
56	Heteromeles arbutifolia	6	8	6	
56	Heteromeles arbutifolia	3	8	6	
56	Heteromeles arbutifolia	3	8	6	
56	Heteromeles arbutifolia	2	8	6	
56	Heteromeles arbutifolia	2	8	6	
250	Heteromeles arbutifolia	2	10	3	
256	Heteromeles arbutifolia	2	3	3	
16	Juniperus sp.	15	21	17	Y
16	Juniperus sp.	8	21	17	Y
16	Juniperus sp.	6	21	17	Y
46	Juniperus sp.	12			Y
203	Juniperus sp.	14			Y
45	Juniperus sp.	4	8	12	
897	Liquidambar styraciflua	6			
898	Liquidambar styraciflua	6			
903	Liquidambar styraciflua	6			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
904	Liquidambar styraciflua	5			
905	Liquidambar styraciflua	5			
911	Liquidambar styraciflua	6			
701	Malus sp.	8			
702	Malus sp.	4			
702	Malus sp.	4			
702	Malus sp.	4			
702	Malus sp.	3			
8	Myoporum laetum	14			Y
9	Myoporum laetum	8	18	15	Y
9	Myoporum laetum	8	18	15	Y
9	Myoporum laetum	7	18	15	Y
9	Myoporum laetum	6	18	15	Y
9	Myoporum laetum	6	18	15	Y
9	Myoporum laetum	5	18	15	Y
9	Myoporum laetum	4	18	15	Y
9	Myoporum laetum	3	18	15	Y
10	Myoporum laetum	9	18	15	Y
10	Myoporum laetum	8	18	15	Y
10	Myoporum laetum	6	18	15	Y
10	Myoporum laetum	6	18	15	Y
10	Myoporum laetum	5	18	15	Y
10	Myoporum laetum	4	18	15	Y
10	Myoporum laetum	4	18	15	Y
10	Myoporum laetum	4	18	15	Y
10	Myoporum laetum	3	18	15	Y
10	Myoporum laetum	3	18	15	Y
10	Myoporum laetum	2	18	15	Y
12	Myoporum laetum	16			Y
13	Myoporum laetum	10	17	18	Y
13	Myoporum laetum	8	17	18	Y
13	Myoporum laetum	8	17	18	Y
13	Myoporum laetum	6	17	18	Y
13	Myoporum laetum	5	17	18	Y
20	Myoporum laetum	6	14	17	Y
20	Myoporum laetum	3	14	17	Y
20	Myoporum laetum	3	14	17	Y
20	Myoporum laetum	2	14	17	Y
20	Myoporum laetum	2	14	17	Y
20	Myoporum laetum	2	14	17	Y
21	Myoporum laetum	6	12	15	Y
21	Myoporum laetum	4	12	15	Y
21	Myoporum laetum	3	12	15	Y
21	Myoporum laetum	2	12	15	Y
21	Myoporum laetum	2	12	15	Y
138	Myoporum laetum	7	14	15	Y
138	Myoporum laetum	7	14	15	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
138	Myoporum laetum	7	14	15	Y
138	Myoporum laetum	6	14	15	Y
138	Myoporum laetum	5	14	15	Y
147	Myoporum laetum	14			Y
148	Myoporum laetum	15			Y
150	Myoporum laetum	28	14	11	Y
156	Myoporum laetum	21			Y
164	Myoporum laetum	7	15	15	Y
164	Myoporum laetum	6	15	15	Y
164	Myoporum laetum	4	15	15	Y
164	Myoporum laetum	3	15	15	Y
164	Myoporum laetum	2	15	15	Y
167	Myoporum laetum	9	18	15	Y
167	Myoporum laetum	8	18	15	Y
167	Myoporum laetum	6	18	15	Y
167	Myoporum laetum	6	18	15	Y
167	Myoporum laetum	4	18	15	Y
169	Myoporum laetum	12			Y
170	Myoporum laetum	15			Y
171	Myoporum laetum	14			Y
175	Myoporum laetum	21			Y
181	Myoporum laetum	7	15	20	Y
181	Myoporum laetum	6	15	20	Y
181	Myoporum laetum	5	15	20	Y
181	Myoporum laetum	5	15	20	Y
181	Myoporum laetum	4	15	20	Y
181	Myoporum laetum	4	15	20	Y
181	Myoporum laetum	4	15	20	Y
181	Myoporum laetum	4	15	20	Y
181	Myoporum laetum	3	15	20	Y
181	Myoporum laetum	3	15	20	Y
181	Myoporum laetum	2	15	20	Y
190	Myoporum laetum	24			Y
191	Myoporum laetum	18	15	12	Y
208	Myoporum laetum	12			Y
214	Myoporum laetum	10	15	20	Y
220	Myoporum laetum	11	20	25	Y
220	Myoporum laetum	10	20	25	Y
220	Myoporum laetum	7	20	25	Y
222	Myoporum laetum	3	12	15	Y
222	Myoporum laetum	3	12	15	Y
222	Myoporum laetum	3	12	15	Y
222	Myoporum laetum	2	12	15	Y
223	Myoporum laetum	3	12	15	Y
223	Myoporum laetum	3	12	15	Y
223	Myoporum laetum	3	12	15	Y
223	Myoporum laetum	2	12	15	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
223	Myoporum laetum	2	12	15	Y
223	Myoporum laetum	2	12	15	Y
226	Myoporum laetum	11	15	15	Y
232	Myoporum laetum	18			Y
236	Myoporum laetum	15			Y
237	Myoporum laetum	12			Y
248	Myoporum laetum	5	15	15	Y
248	Myoporum laetum	5	15	15	Y
248	Myoporum laetum	4	15	15	Y
251	Myoporum laetum	10	15	20	Y
251	Myoporum laetum	8	15	20	Y
251	Myoporum laetum	7	15	20	Y
251	Myoporum laetum	3	15	20	Y
697	Myoporum laetum	14			Y
698	Myoporum laetum	13			Y
700	Myoporum laetum	12			Y
963	Myoporum laetum	16			Y
963	Myoporum laetum	13			Y
964	Myoporum laetum	20			Y
964	Myoporum laetum	13			Y
964	Myoporum laetum	12			Y
964	Myoporum laetum	12			Y
964	Myoporum laetum	12			Y
5	Myoporum laetum	6	15	12	
5	Myoporum laetum	6	15	12	
5	Myoporum laetum	4	15	12	
5	Myoporum laetum	3	15	12	
6	Myoporum laetum	6	10	8	
6	Myoporum laetum	6	10	8	
6	Myoporum laetum	4	10	8	
6	Myoporum laetum	4	10	8	
22	Myoporum laetum	8	10	12	
22	Myoporum laetum	3	10	12	
22	Myoporum laetum	2	10	12	
23	Myoporum laetum	4	8	10	
23	Myoporum laetum	3	8	10	
23	Myoporum laetum	3	8	10	
23	Myoporum laetum	2	8	10	
24	Myoporum laetum	6	8	9	
25	Myoporum laetum	4	10	13	
25	Myoporum laetum	3	10	13	
25	Myoporum laetum	2	10	13	
25	Myoporum laetum	2	10	13	
26	Myoporum laetum	5	12	12	
26	Myoporum laetum	4	12	12	
26	Myoporum laetum	4	12	12	
26	Myoporum laetum	4	12	12	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
31	Myoporum laetum	8	11	12	
31	Myoporum laetum	2	11	12	
31	Myoporum laetum	2	11	12	
32	Myoporum laetum	5	8	12	
32	Myoporum laetum	3	8	12	
32	Myoporum laetum	3	8	12	
32	Myoporum laetum	2	8	12	
32	Myoporum laetum	2	8	12	
32	Myoporum laetum	2	8	12	
33	Myoporum laetum	10	8	8	
33	Myoporum laetum	2	8	8	
33	Myoporum laetum	2	8	8	
34	Myoporum laetum	6	8	8	
34	Myoporum laetum	2	8	8	
34	Myoporum laetum	2	8	8	
35	Myoporum laetum	4	8	10	
35	Myoporum laetum	3	8	10	
35	Myoporum laetum	2	8	10	
35	Myoporum laetum	2	8	10	
35	Myoporum laetum	2	8	10	
35	Myoporum laetum	2	8	10	
52	Myoporum laetum	8	16	11	
52	Myoporum laetum	3	16	11	
52	Myoporum laetum	2	16	11	
52	Myoporum laetum	2	16	11	
59	Myoporum laetum	5	8	8	
59	Myoporum laetum	3	8	8	
59	Myoporum laetum	2	8	8	
59	Myoporum laetum	2	8	8	
60	Myoporum laetum	2	8	6	
60	Myoporum laetum	2	8	6	
60	Myoporum laetum	2	8	6	
61	Myoporum laetum	3	8	8	
61	Myoporum laetum	2	8	8	
61	Myoporum laetum	2	8	8	
62	Myoporum laetum	3	8	6	
62	Myoporum laetum	2	8	6	
63	Myoporum laetum	3	8	7	
63	Myoporum laetum	2	8	7	
63	Myoporum laetum	2	8	7	
65	Myoporum laetum	5	9	8	
65	Myoporum laetum	4	9	8	
65	Myoporum laetum	3	9	8	
65	Myoporum laetum	3	9	8	
65	Myoporum laetum	3	9	8	
65	Myoporum laetum	2	9	8	
65	Myoporum laetum	2	9	8	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
65	Myoporum laetum	2	9	8	
65	Myoporum laetum	2	9	8	
65	Myoporum laetum	2	9	8	
65	Myoporum laetum	2	9	8	
67	Myoporum laetum	6	10	8	
67	Myoporum laetum	5	10	8	
67	Myoporum laetum	4	10	8	
67	Myoporum laetum	3	10	8	
93	Myoporum laetum	5	15	12	
93	Myoporum laetum	5	15	12	
93	Myoporum laetum	4	15	12	
93	Myoporum laetum	3	15	12	
93	Myoporum laetum	3	15	12	
93	Myoporum laetum	2	15	12	
93	Myoporum laetum	2	15	12	
94	Myoporum laetum	6	15	12	
94	Myoporum laetum	5	15	12	
94	Myoporum laetum	5	15	12	
94	Myoporum laetum	4	15	12	
94	Myoporum laetum	3	15	12	
94	Myoporum laetum	3	15	12	
94	Myoporum laetum	3	15	12	
94	Myoporum laetum	3	15	12	
94	Myoporum laetum	2	15	12	
94	Myoporum laetum	2	15	12	
95	Myoporum laetum	7	15	12	
95	Myoporum laetum	6	15	12	
95	Myoporum laetum	4	15	12	
95	Myoporum laetum	4	15	12	
95	Myoporum laetum	3	15	12	
95	Myoporum laetum	2	15	12	
96	Myoporum laetum	6	15	12	
96	Myoporum laetum	5	15	12	
96	Myoporum laetum	5	15	12	
96	Myoporum laetum	5	15	12	
96	Myoporum laetum	4	15	12	
96	Myoporum laetum	3	15	12	
96	Myoporum laetum	3	15	12	
96	Myoporum laetum	3	15	12	
96	Myoporum laetum	2	15	12	
96	Myoporum laetum	2	15	12	
97	Myoporum laetum	8	15	10	
97	Myoporum laetum	6	15	10	
97	Myoporum laetum	5	15	10	
97	Myoporum laetum	4	15	10	
97	Myoporum laetum	2	15	10	
97	Myoporum laetum	2	15	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
98	Myoporum laetum	6	15	10	
98	Myoporum laetum	4	15	10	
98	Myoporum laetum	4	15	10	
98	Myoporum laetum	4	15	10	
98	Myoporum laetum	3	15	10	
98	Myoporum laetum	3	15	10	
98	Myoporum laetum	2	15	10	
98	Myoporum laetum	2	15	10	
98	Myoporum laetum	2	15	10	
98	Myoporum laetum	2	15	10	
99	Myoporum laetum	7	15	11	
99	Myoporum laetum	7	15	11	
99	Myoporum laetum	5	15	11	
99	Myoporum laetum	4	15	11	
99	Myoporum laetum	4	15	11	
99	Myoporum laetum	2	15	11	
99	Myoporum laetum	2	15	11	
100	Myoporum laetum	6	15	10	
100	Myoporum laetum	4	15	10	
100	Myoporum laetum	4	15	10	
100	Myoporum laetum	3	15	10	
100	Myoporum laetum	3	15	10	
100	Myoporum laetum	2	15	10	
101	Myoporum laetum	10	12	10	
102	Myoporum laetum	6	13	11	
102	Myoporum laetum	6	13	11	
102	Myoporum laetum	6	13	11	
102	Myoporum laetum	5	13	11	
102	Myoporum laetum	4	13	11	
102	Myoporum laetum	4	13	11	
102	Myoporum laetum	4	13	11	
102	Myoporum laetum	3	13	11	
102	Myoporum laetum	2	13	11	
103	Myoporum laetum	6	12	12	
103	Myoporum laetum	5	12	12	
103	Myoporum laetum	4	12	12	
104	Myoporum laetum	5	12	11	
104	Myoporum laetum	4	12	11	
104	Myoporum laetum	4	12	11	
104	Myoporum laetum	3	12	11	
104	Myoporum laetum	3	12	11	
104	Myoporum laetum	3	12	11	
104	Myoporum laetum	2	12	11	
104	Myoporum laetum	2	12	11	
111	Myoporum laetum	6	8	7	
112	Myoporum laetum	9	12	8	
112	Myoporum laetum	7	12	8	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
112	Myoporum laetum	6	12	8	
112	Myoporum laetum	6	12	8	
112	Myoporum laetum	2	12	8	
113	Myoporum laetum	9	14	11	
113	Myoporum laetum	7	14	11	
113	Myoporum laetum	7	14	11	
113	Myoporum laetum	6	14	11	
114	Myoporum laetum	8	15	8	
114	Myoporum laetum	8	15	8	
114	Myoporum laetum	5	15	8	
114	Myoporum laetum	4	15	8	
115	Myoporum laetum	8	14	10	
115	Myoporum laetum	6	14	10	
115	Myoporum laetum	6	14	10	
115	Myoporum laetum	5	14	10	
115	Myoporum laetum	4	14	10	
116	Myoporum laetum	10	14	8	
116	Myoporum laetum	3	14	8	
116	Myoporum laetum	2	14	8	
116	Myoporum laetum	2	14	8	
117	Myoporum laetum	6	14	8	
117	Myoporum laetum	6	14	8	
117	Myoporum laetum	6	14	8	
117	Myoporum laetum	5	14	8	
117	Myoporum laetum	4	14	8	
117	Myoporum laetum	3	14	8	
117	Myoporum laetum	2	14	8	
118	Myoporum laetum	6	16	10	
118	Myoporum laetum	5	16	10	
119	Myoporum laetum	7	14	8	
119	Myoporum laetum	5	14	8	
119	Myoporum laetum	4	14	8	
119	Myoporum laetum	4	14	8	
119	Myoporum laetum	4	14	8	
119	Myoporum laetum	3	14	8	
120	Myoporum laetum	10	12	8	
120	Myoporum laetum	7	12	8	
121	Myoporum laetum	6	14	8	
121	Myoporum laetum	5	14	8	
121	Myoporum laetum	3	14	8	
121	Myoporum laetum	3	14	8	
122	Myoporum laetum	10	14	8	
122	Myoporum laetum	7	14	8	
122	Myoporum laetum	6	14	8	
122	Myoporum laetum	6	14	8	
122	Myoporum laetum	6	14	8	
122	Myoporum laetum	4	14	8	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
122	Myoporum laetum	3	14	8	
123	Myoporum laetum	5	14	7	
123	Myoporum laetum	5	14	7	
123	Myoporum laetum	4	14	7	
123	Myoporum laetum	3	14	7	
124	Myoporum laetum	4	14	8	
124	Myoporum laetum	3	14	8	
124	Myoporum laetum	2	14	8	
124	Myoporum laetum	2	14	8	
125	Myoporum laetum	7	14	8	
125	Myoporum laetum	5	14	8	
125	Myoporum laetum	4	14	8	
125	Myoporum laetum	4	14	8	
126	Myoporum laetum	4	13	9	
126	Myoporum laetum	4	13	9	
126	Myoporum laetum	3	13	9	
126	Myoporum laetum	2	13	9	
127	Myoporum laetum	6	10	8	
127	Myoporum laetum	4	10	8	
127	Myoporum laetum	3	10	8	
145	Myoporum laetum	8	14	10	
145	Myoporum laetum	8	14	10	
145	Myoporum laetum	4	14	10	
145	Myoporum laetum	3	14	10	
146	Myoporum laetum	6	14	10	
146	Myoporum laetum	5	14	10	
146	Myoporum laetum	5	14	10	
146	Myoporum laetum	4	14	10	
149	Myoporum laetum	11	15	11	
149	Myoporum laetum	10	15	11	
149	Myoporum laetum	7	15	11	
151	Myoporum laetum	8	14	12	
151	Myoporum laetum	8	14	12	
151	Myoporum laetum	7	14	12	
151	Myoporum laetum	6	14	12	
155	Myoporum laetum	8	10	8	
155	Myoporum laetum	5	10	8	
157	Myoporum laetum	10	14	11	
158	Myoporum laetum	6	12	12	
158	Myoporum laetum	6	12	12	
158	Myoporum laetum	6	12	12	
158	Myoporum laetum	6	12	12	
158	Myoporum laetum	3	12	12	
160	Myoporum laetum	2	8	10	
160	Myoporum laetum	2	8	10	
160	Myoporum laetum	2	8	10	
161	Myoporum laetum	4	10	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
161	Myoporum laetum	4	10	10	
161	Myoporum laetum	4	10	10	
161	Myoporum laetum	4	10	10	
161	Myoporum laetum	2	10	10	
162	Myoporum laetum	5	10	8	
162	Myoporum laetum	2	10	8	
162	Myoporum laetum	2	10	8	
163	Myoporum laetum	6	15	11	
163	Myoporum laetum	4	15	11	
163	Myoporum laetum	4	15	11	
163	Myoporum laetum	4	15	11	
169	Myoporum laetum	7			
170	Myoporum laetum	9			
171	Myoporum laetum	8			
172	Myoporum laetum	9	15	12	
172	Myoporum laetum	9	15	12	
172	Myoporum laetum	8	15	12	
173	Myoporum laetum	9	14	8	
173	Myoporum laetum	6	14	8	
174	Myoporum laetum	8	12	10	
174	Myoporum laetum	5	12	10	
174	Myoporum laetum	4	12	10	
177	Myoporum laetum	5	10	12	
177	Myoporum laetum	3	10	12	
177	Myoporum laetum	3	10	12	
177	Myoporum laetum	3	10	12	
177	Myoporum laetum	2	10	12	
177	Myoporum laetum	2	10	12	
177	Myoporum laetum	2	10	12	
177	Myoporum laetum	2	10	12	
177	Myoporum laetum	2	10	12	
178	Myoporum laetum	4	8	6	
178	Myoporum laetum	2	8	6	
179	Myoporum laetum	3	10	8	
179	Myoporum laetum	2	10	8	
179	Myoporum laetum	2	10	8	
180	Myoporum laetum	6	15	13	
180	Myoporum laetum	5	15	13	
180	Myoporum laetum	4	15	13	
180	Myoporum laetum	3	15	13	
182	Myoporum laetum	7	12	10	
182	Myoporum laetum	4	12	10	
183	Myoporum laetum	8	8	8	
183	Myoporum laetum	2	8	8	
184	Myoporum laetum	4			
184	Myoporum laetum	3			
184	Myoporum laetum	2			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
185	Myoporum laetum	4	10	8	
185	Myoporum laetum	2	10	8	
185	Myoporum laetum	2	10	8	
186	Myoporum laetum	4	9	8	
187	Myoporum laetum	3	8	7	
187	Myoporum laetum	2	8	7	
187	Myoporum laetum	2	8	7	
187	Myoporum laetum	2	8	7	
188	Myoporum laetum	9	15	12	
189	Myoporum laetum	10	15	12	
189	Myoporum laetum	9	15	12	
189	Myoporum laetum	6	15	12	
192	Myoporum laetum	4	10	8	
192	Myoporum laetum	3	10	8	
192	Myoporum laetum	2	10	8	
193	Myoporum laetum	4	10	8	
193	Myoporum laetum	4	10	8	
204	Myoporum laetum	6	10	8	
204	Myoporum laetum	3	10	8	
204	Myoporum laetum	2	10	8	
204	Myoporum laetum	2	10	8	
204	Myoporum laetum	2	10	8	
204	Myoporum laetum	2	10	8	
204	Myoporum laetum	2	10	8	
205	Myoporum laetum	8	12	10	
205	Myoporum laetum	3	12	10	
205	Myoporum laetum	2	12	10	
205	Myoporum laetum	2	12	10	
205	Myoporum laetum	2	12	10	
205	Myoporum laetum	2	12	10	
206	Myoporum laetum	5	10	8	
206	Myoporum laetum	3	10	8	
206	Myoporum laetum	2	10	8	
206	Myoporum laetum	2	10	8	
206	Myoporum laetum	2	10	8	
207	Myoporum laetum	4	12	10	
207	Myoporum laetum	3	12	10	
207	Myoporum laetum	3	12	10	
207	Myoporum laetum	3	12	10	
207	Myoporum laetum	2	12	10	
209	Myoporum laetum	4	11	10	
209	Myoporum laetum	4	11	10	
209	Myoporum laetum	3	11	10	
209	Myoporum laetum	3	11	10	
209	Myoporum laetum	2	11	10	
209	Myoporum laetum	2	11	10	
209	Myoporum laetum	2	11	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
225	Myoporum laetum	2	12	10	
225	Myoporum laetum	2	12	10	
227	Myoporum laetum	2	10	8	
227	Myoporum laetum	2	10	8	
228	Myoporum laetum	3	10	8	
228	Myoporum laetum	3	10	8	
228	Myoporum laetum	2	10	8	
228	Myoporum laetum	2	10	8	
229	Myoporum laetum	2			
231	Myoporum laetum	5	12	8	
235	Myoporum laetum	10	15	8	
240	Myoporum laetum	3	15	6	
240	Myoporum laetum	2	15	6	
699	Myoporum laetum	10			
712	Myoporum laetum	4			
712	Myoporum laetum	4			
721	Myoporum laetum	8			
722	Myoporum laetum	8			
723	Myoporum laetum	8			
724	Myoporum laetum	10			
745	Myoporum laetum	8			
746	Myoporum laetum	6			
747	Myoporum laetum	8			
748	Myoporum laetum	8			
751	Myoporum laetum	6			
752	Myoporum laetum	10			
753	Myoporum laetum	8			
761	Myoporum laetum	8			
762	Myoporum laetum	8			
763	Myoporum laetum	8			
764	Myoporum laetum	7			
922	Myoporum laetum	5			
963	Myoporum laetum	10			
964	Myoporum laetum	6			
964	Myoporum laetum	10			
964	Myoporum laetum	8			
216	Myrica sp.	2	12	10	
298	Olea europaea	9	20	15	Y
298	Olea europaea	7	20	15	Y
299	Olea europaea	10	20	15	Y
299	Olea europaea	5	20	15	Y
300	Olea europaea	12	20	15	Y
300	Olea europaea	6	20	15	Y
301	Olea europaea	6	15	15	Y
301	Olea europaea	5	15	15	Y
301	Olea europaea	4	15	15	Y
309	Olea europaea	11	15	15	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
310	Olea europaea	12			Y
311	Olea europaea	12			Y
311	Olea europaea	12			Y
312	Olea europaea	10	25	15	Y
312	Olea europaea	9	25	15	Y
312	Olea europaea	9	25	15	Y
317	Olea europaea	8	25	10	Y
334	Olea europaea	6	25	15	Y
369	Olea europaea	12			Y
451	Olea europaea	8	20	12	Y
452	Olea europaea	10	20	12	Y
452	Olea europaea	9	20	12	Y
453	Olea europaea	6	20	12	Y
453	Olea europaea	6	20	12	Y
453	Olea europaea	5	20	12	Y
454	Olea europaea	14			Y
455	Olea europaea	8	20	10	Y
455	Olea europaea	6	20	10	Y
455	Olea europaea	4	20	10	Y
456	Olea europaea	10	20	6	Y
456	Olea europaea	8	20	6	Y
457	Olea europaea	7	20	8	Y
457	Olea europaea	4	20	8	Y
458	Olea europaea	7	20	8	Y
458	Olea europaea	6	20	8	Y
458	Olea europaea	4	20	8	Y
459	Olea europaea	6	20	10	Y
459	Olea europaea	6	20	10	Y
459	Olea europaea	6	20	10	Y
460	Olea europaea	8	20	8	Y
460	Olea europaea	8	20	8	Y
460	Olea europaea	4	20	8	Y
461	Olea europaea	7	20	10	Y
461	Olea europaea	6	20	10	Y
462	Olea europaea	7	20	8	Y
462	Olea europaea	7	20	8	Y
462	Olea europaea	7	20	8	Y
463	Olea europaea	7	20	8	Y
463	Olea europaea	6	20	8	Y
463	Olea europaea	5	20	8	Y
464	Olea europaea	8	20	8	Y
464	Olea europaea	8	20	8	Y
464	Olea europaea	4	20	8	Y
465	Olea europaea	9	20	10	Y
465	Olea europaea	7	20	10	Y
465	Olea europaea	6	20	10	Y
466	Olea europaea	9	20	8	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
467	Olea europaea	7	20	8	Y
467	Olea europaea	7	20	8	Y
468	Olea europaea	8	20	8	Y
468	Olea europaea	6	20	8	Y
468	Olea europaea	6	20	8	Y
468	Olea europaea	3	20	8	Y
468	Olea europaea	3	20	8	Y
469	Olea europaea	7	20	10	Y
469	Olea europaea	6	20	10	Y
469	Olea europaea	5	20	10	Y
470	Olea europaea	9	20	6	Y
471	Olea europaea	9	20	6	Y
471	Olea europaea	5	20	6	Y
471	Olea europaea	4	20	6	Y
472	Olea europaea	8	20	8	Y
472	Olea europaea	6	20	8	Y
473	Olea europaea	6	20	10	Y
473	Olea europaea	6	20	10	Y
474	Olea europaea	8	20	8	Y
474	Olea europaea	8	20	8	Y
475	Olea europaea	9	20	6	Y
475	Olea europaea	7	20	6	Y
476	Olea europaea	8	20	10	Y
476	Olea europaea	7	20	10	Y
477	Olea europaea	8	20	8	Y
477	Olea europaea	7	20	8	Y
478	Olea europaea	8	20	8	Y
480	Olea europaea	11	20	10	Y
481	Olea europaea	11	20	8	Y
481	Olea europaea	8	20	8	Y
482	Olea europaea	7	20	8	Y
482	Olea europaea	7	20	8	Y
484	Olea europaea	8	20	8	Y
484	Olea europaea	7	20	8	Y
485	Olea europaea	10	20	8	Y
485	Olea europaea	8	20	8	Y
486	Olea europaea	7	20	8	Y
486	Olea europaea	6	20	8	Y
486	Olea europaea	4	20	8	Y
489	Olea europaea	6	20	10	Y
489	Olea europaea	6	20	10	Y
489	Olea europaea	4	20	10	Y
490	Olea europaea	6	20	8	Y
490	Olea europaea	6	20	8	Y
491	Olea europaea	8	20	10	Y
491	Olea europaea	5	20	10	Y
491	Olea europaea	5	20	10	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
492	Olea europaea	8	20	8	Y
492	Olea europaea	7	20	8	Y
492	Olea europaea	5	20	8	Y
493	Olea europaea	11	20	8	Y
493	Olea europaea	8	20	8	Y
494	Olea europaea	9	20	8	Y
494	Olea europaea	6	20	8	Y
495	Olea europaea	8	20	8	Y
495	Olea europaea	7	20	8	Y
496	Olea europaea	9	20	10	Y
496	Olea europaea	7	20	10	Y
497	Olea europaea	8	20	10	Y
497	Olea europaea	7	20	10	Y
497	Olea europaea	5	20	10	Y
498	Olea europaea	9	20	8	Y
498	Olea europaea	6	20	8	Y
498	Olea europaea	6	20	8	Y
499	Olea europaea	15	20	8	Y
500	Olea europaea	10	20	8	Y
500	Olea europaea	8	20	8	Y
502	Olea europaea	7	20	10	Y
502	Olea europaea	7	20	10	Y
502	Olea europaea	5	20	10	Y
503	Olea europaea	9	20	10	Y
503	Olea europaea	8	20	10	Y
504	Olea europaea	9	20	8	Y
504	Olea europaea	7	20	8	Y
505	Olea europaea	8	20	10	Y
505	Olea europaea	6	20	10	Y
506	Olea europaea	10	20	8	Y
506	Olea europaea	9	20	8	Y
507	Olea europaea	8	20	10	Y
507	Olea europaea	6	20	10	Y
508	Olea europaea	6	20	8	Y
508	Olea europaea	5	20	8	Y
509	Olea europaea	7	20	8	Y
509	Olea europaea	7	20	8	Y
509	Olea europaea	4	20	8	Y
509	Olea europaea	3	20	8	Y
510	Olea europaea	7	20	10	Y
510	Olea europaea	7	20	10	Y
510	Olea europaea	5	20	10	Y
511	Olea europaea	8	20	10	Y
511	Olea europaea	7	20	10	Y
512	Olea europaea	13	20	10	Y
512	Olea europaea	8	20	10	Y
513	Olea europaea	14			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
514	Olea europaea	6	20	8	Y
514	Olea europaea	6	20	8	Y
514	Olea europaea	5	20	8	Y
514	Olea europaea	5	20	8	Y
514	Olea europaea	4	20	8	Y
515	Olea europaea	9	20	10	Y
515	Olea europaea	7	20	10	Y
515	Olea europaea	5	20	10	Y
516	Olea europaea	12			Y
517	Olea europaea	7	20	10	Y
517	Olea europaea	7	20	10	Y
517	Olea europaea	5	20	10	Y
517	Olea europaea	4	20	10	Y
518	Olea europaea	9	20	10	Y
518	Olea europaea	6	20	10	Y
519	Olea europaea	12			Y
521	Olea europaea	13			Y
522	Olea europaea	9	20	15	Y
522	Olea europaea	8	20	15	Y
522	Olea europaea	7	20	15	Y
523	Olea europaea	9	25	15	Y
523	Olea europaea	8	25	15	Y
524	Olea europaea	6	20	10	Y
524	Olea europaea	6	20	10	Y
525	Olea europaea	7	20	10	Y
525	Olea europaea	6	20	10	Y
526	Olea europaea	9	20	8	Y
526	Olea europaea	8	20	8	Y
526	Olea europaea	7	20	8	Y
527	Olea europaea	9	20	10	Y
527	Olea europaea	4	20	10	Y
528	Olea europaea	8	20	10	Y
529	Olea europaea	9	15	15	Y
529	Olea europaea	7	15	15	Y
529	Olea europaea	6	15	15	Y
529	Olea europaea	6	15	15	Y
532	Olea europaea	8	15	15	Y
532	Olea europaea	7	15	15	Y
532	Olea europaea	6	15	15	Y
532	Olea europaea	6	15	15	Y
533	Olea europaea	6	15	15	Y
533	Olea europaea	6	15	15	Y
533	Olea europaea	5	15	15	Y
535	Olea europaea	6	20	15	Y
535	Olea europaea	5	20	15	Y
535	Olea europaea	5	20	15	Y
535	Olea europaea	5	20	15	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
535	Olea europaea	4	20	15	Y
537	Olea europaea	7	20	15	Y
537	Olea europaea	6	20	15	Y
537	Olea europaea	3	20	15	Y
538	Olea europaea	6	20	15	Y
538	Olea europaea	6	20	15	Y
538	Olea europaea	4	20	15	Y
539	Olea europaea	9	20	15	Y
539	Olea europaea	7	20	15	Y
539	Olea europaea	5	20	15	Y
539	Olea europaea	4	20	15	Y
540	Olea europaea	10	20	15	Y
540	Olea europaea	8	20	15	Y
540	Olea europaea	7	20	15	Y
541	Olea europaea	10	20	15	Y
541	Olea europaea	8	20	15	Y
551	Olea europaea	11	20	15	Y
551	Olea europaea	10	20	15	Y
551	Olea europaea	9	20	15	Y
552	Olea europaea	13	20	15	Y
552	Olea europaea	9	20	15	Y
553	Olea europaea	22			Y
554	Olea europaea	15			Y
555	Olea europaea	16			Y
556	Olea europaea	14			Y
556	Olea europaea	13			Y
557	Olea europaea	13			Y
558	Olea europaea	12			Y
559	Olea europaea	12			Y
560	Olea europaea	13			Y
560	Olea europaea	12			Y
561	Olea europaea	12			Y
562	Olea europaea	8	20	10	Y
563	Olea europaea	9	15	18	Y
587	Olea europaea	8	20		Y
588	Olea europaea	12			Y
757	Olea europaea	10		20	Y
758	Olea europaea	8		15	Y
857	Olea europaea	8		15	Y
858	Olea europaea	11		15	Y
128	Olea europaea	4	11	6	
128	Olea europaea	3	11	6	
128	Olea europaea	2	11	6	
129	Olea europaea	6	11	8	
129	Olea europaea	4	11	8	
129	Olea europaea	3	11	8	
129	Olea europaea	3	11	8	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
129	Olea europaea	2	11	8	
129	Olea europaea	2	11	8	
302	Olea europaea	11	15	12	
302	Olea europaea	6	15	12	
302	Olea europaea	2	15	12	
303	Olea europaea	8	15	10	
303	Olea europaea	7	15	10	
304	Olea europaea	8	15	12	
304	Olea europaea	6	15	12	
304	Olea europaea	6	15	12	
305	Olea europaea	8	15	10	
305	Olea europaea	8	15	10	
305	Olea europaea	6	15	10	
306	Olea europaea	5	12	8	
307	Olea europaea	6	10	6	
308	Olea europaea	6	10	8	
310	Olea europaea	9			
310	Olea europaea	8			
311	Olea europaea	10			
313	Olea europaea	9	10	6	
335	Olea europaea	5	15	10	
340	Olea europaea	6			
340	Olea europaea	6			
358	Olea europaea	7	15	10	
361	Olea europaea	9	15	10	
365	Olea europaea	4	15	10	
370	Olea europaea	8	15	10	
372	Olea europaea	4	15	10	
372	Olea europaea	3	15	10	
372	Olea europaea	3	15	10	
479	Olea europaea	6	15	6	
483	Olea europaea	8	15	8	
483	Olea europaea	7	15	8	
487	Olea europaea	8	15	10	
487	Olea europaea	6	15	10	
487	Olea europaea	5	15	10	
487	Olea europaea	4	15	10	
488	Olea europaea	8	15	8	
488	Olea europaea	7	15	8	
488	Olea europaea	6	15	8	
488	Olea europaea	4	15	8	
501	Olea europaea	8	15	8	
501	Olea europaea	8	15	8	
501	Olea europaea	6	15	8	
513	Olea europaea	10			
519	Olea europaea	10			
519	Olea europaea	6			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
520	Olea europaea	8	15	10	
520	Olea europaea	7	15	10	
520	Olea europaea	6	15	10	
520	Olea europaea	5	15	10	
530	Olea europaea	10	15	10	
530	Olea europaea	8	15	10	
530	Olea europaea	7	15	10	
531	Olea europaea	8	15	10	
531	Olea europaea	7	15	10	
531	Olea europaea	7	15	10	
534	Olea europaea	9	15	12	
534	Olea europaea	6	15	12	
534	Olea europaea	4	15	12	
536	Olea europaea	7	15	10	
536	Olea europaea	6	15	10	
536	Olea europaea	4	15	10	
553	Olea europaea	9			
554	Olea europaea	9			
554	Olea europaea	8			
555	Olea europaea	10			
557	Olea europaea	11			
557	Olea europaea	10			
558	Olea europaea	11			
558	Olea europaea	10			
559	Olea europaea	11			
560	Olea europaea	7			
564	Olea europaea	11	15	8	
576	Olea europaea	6			
591	Olea europaea	6	18		
592	Olea europaea	5			
594	Olea europaea	10			
595	Olea europaea	4			
632	Olea europaea	8			
645	Olea europaea	4			
760	Olea europaea	6			
578	Pinus radiata	28			Y
579	Pinus radiata	22			Y
580	Pinus radiata	26			Y
581	Pinus radiata	24			Y
583	Pinus radiata	28			Y
584	Pinus radiata	52			Y
589	Pinus radiata	16			Y
590	Pinus radiata	19			Y
593	Pinus radiata	32			Y
605	Pinus radiata	16			Y
606	Pinus radiata	10	20		Y
617	Pinus radiata	14			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
618	Pinus radiata	16			Y
620	Pinus radiata	22			Y
622	Pinus radiata	30			Y
623	Pinus radiata	27			Y
624	Pinus radiata	29			Y
625	Pinus radiata	31			Y
627	Pinus radiata	14			Y
628	Pinus radiata	27			Y
628	Pinus radiata	26			Y
630	Pinus radiata	51			Y
631	Pinus radiata	32			Y
633	Pinus radiata	53			Y
634	Pinus radiata	47			Y
635	Pinus radiata	16			Y
638	Pinus radiata	16			Y
639	Pinus radiata	12			Y
640	Pinus radiata	28			Y
641	Pinus radiata	22			Y
642	Pinus radiata	33			Y
647	Pinus radiata	25			Y
648	Pinus radiata	12			Y
649	Pinus radiata	22			Y
651	Pinus radiata	28			Y
652	Pinus radiata	44			Y
653	Pinus radiata	52			Y
664	Pinus radiata	10	20		Y
678	Pinus radiata	42			Y
689	Pinus radiata	13			Y
691	Pinus radiata	19			Y
692	Pinus radiata	16			Y
693	Pinus radiata	17			Y
694	Pinus radiata	15			Y
725	Pinus radiata	15			Y
726	Pinus radiata	21			Y
728	Pinus radiata	18			Y
729	Pinus radiata	18			Y
730	Pinus radiata	16			Y
739	Pinus radiata	14			Y
740	Pinus radiata	16			Y
743	Pinus radiata	31			Y
744	Pinus radiata	18			Y
756	Pinus radiata	19			Y
756	Pinus radiata	16			Y
771	Pinus radiata	24			Y
772	Pinus radiata	24			Y
773	Pinus radiata	24			Y
774	Pinus radiata	28			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
775	Pinus radiata	36			Y
776	Pinus radiata	33			Y
777	Pinus radiata	21			Y
778	Pinus radiata	22			Y
779	Pinus radiata	21			Y
621	Pinus radiata	10			
577	Pinus radiata	24			Y
36	Pinus sp.	15	18	12	Y
47	Pinus sp.	16			Y
70	Pinus sp.	12			Y
71	Pinus sp.	18			Y
75	Pinus sp.	18			Y
76	Pinus sp.	15			Y
77	Pinus sp.	14			Y
79	Pinus sp.	27			Y
80	Pinus sp.	12			Y
81	Pinus sp.	12			Y
82	Pinus sp.	17			Y
83	Pinus sp.	19			Y
84	Pinus sp.	15			Y
85	Pinus sp.	14			Y
86	Pinus sp.	14			Y
86	Pinus sp.	12			Y
87	Pinus sp.	19			Y
88	Pinus sp.	12			Y
89	Pinus sp.	14			Y
90	Pinus sp.	9	30	8	Y
91	Pinus sp.	14			Y
106	Pinus sp.	13			Y
108	Pinus sp.	14			Y
109	Pinus sp.	12			Y
139	Pinus sp.	27			Y
140	Pinus sp.	20			Y
141	Pinus sp.	26			Y
142	Pinus sp.	12			Y
143	Pinus sp.	24			Y
176	Pinus sp.	10	20	14	Y
198	Pinus sp.	12			Y
200	Pinus sp.	12			Y
201	Pinus sp.	12			Y
264	Pinus sp.	11	30	20	Y
264	Pinus sp.	10	30	20	Y
264	Pinus sp.	9	30	20	Y
264	Pinus sp.	8	30	20	Y
264	Pinus sp.	4	30	20	Y
264	Pinus sp.	3	30	20	Y
265	Pinus sp.	34			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
266	Pinus sp.	13			Y
266	Pinus sp.	12			Y
267	Pinus sp.	12			Y
268	Pinus sp.	15			Y
269	Pinus sp.	18			Y
270	Pinus sp.	16			Y
271	Pinus sp.	24			Y
272	Pinus sp.	6	6	20	Y
273	Pinus sp.	15			Y
274	Pinus sp.	15			Y
275	Pinus sp.	18			Y
275	Pinus sp.	14			Y
276	Pinus sp.	25			Y
277	Pinus sp.	12			Y
277	Pinus sp.	12			Y
278	Pinus sp.	26			Y
279	Pinus sp.	8	30	8	Y
280	Pinus sp.	26			Y
282	Pinus sp.	24			Y
283	Pinus sp.	15			Y
284	Pinus sp.	18			Y
285	Pinus sp.	7	25	15	Y
285	Pinus sp.	6	25	15	Y
285	Pinus sp.	4	25	15	Y
286	Pinus sp.	19			Y
287	Pinus sp.	18			Y
288	Pinus sp.	16			Y
289	Pinus sp.	21			Y
290	Pinus sp.	6	15	20	Y
290	Pinus sp.	4	15	20	Y
291	Pinus sp.	15			Y
292	Pinus sp.	18			Y
293	Pinus sp.	24			Y
294	Pinus sp.	10	20	15	Y
294	Pinus sp.	7	20	15	Y
294	Pinus sp.	3	20	15	Y
295	Pinus sp.	10	30	20	Y
295	Pinus sp.	8	30	20	Y
295	Pinus sp.	6	30	20	Y
333	Pinus sp.	24			Y
337	Pinus sp.	25			Y
353	Pinus sp.	28			Y
354	Pinus sp.	28			Y
355	Pinus sp.	27			Y
356	Pinus sp.	16			Y
357	Pinus sp.	32			Y
359	Pinus sp.	27			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
360	Pinus sp.	14			Y
362	Pinus sp.	18			Y
367	Pinus sp.	28			Y
368	Pinus sp.	20			Y
371	Pinus sp.	28			Y
859	Pinus sp.	12			Y
860	Pinus sp.	17			Y
861	Pinus sp.	16			Y
862	Pinus sp.	10		20	Y
862	Pinus sp.	10		20	Y
863	Pinus sp.	10		22	Y
865	Pinus sp.	8		18	Y
865	Pinus sp.	6		18	Y
865	Pinus sp.	4		18	Y
866	Pinus sp.	10		20	Y
867	Pinus sp.	13			Y
868	Pinus sp.	10		20	Y
869	Pinus sp.	17			Y
870	Pinus sp.	10		20	Y
871	Pinus sp.	10		18	Y
872	Pinus sp.	6		18	Y
872	Pinus sp.	4		18	Y
873	Pinus sp.	8		16	Y
875	Pinus sp.	16			Y
876	Pinus sp.	20			Y
877	Pinus sp.	20			Y
877	Pinus sp.	15			Y
878	Pinus sp.	30			Y
879	Pinus sp.	47			Y
968	Pinus sp.	24			Y
969	Pinus sp.	20			Y
970	Pinus sp.	20			Y
971	Pinus sp.	25			Y
972	Pinus sp.	16			Y
973	Pinus sp.	16			Y
973	Pinus sp.	14			Y
974	Pinus sp.	12			Y
975	Pinus sp.	34			Y
976	Pinus sp.	20			Y
977	Pinus sp.	20			Y
978	Pinus sp.	30			Y
979	Pinus sp.	29			Y
980	Pinus sp.	17			Y
981	Pinus sp.	29			Y
981	Pinus sp.	20			Y
982	Pinus sp.	20			Y
982	Pinus sp.	16			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
983	Pinus sp.	20			Y
984	Pinus sp.	21			Y
985	Pinus sp.	37			Y
986	Pinus sp.	20			Y
987	Pinus sp.	25			Y
987	Pinus sp.	22			Y
988	Pinus sp.	18			Y
989	Pinus sp.	10		23	Y
990	Pinus sp.	12			Y
991	Pinus sp.	26			Y
992	Pinus sp.	12			Y
993	Pinus sp.	8		17	Y
994	Pinus sp.	16			Y
995	Pinus sp.	19			Y
996	Pinus sp.	20			Y
997	Pinus sp.	20			Y
998	Pinus sp.	30			Y
999	Pinus sp.	16			Y
1000	Pinus sp.	20			Y
1001	Pinus sp.	6		20	Y
1001	Pinus sp.	6		20	Y
1001	Pinus sp.	6		20	Y
1001	Pinus sp.	6		20	Y
1001	Pinus sp.	4		20	Y
1001	Pinus sp.	2		20	Y
1002	Pinus sp.	22			Y
1003	Pinus sp.	13			Y
1004	Pinus sp.	10		18	Y
1007	Pinus sp.	9		18	Y
1007	Pinus sp.	8		18	Y
1009	Pinus sp.	20			Y
1010	Pinus sp.	24			Y
1010	Pinus sp.	13			Y
1038	Pinus sp.	19			Y
1039	Pinus sp.	12			Y
1040	Pinus sp.	12			Y
36	Pinus sp.	6	18	12	
36	Pinus sp.	5	18	12	
36	Pinus sp.	4	18	12	
37	Pinus sp.	9	18	8	
48	Pinus sp.	4	10	12	
78	Pinus sp.	10			
79	Pinus sp.	11			
80	Pinus sp.	7			
80	Pinus sp.	4			
86	Pinus sp.	11			
86	Pinus sp.	8			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
107	Pinus sp.	7	9	6	
109	Pinus sp.	11			
109	Pinus sp.	10			
110	Pinus sp.	7	7	7	
110	Pinus sp.	4			
110	Pinus sp.	3			
110	Pinus sp.	2			
131	Pinus sp.	11	8	4	
131	Pinus sp.	2	8	4	
132	Pinus sp.	4	10	6	
133	Pinus sp.	4	10	6	
134	Pinus sp.	6	9	5	
135	Pinus sp.	10	15	8	
136	Pinus sp.	10	14	6	
137	Pinus sp.	6	12	6	
195	Pinus sp.	6	18	10	
196	Pinus sp.	4	12	7	
197	Pinus sp.	7	12	10	
199	Pinus sp.	5	10	8	
199	Pinus sp.	4	10	8	
266	Pinus sp.	8			
266	Pinus sp.	7			
542	Pinus sp.	4	15	8	
542	Pinus sp.	4	15	8	
542	Pinus sp.	3	15	8	
543	Pinus sp.	6	15	10	
543	Pinus sp.	6	15	10	
543	Pinus sp.	4	15	10	
543	Pinus sp.	4	15	10	
615	Pinus sp.	6			
666	Pinus sp.	5			
859	Pinus sp.	8			
864	Pinus sp.	10			
874	Pinus sp.	11			
877	Pinus sp.	10			
996	Pinus sp.	9			
996	Pinus sp.	8			
1005	Pinus sp.	8			
1006	Pinus sp.	11			
1006	Pinus sp.	6			
1008	Pinus sp.	8			
601	Podocarpus sp.	8	30		Y
602	Podocarpus sp.	5	25		Y
717	Populus sp.	12			Y
718	Populus sp.	10	22		Y
144	Populus sp.	15			Y
144	Populus sp.	10			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
144	Populus sp.	8			
38	Quercus agrifolia	14	17	20	Y
38	Quercus agrifolia	9	17	20	Y
38	Quercus agrifolia	7	17	20	Y
38	Quercus agrifolia	6	17	20	Y
72	Quercus agrifolia	8	20	12	Y
72	Quercus agrifolia	6	20	12	Y
72	Quercus agrifolia	6	20	12	Y
28	Quercus agrifolia	8	10	10	
28	Quercus agrifolia	6	10	10	
28	Quercus agrifolia	6	10	10	
29	Quercus agrifolia	7	10	11	
29	Quercus agrifolia	6	10	11	
29	Quercus agrifolia	5	10	11	
29	Quercus agrifolia	4	10	11	
39	Quercus agrifolia	3	8	7	
39	Quercus agrifolia	2	8	7	
39	Quercus agrifolia	2	8	7	
49	Quercus agrifolia	6	14	12	
49	Quercus agrifolia	6	14	12	
49	Quercus agrifolia	6	14	12	
50	Quercus agrifolia	8	12	12	
50	Quercus agrifolia	4	12	12	
50	Quercus agrifolia	3	12	12	
50	Quercus agrifolia	3	12	12	
51	Quercus agrifolia	9	10	12	
51	Quercus agrifolia	7	10	12	
51	Quercus agrifolia	6	10	12	
51	Quercus agrifolia	4	10	12	
51	Quercus agrifolia	4	10	12	
51	Quercus agrifolia	4	10	12	
53	Quercus agrifolia	6	15	11	
53	Quercus agrifolia	6	15	11	
53	Quercus agrifolia	4	15	11	
53	Quercus agrifolia	4	15	11	
53	Quercus agrifolia	4	15	11	
53	Quercus agrifolia	3	15	11	
55	Quercus agrifolia	5	10	8	
55	Quercus agrifolia	2	10	8	
55	Quercus agrifolia	2	10	8	
57	Rhamnus californica	8	10	8	
57	Rhamnus californica	3	10	8	
57	Rhamnus californica	2	10	8	
57	Rhamnus californica	2	10	8	
159	Salix laevigata	22			Y
166	Salix laevigata	11	15	25	Y
215	Salix laevigata	7	25	15	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
215	Salix laevigata	6	25	15	Y
215	Salix laevigata	2	25	15	Y
217	Salix laevigata	6	25	6	Y
218	Salix laevigata	18			Y
219	Salix laevigata	13			Y
221	Salix laevigata	9	20	15	Y
221	Salix laevigata	5	20	15	Y
221	Salix laevigata	4	20	15	Y
238	Salix laevigata	4	25	15	Y
238	Salix laevigata	3	25	15	Y
238	Salix laevigata	3	25	15	Y
239	Salix laevigata	6	20	8	Y
244	Salix laevigata	5	20	15	Y
244	Salix laevigata	4	20	15	Y
244	Salix laevigata	3	20	15	Y
244	Salix laevigata	3	20	15	Y
656	Salix laevigata	12			Y
1042	Salix laevigata	3	15	30	Y
1042	Salix laevigata	3	15	30	Y
1042	Salix laevigata	3	15	30	Y
1042	Salix laevigata	2	15	30	Y
1042	Salix laevigata	2	15	30	Y
1042	Salix laevigata	2	15	30	Y
1042	Salix laevigata	2	15	30	Y
1042	Salix laevigata	2	15	30	Y
159	Salix laevigata	8			
159	Salix laevigata	7			
159	Salix laevigata	7			
159	Salix laevigata	6			
159	Salix laevigata	6			
159	Salix laevigata	5			
159	Salix laevigata	5			
165	Salix laevigata	2	10	5	
165	Salix laevigata	2	10	5	
202	Salix laevigata	11	17	14	
202	Salix laevigata	10	17	14	
202	Salix laevigata	9	17	14	
202	Salix laevigata	7	17	14	
224	Salix laevigata	6	15	12	
224	Salix laevigata	4	15	12	
224	Salix laevigata	3	15	12	
224	Salix laevigata	3	15	12	
241	Salix laevigata	6	8	4	
242	Salix laevigata	3	15	12	
242	Salix laevigata	2	15	12	
245	Salix laevigata	11	15	10	
246	Salix laevigata	3	8	6	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
656	Salix laevigata	5			
656	Salix laevigata	3			
656	Salix laevigata	2			
1028	Sequoia sempervirens	8	25	15	Y
1029	Sequoia sempervirens	8	25	15	Y
1030	Sequoia sempervirens	11	25	15	Y
1031	Sequoia sempervirens	11	25	15	Y
1032	Sequoia sempervirens	6	25	15	Y
1033	Sequoia sempervirens	6	25	15	Y
1034	Sequoia sempervirens	11	25	15	Y
1035	Sequoia sempervirens	8	25	15	Y
1036	Sequoia sempervirens	5	20	10	Y
352	Sequoia sempervirens	19			Y
1037	Sequoia sempervirens	3	15	8	
347	Sequoiadendron giganticum	6	15	6	
637	Ulmus parviflora	6	20		Y
643	Ulmus parviflora	15			Y
644	Ulmus parviflora	15			Y
675	Ulmus parviflora	10	25		Y
676	Ulmus parviflora	12			Y
637	Ulmus parviflora	5			
58	Umbellularia californica	6	10	11	
58	Umbellularia californica	5	10	11	
58	Umbellularia californica	3	10	11	
58	Umbellularia californica	2	10	11	
17	Unknown	14			Y
68	Unknown	8	25	18	Y
68	Unknown	8	25	18	Y
68	Unknown	7	25	18	Y
68	Unknown	7	25	18	Y
68	Unknown	5	25	18	Y
68	Unknown	4	25	18	Y
69	Unknown	26			Y
69	Unknown	16			Y
567	Unknown	8	20		Y
568	Unknown	7	22		Y
569	Unknown	8	24		Y
572	Unknown	6	25		Y
573	Unknown	10	30		Y
574	Unknown	5	20		Y
575	Unknown	8	20		Y
582	Unknown	8	22		Y
585	Unknown	8	20		Y
598	Unknown	8	30		Y
650	Unknown	8		16	Y
655	Unknown	16			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
657	Unknown	18			Y
679	Unknown	16			Y
686	Unknown	6		20	Y
687	Unknown	19		25	Y
703	Unknown	14			Y
704	Unknown	12			Y
713	Unknown	12			Y
715	Unknown	14			Y
733	Unknown	10		17	Y
766	Unknown	6		15	Y
767	Unknown	28			Y
917	Unknown	18			Y
918	Unknown	15			Y
939	Unknown	16			Y
17	Unknown	8			
17	Unknown	6			
566	Unknown	6			
570	Unknown	4			
596	Unknown	6			
603	Unknown	8	18		
604	Unknown	8			
607	Unknown	6			
608	Unknown	6			
616	Unknown	4			
619	Unknown	4			
646	Unknown	6			
654	Unknown	8			
658	Unknown	8			
684	Unknown	6			
684	Unknown	6			
704	Unknown	8			
704	Unknown	8			
704	Unknown	8			
704	Unknown	5			
714	Unknown	6			
731	Unknown	5			
732	Unknown	5			
742	Unknown	5			
882	Unknown	10			
883	Unknown	10			
884	Unknown	9			
886	Unknown	10			
888	Unknown	11			
890	Unknown	8			
891	Unknown	11			
892	Unknown	11			
893	Unknown	8			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
894	Unknown	10			
895	Unknown	6			
899	Unknown	11			
902	Unknown	11			
906	Unknown	10			
907	Unknown	9			
910	Unknown	9			
912	Unknown	6			
913	Unknown	10			
914	Unknown	10			
915	Unknown	9			
916	Unknown	9.5			
919	Unknown	8			
920	Unknown	6			
921	Unknown	10			
923	Unknown	3			
924	Unknown	4			
925	Unknown	2			
926	Unknown	8			
927	Unknown	2			
928	Unknown	8			
929	Unknown	3			
930	Unknown	8			
931	Unknown	3			
932	Unknown	10			
933	Unknown	2			
934	Unknown	9			
935	Unknown	2			
936	Unknown	10			
937	Unknown	2			
938	Unknown	10			
940	Unknown	2			
941	Unknown	2.5			
942	Unknown	3			
943	Unknown	2			
944	Unknown	8			
945	Unknown	7			
946	Unknown	3			
947	Unknown	7			
948	Unknown	3			
949	Unknown	7			
950	Unknown	8			
951	Unknown	5			
952	Unknown	8			
953	Unknown	4			
954	Unknown	10			
955	Unknown	3			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
956	Unknown	2			
957	Unknown	7			
958	Unknown	3			
959	Unknown	7			
960	Unknown	3			
64	Unknown	10	21	12	Y
64	Unknown	6	21	12	Y
64	Unknown	6	21	12	Y
64	Unknown	6	21	12	Y
64	Unknown	4	21	12	Y
64	Unknown	4	21	12	Y
880	Washingtonia sp.	22			Y
880	Washingtonia sp.	16			Y
880	Washingtonia sp.	13			Y
881	Washingtonia sp.	22			Y
881	Washingtonia sp.	17			Y
881	Washingtonia sp.	16			Y

APPENDIX B.
HUNTERS POINT SHIPYARD PHASE II
TREE SURVEY DATA

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
11	Acacia sp.	4	10	15	Y
13	Acacia sp.	14			Y
16	Acacia sp.	6	12	15	Y
16	Acacia sp.	5	12	15	Y
16	Acacia sp.	5	12	15	Y
16	Acacia sp.	4	12	15	Y
16	Acacia sp.	3	12	15	Y
17	Acacia sp.	6	15	20	Y
17	Acacia sp.	5	15	20	Y
17	Acacia sp.	4	15	20	Y
17	Acacia sp.	3	15	20	Y
17	Acacia sp.	2	15	20	Y
18	Acacia sp.	20	15	10	Y
18	Acacia sp.	4	15	10	
18	Acacia sp.	3	15	10	
28	Acacia sp.	13			Y
87	Acacia sp.	8	30	15	Y
87	Acacia sp.	4	30	15	Y
87	Acacia sp.	3	30	15	Y
133	Acacia sp.	9	35	30	Y
133	Acacia sp.	8	35	30	Y
133	Acacia sp.	8	35	30	Y
133	Acacia sp.	6	35	30	Y
133	Acacia sp.	6	35	30	Y
171	Acacia sp.	2	10	15	Y
186	Acacia sp.	4	10	8	
187	Acacia sp.	3	10	10	
187	Acacia sp.	2	10	10	
187	Acacia sp.	2	10	10	
188	Acacia sp.	3	10	10	
188	Acacia sp.	2	10	10	
189	Acacia sp.	3	15	10	
189	Acacia sp.	2	15	10	
190	Acacia sp.	2	12	12	
191	Acacia sp.	2	8	6	
192	Acacia sp.	3	10	8	
192	Acacia sp.	2	10	8	
193	Acacia sp.	4	8	12	
193	Acacia sp.	2	8	12	
194	Acacia sp.	4	12	10	
194	Acacia sp.	3	12	10	
194	Acacia sp.	3	12	10	
195	Acacia sp.	2	10	10	
244	Acacia sp.	5	15	10	
244	Acacia sp.	4	15	10	
244	Acacia sp.	3	15	10	
244	Acacia sp.	2	15	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
244	Acacia sp.	2	15	10	
244	Acacia sp.	2	15	10	
245	Acacia sp.	13			Y
245	Acacia sp.	8			
246	Acacia sp.	16			Y
246	Acacia sp.	12			Y
246	Acacia sp.	12			Y
246	Acacia sp.	5			
251	Acacia sp.	3	10	8	
251	Acacia sp.	3	10	8	
252	Acacia sp.	4	10	6	
252	Acacia sp.	3	10	6	
252	Acacia sp.	3	10	6	
253	Acacia sp.	4	8	6	
253	Acacia sp.	3	8	6	
253	Acacia sp.	2	8	6	
253	Acacia sp.	2	8	6	
253	Acacia sp.	2	8	6	
254	Acacia sp.	7	8	6	
254	Acacia sp.	5	8	6	
254	Acacia sp.	4	8	6	
254	Acacia sp.	3	8	6	
254	Acacia sp.	3	8	6	
293	Acacia sp.	6	25	15	Y
293	Acacia sp.	5	25	15	Y
293	Acacia sp.	5	25	15	Y
293	Acacia sp.	4	25	15	Y
313	Acacia sp.	3	10	15	Y
313	Acacia sp.	2	10	15	Y
313	Acacia sp.	2	10	15	Y
313	Acacia sp.	2	10	15	Y
313	Acacia sp.	2	10	15	Y
313	Acacia sp.	2	10	15	Y
314	Acacia sp.	2	8	8	
315	Acacia sp.	3	8	8	
315	Acacia sp.	3	8	8	
315	Acacia sp.	2	8	8	
315	Acacia sp.	2	8	8	
295	Betula sp.	8	20	12	Y
295	Betula sp.	6	20	12	Y
297	Betula sp.	2	15	8	
297	Betula sp.	2	15	8	
49	Cedrus sp.	12			Y
49	Cedrus sp.	7			
83	Cedrus sp.	13			Y
102	Cedrus sp.	13			Y
102	Cedrus sp.	11			

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
102	Cedrus sp.	10			
131	Cedrus sp.	12			Y
131	Cedrus sp.	11			
131	Cedrus sp.	10			
24	Cupressus	25			Y
25	Cupressus	15			Y
5	Eucalyptus sp.	15	15	12	Y
7	Eucalyptus sp.	15			Y
7	Eucalyptus sp.	5			
7	Eucalyptus sp.	4			
7	Eucalyptus sp.	3			
7	Eucalyptus sp.	3			
7	Eucalyptus sp.	2			
8	Eucalyptus sp.	4	15	15	Y
8	Eucalyptus sp.	4	15	15	Y
8	Eucalyptus sp.	3	15	15	Y
9	Eucalyptus sp.	2	15	20	Y
9	Eucalyptus sp.	2	15	20	Y
12	Eucalyptus sp.	5	12	15	Y
12	Eucalyptus sp.	4	12	15	Y
12	Eucalyptus sp.	4	12	15	Y
182	Eucalyptus sp.	37	16	18	Y
183	Eucalyptus sp.	18			Y
183	Eucalyptus sp.	16			Y
1	Heteromeles arbutifolia	4	10	7	
1	Heteromeles arbutifolia	3	10	7	
1	Heteromeles arbutifolia	2	10	7	
1	Heteromeles arbutifolia	2	10	7	
2	Heteromeles arbutifolia	6	15	8	
2	Heteromeles arbutifolia	3	15	8	
2	Heteromeles arbutifolia	2	15	8	
2	Heteromeles arbutifolia	2	15	8	
3	Heteromeles arbutifolia	6	15	8	
3	Heteromeles arbutifolia	4	15	8	
3	Heteromeles arbutifolia	3	15	8	
3	Heteromeles arbutifolia	2	15	8	
3	Heteromeles arbutifolia	2	15	8	
3	Heteromeles arbutifolia	2	15	8	
71	Heteromeles arbutifolia	8	12	15	Y
71	Heteromeles arbutifolia	3	12	15	Y
71	Heteromeles arbutifolia	2	12	15	Y
71	Heteromeles arbutifolia	2	12	15	Y
71	Heteromeles arbutifolia	2	12	15	Y
72	Heteromeles arbutifolia	5	12	10	
72	Heteromeles arbutifolia	3	12	10	
72	Heteromeles arbutifolia	2	12	10	
72	Heteromeles arbutifolia	2	12	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
72	Heteromeles arbutifolia	2	12	10	
72	Heteromeles arbutifolia	2	12	10	
72	Heteromeles arbutifolia	2	12	10	
72	Heteromeles arbutifolia	2	12	10	
73	Heteromeles arbutifolia	5	15	10	
73	Heteromeles arbutifolia	4	15	10	
75	Heteromeles arbutifolia	10	20	15	Y
77	Heteromeles arbutifolia	10	15	15	Y
77	Heteromeles arbutifolia	8	15	15	Y
78	Heteromeles arbutifolia	6	15	10	
78	Heteromeles arbutifolia	4	15	10	
82	Heteromeles arbutifolia	6	25	15	Y
82	Heteromeles arbutifolia	5	25	15	Y
82	Heteromeles arbutifolia	4	25	15	Y
82	Heteromeles arbutifolia	4	25	15	Y
89	Heteromeles arbutifolia	5	25	25	Y
89	Heteromeles arbutifolia	4	25	25	Y
89	Heteromeles arbutifolia	3	25	25	Y
100	Heteromeles arbutifolia	8	20	20	Y
100	Heteromeles arbutifolia	5	20	20	Y
100	Heteromeles arbutifolia	4	20	20	Y
100	Heteromeles arbutifolia	4	20	20	Y
100	Heteromeles arbutifolia	4	20	20	Y
100	Heteromeles arbutifolia	3	20	20	Y
100	Heteromeles arbutifolia	3	20	20	Y
137	Heteromeles arbutifolia	6	15	10	
137	Heteromeles arbutifolia	4	15	10	
137	Heteromeles arbutifolia	3	15	10	
137	Heteromeles arbutifolia	2	15	10	
140	Heteromeles arbutifolia	4	15	15	Y
140	Heteromeles arbutifolia	3	15	15	Y
140	Heteromeles arbutifolia	3	15	15	Y
140	Heteromeles arbutifolia	3	15	15	Y
140	Heteromeles arbutifolia	2	15	15	Y
140	Heteromeles arbutifolia	2	15	15	Y
140	Heteromeles arbutifolia	2	15	15	Y
140	Heteromeles arbutifolia	2	15	15	Y
140	Heteromeles arbutifolia	2	15	15	Y
141	Heteromeles arbutifolia	7	12	15	Y
141	Heteromeles arbutifolia	5	12	15	Y
141	Heteromeles arbutifolia	4	12	15	Y
141	Heteromeles arbutifolia	4	12	15	Y
141	Heteromeles arbutifolia	3	12	15	Y
141	Heteromeles arbutifolia	3	12	15	Y
141	Heteromeles arbutifolia	2	12	15	Y
142	Heteromeles arbutifolia	3	12	10	
142	Heteromeles arbutifolia	2	12	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
142	Heteromeles arbutifolia	2	12	10	
142	Heteromeles arbutifolia	2	12	10	
142	Heteromeles arbutifolia	2	12	10	
143	Heteromeles arbutifolia	2	12	10	
143	Heteromeles arbutifolia	2	12	10	
143	Heteromeles arbutifolia	2	12	10	
145	Heteromeles arbutifolia	2	8	6	
145	Heteromeles arbutifolia	2	8	6	
145	Heteromeles arbutifolia	2	8	6	
146	Heteromeles arbutifolia	4	20	15	Y
146	Heteromeles arbutifolia	3	20	15	Y
146	Heteromeles arbutifolia	3	20	15	Y
146	Heteromeles arbutifolia	2	20	15	Y
146	Heteromeles arbutifolia	2	20	15	Y
146	Heteromeles arbutifolia	2	20	15	Y
146	Heteromeles arbutifolia	2	20	15	Y
146	Heteromeles arbutifolia	2	20	15	Y
147	Heteromeles arbutifolia	6	12	8	
147	Heteromeles arbutifolia	3	12	8	
147	Heteromeles arbutifolia	2	12	8	
147	Heteromeles arbutifolia	2	12	8	
147	Heteromeles arbutifolia	2	12	8	
147	Heteromeles arbutifolia	2	12	8	
148	Heteromeles arbutifolia	2	12	8	
148	Heteromeles arbutifolia	2	12	8	
149	Heteromeles arbutifolia	2	10	8	
149	Heteromeles arbutifolia	2	10	8	
149	Heteromeles arbutifolia	2	10	8	
150	Heteromeles arbutifolia	3	12	8	
150	Heteromeles arbutifolia	2	12	8	
150	Heteromeles arbutifolia	2	12	8	
150	Heteromeles arbutifolia	2	12	8	
151	Heteromeles arbutifolia	2	12	8	
151	Heteromeles arbutifolia	2	12	8	
151	Heteromeles arbutifolia	2	12	8	
152	Heteromeles arbutifolia	3	15	10	
152	Heteromeles arbutifolia	3	15	10	
152	Heteromeles arbutifolia	2	15	10	
152	Heteromeles arbutifolia	2	15	10	
152	Heteromeles arbutifolia	2	15	10	
153	Heteromeles arbutifolia	3	15	10	
153	Heteromeles arbutifolia	2	15	10	
153	Heteromeles arbutifolia	2	15	10	
153	Heteromeles arbutifolia	2	15	10	
153	Heteromeles arbutifolia	2	15	10	
154	Heteromeles arbutifolia	3	12	8	
154	Heteromeles arbutifolia	2	12	8	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
155	Heteromeles arbutifolia	3	12	10	
155	Heteromeles arbutifolia	3	12	10	
155	Heteromeles arbutifolia	2	12	10	
155	Heteromeles arbutifolia	2	12	10	
155	Heteromeles arbutifolia	2	12	10	
155	Heteromeles arbutifolia	2	12	10	
156	Heteromeles arbutifolia	3	15	10	
156	Heteromeles arbutifolia	3	15	10	
156	Heteromeles arbutifolia	2	15	10	
156	Heteromeles arbutifolia	2	15	10	
157	Heteromeles arbutifolia	10	20	15	Y
157	Heteromeles arbutifolia	6	20	15	Y
157	Heteromeles arbutifolia	5	20	15	Y
157	Heteromeles arbutifolia	3	20	15	Y
157	Heteromeles arbutifolia	3	20	15	Y
158	Heteromeles arbutifolia	2	12	8	
159	Heteromeles arbutifolia	3	12	12	
159	Heteromeles arbutifolia	3	12	12	
159	Heteromeles arbutifolia	2	12	12	
159	Heteromeles arbutifolia	2	12	12	
159	Heteromeles arbutifolia	2	12	12	
159	Heteromeles arbutifolia	2	12	12	
159	Heteromeles arbutifolia	2	12	12	
160	Heteromeles arbutifolia	3	12	6	
161	Heteromeles arbutifolia	2	12	8	
162	Heteromeles arbutifolia	3	10	8	
162	Heteromeles arbutifolia	2	10	8	
162	Heteromeles arbutifolia	2	10	8	
162	Heteromeles arbutifolia	2	10	8	
162	Heteromeles arbutifolia	2	10	8	
163	Heteromeles arbutifolia	3	8	8	
163	Heteromeles arbutifolia	2	8	8	
163	Heteromeles arbutifolia	2	8	8	
163	Heteromeles arbutifolia	2	8	8	
164	Heteromeles arbutifolia	3	10	8	
164	Heteromeles arbutifolia	2	10	8	
164	Heteromeles arbutifolia	2	10	8	
165	Heteromeles arbutifolia	3	10	20	Y
165	Heteromeles arbutifolia	2	10	20	Y
165	Heteromeles arbutifolia	2	10	20	Y
166	Heteromeles arbutifolia	7	12	20	Y
166	Heteromeles arbutifolia	6	12	20	Y
166	Heteromeles arbutifolia	5	12	20	Y
166	Heteromeles arbutifolia	4	12	20	Y
166	Heteromeles arbutifolia	4	12	20	Y
166	Heteromeles arbutifolia	3	12	20	Y
166	Heteromeles arbutifolia	3	12	20	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
166	Heteromeles arbutifolia	3	12	20	Y
167	Heteromeles arbutifolia	3	10	8	
167	Heteromeles arbutifolia	2	10	8	
167	Heteromeles arbutifolia	2	10	8	
168	Heteromeles arbutifolia	2	10	8	
168	Heteromeles arbutifolia	2	10	8	
169	Heteromeles arbutifolia	2	10	8	
169	Heteromeles arbutifolia	2	10	8	
169	Heteromeles arbutifolia	2	10	8	
170	Heteromeles arbutifolia	3	10	8	
170	Heteromeles arbutifolia	3	10	8	
170	Heteromeles arbutifolia	2	10	8	
170	Heteromeles arbutifolia	2	10	8	
170	Heteromeles arbutifolia	2	10	8	
170	Heteromeles arbutifolia	2	10	8	
170	Heteromeles arbutifolia	2	10	8	
172	Heteromeles arbutifolia	4	8	10	
172	Heteromeles arbutifolia	3	8	10	
172	Heteromeles arbutifolia	2	8	10	
172	Heteromeles arbutifolia	2	8	10	
172	Heteromeles arbutifolia	2	8	10	
173	Heteromeles arbutifolia	3	8	10	
173	Heteromeles arbutifolia	2	8	10	
174	Heteromeles arbutifolia	4	8	10	
174	Heteromeles arbutifolia	4	8	10	
174	Heteromeles arbutifolia	3	8	10	
175	Heteromeles arbutifolia	5	8	10	
175	Heteromeles arbutifolia	4	8	10	
175	Heteromeles arbutifolia	4	8	10	
175	Heteromeles arbutifolia	2	8	10	
176	Heteromeles arbutifolia	2	10	8	
176	Heteromeles arbutifolia	2	10	8	
177	Heteromeles arbutifolia	2	8	8	
178	Heteromeles arbutifolia	2	7	8	
178	Heteromeles arbutifolia	2	7	8	
178	Heteromeles arbutifolia	2	7	8	
179	Heteromeles arbutifolia	5	10	8	
179	Heteromeles arbutifolia	3	10	8	
179	Heteromeles arbutifolia	2	10	8	
179	Heteromeles arbutifolia	2	10	8	
179	Heteromeles arbutifolia	2	10	8	
180	Heteromeles arbutifolia	3	12	10	
180	Heteromeles arbutifolia	2	12	10	
180	Heteromeles arbutifolia	2	12	10	
181	Heteromeles arbutifolia	2	12	8	
184	Heteromeles arbutifolia	4	10	10	
184	Heteromeles arbutifolia	2	10	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
184	Heteromeles arbutifolia	2	10	10	
196	Heteromeles arbutifolia	4	15	20	Y
196	Heteromeles arbutifolia	3	15	20	Y
196	Heteromeles arbutifolia	3	15	20	Y
196	Heteromeles arbutifolia	3	15	20	Y
196	Heteromeles arbutifolia	2	15	20	Y
196	Heteromeles arbutifolia	2	15	20	Y
196	Heteromeles arbutifolia	2	15	20	Y
197	Heteromeles arbutifolia	5	15	15	Y
197	Heteromeles arbutifolia	4	15	15	Y
197	Heteromeles arbutifolia	3	15	15	Y
197	Heteromeles arbutifolia	2	15	15	Y
197	Heteromeles arbutifolia	2	15	15	Y
233	Heteromeles arbutifolia	4	15	20	Y
233	Heteromeles arbutifolia	3	15	20	Y
233	Heteromeles arbutifolia	3	15	20	Y
233	Heteromeles arbutifolia	2	15	20	Y
234	Heteromeles arbutifolia	7	15	12	
236	Heteromeles arbutifolia	3	15	10	
236	Heteromeles arbutifolia	2	15	10	
236	Heteromeles arbutifolia	2	15	10	
237	Heteromeles arbutifolia	4	12	8	
238	Heteromeles arbutifolia	3	15	8	
239	Heteromeles arbutifolia	2	12	8	
240	Heteromeles arbutifolia	2	12	8	
241	Heteromeles arbutifolia	3	15	10	
241	Heteromeles arbutifolia	2	15	10	
242	Heteromeles arbutifolia	3	8	10	
243	Heteromeles arbutifolia	3	15	10	
243	Heteromeles arbutifolia	2	15	10	
247	Heteromeles arbutifolia	4	15	10	
247	Heteromeles arbutifolia	3	15	10	
247	Heteromeles arbutifolia	2	15	10	
248	Heteromeles arbutifolia	6	12	8	
248	Heteromeles arbutifolia	4	12	8	
248	Heteromeles arbutifolia	3	12	8	
248	Heteromeles arbutifolia	2	12	8	
249	Heteromeles arbutifolia	5	10	8	
249	Heteromeles arbutifolia	2	10	8	
249	Heteromeles arbutifolia	2	10	8	
249	Heteromeles arbutifolia	2	10	8	
249	Heteromeles arbutifolia	2	10	8	
250	Heteromeles arbutifolia	3	10	8	
250	Heteromeles arbutifolia	3	10	8	
250	Heteromeles arbutifolia	3	10	8	
250	Heteromeles arbutifolia	2	10	8	
255	Heteromeles arbutifolia	3	15	15	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
255	Heteromeles arbutifolia	2	15	15	Y
255	Heteromeles arbutifolia	2	15	15	Y
256	Heteromeles arbutifolia	10	15	20	Y
256	Heteromeles arbutifolia	3	15	20	Y
256	Heteromeles arbutifolia	2	15	20	Y
257	Heteromeles arbutifolia	3	20	15	Y
257	Heteromeles arbutifolia	3	20	15	Y
257	Heteromeles arbutifolia	3	20	15	Y
257	Heteromeles arbutifolia	2	20	15	Y
257	Heteromeles arbutifolia	2	20	15	Y
258	Heteromeles arbutifolia	5	20	15	Y
258	Heteromeles arbutifolia	4	20	15	Y
258	Heteromeles arbutifolia	3	20	15	Y
258	Heteromeles arbutifolia	3	20	15	Y
259	Heteromeles arbutifolia	4	15	10	
260	Heteromeles arbutifolia	5	12	8	
260	Heteromeles arbutifolia	4	12	8	
260	Heteromeles arbutifolia	2	12	8	
260	Heteromeles arbutifolia	2	12	8	
261	Heteromeles arbutifolia	3	10	10	
261	Heteromeles arbutifolia	3	10	10	
261	Heteromeles arbutifolia	2	10	10	
262	Heteromeles arbutifolia	6	12	10	
262	Heteromeles arbutifolia	5	12	10	
262	Heteromeles arbutifolia	3	12	10	
263	Heteromeles arbutifolia	2	12	10	
264	Heteromeles arbutifolia	3	15	8	
264	Heteromeles arbutifolia	2	15	8	
264	Heteromeles arbutifolia	2	15	8	
265	Heteromeles arbutifolia	3	15	25	Y
265	Heteromeles arbutifolia	3	15	25	Y
265	Heteromeles arbutifolia	2	15	25	Y
265	Heteromeles arbutifolia	2	15	25	Y
266	Heteromeles arbutifolia	3	20	8	Y
266	Heteromeles arbutifolia	2	20	8	Y
267	Heteromeles arbutifolia	2	15	10	
268	Heteromeles arbutifolia	6	12	8	
268	Heteromeles arbutifolia	3	12	8	
268	Heteromeles arbutifolia	3	12	8	
270	Heteromeles arbutifolia	4	10	8	
271	Heteromeles arbutifolia	4	10	6	
271	Heteromeles arbutifolia	4	10	6	
271	Heteromeles arbutifolia	3	10	6	
272	Heteromeles arbutifolia	3	10	8	
272	Heteromeles arbutifolia	3	10	8	
272	Heteromeles arbutifolia	2	10	8	
273	Heteromeles arbutifolia	3	10	6	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
274	Heteromeles arbutifolia	6	15	12	
274	Heteromeles arbutifolia	5	15	12	
274	Heteromeles arbutifolia	4	15	12	
274	Heteromeles arbutifolia	3	15	12	
274	Heteromeles arbutifolia	3	15	12	
274	Heteromeles arbutifolia	2	15	12	
274	Heteromeles arbutifolia	2	15	12	
274	Heteromeles arbutifolia	2	15	12	
274	Heteromeles arbutifolia	2	15	12	
275	Heteromeles arbutifolia	5	15	10	
275	Heteromeles arbutifolia	4	15	10	
275	Heteromeles arbutifolia	3	15	10	
275	Heteromeles arbutifolia	2	15	10	
275	Heteromeles arbutifolia	2	15	10	
276	Heteromeles arbutifolia	3	12	8	
276	Heteromeles arbutifolia	2	12	8	
276	Heteromeles arbutifolia	2	12	8	
277	Heteromeles arbutifolia	6	15	10	
277	Heteromeles arbutifolia	5	15	10	
277	Heteromeles arbutifolia	5	15	10	
277	Heteromeles arbutifolia	5	15	10	
277	Heteromeles arbutifolia	4	15	10	
277	Heteromeles arbutifolia	3	15	10	
277	Heteromeles arbutifolia	3	15	10	
277	Heteromeles arbutifolia	2	15	10	
278	Heteromeles arbutifolia	3	15	10	
278	Heteromeles arbutifolia	3	15	10	
278	Heteromeles arbutifolia	2	15	10	
278	Heteromeles arbutifolia	2	15	10	
278	Heteromeles arbutifolia	2	15	10	
279	Heteromeles arbutifolia	2	10	6	
279	Heteromeles arbutifolia	2	10	6	
280	Heteromeles arbutifolia	3	12	8	
280	Heteromeles arbutifolia	2	12	8	
280	Heteromeles arbutifolia	2	12	8	
281	Heteromeles arbutifolia	3	10	6	
281	Heteromeles arbutifolia	3	10	6	
281	Heteromeles arbutifolia	2	10	6	
282	Heteromeles arbutifolia	5	15	8	
282	Heteromeles arbutifolia	4	15	8	
282	Heteromeles arbutifolia	3	15	8	
282	Heteromeles arbutifolia	3	15	8	
283	Heteromeles arbutifolia	5	20	15	Y
283	Heteromeles arbutifolia	4	20	15	Y
283	Heteromeles arbutifolia	2	20	15	Y
283	Heteromeles arbutifolia	2	20	15	Y
284	Heteromeles arbutifolia	3	15	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
284	Heteromeles arbutifolia	3	15	10	
284	Heteromeles arbutifolia	2	15	10	
284	Heteromeles arbutifolia	2	15	10	
284	Heteromeles arbutifolia	2	15	10	
284	Heteromeles arbutifolia	1	15	10	
294	Heteromeles arbutifolia	3	25	15	Y
294	Heteromeles arbutifolia	3	25	15	Y
294	Heteromeles arbutifolia	3	25	15	Y
294	Heteromeles arbutifolia	3	25	15	Y
294	Heteromeles arbutifolia	2	25	15	Y
294	Heteromeles arbutifolia	2	25	15	Y
294	Heteromeles arbutifolia	2	25	15	Y
294	Heteromeles arbutifolia	2	25	15	Y
294	Heteromeles arbutifolia	2	25	15	Y
294	Heteromeles arbutifolia	2	25	15	Y
294	Heteromeles arbutifolia	2	25	15	Y
296	Heteromeles arbutifolia	3	12	10	
296	Heteromeles arbutifolia	2	12	10	
296	Heteromeles arbutifolia	2	12	10	
296	Heteromeles arbutifolia	2	12	10	
296	Heteromeles arbutifolia	2	12	10	
308	Heteromeles arbutifolia	2	10	6	
308	Heteromeles arbutifolia	2	10	6	
308	Heteromeles arbutifolia	2	10	6	
309	Heteromeles arbutifolia	2	8	4	
309	Heteromeles arbutifolia	2	8	4	
310	Heteromeles arbutifolia	3	10	8	
310	Heteromeles arbutifolia	3	10	8	
310	Heteromeles arbutifolia	2	10	8	
310	Heteromeles arbutifolia	2	10	8	
312	Heteromeles arbutifolia	3	12	8	
312	Heteromeles arbutifolia	2	12	8	
312	Heteromeles arbutifolia	2	12	8	
312	Heteromeles arbutifolia	2	12	8	
316	Heteromeles arbutifolia	3	10	8	
316	Heteromeles arbutifolia	3	10	8	
316	Heteromeles arbutifolia	2	10	8	
316	Heteromeles arbutifolia	2	10	8	
316	Heteromeles arbutifolia	2	10	8	
317	Heteromeles arbutifolia	3	12	8	
317	Heteromeles arbutifolia	3	12	8	
317	Heteromeles arbutifolia	3	12	8	
317	Heteromeles arbutifolia	2	12	8	
317	Heteromeles arbutifolia	2	12	8	
317	Heteromeles arbutifolia	2	12	8	
317	Heteromeles arbutifolia	2	12	8	
317	Heteromeles arbutifolia	2	12	8	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
10	Juglans californica	5	15	20	Y
10	Juglans californica	4	15	20	Y
185	Juglans californica	12			Y
19	Juniperus sp.	8	20	10	Y
19	Juniperus sp.	8	20	10	Y
19	Juniperus sp.	6	20	10	Y
19	Juniperus sp.	6	20	10	Y
20	Juniperus sp.	13	20	10	Y
20	Juniperus sp.	8	20	10	Y
20	Juniperus sp.	8	20	10	Y
20	Juniperus sp.	6	20	10	Y
127	Juniperus sp.	7	15	15	Y
127	Juniperus sp.	4	15	15	Y
127	Juniperus sp.	2	15	15	Y
130	Juniperus sp.	5	15	12	
130	Juniperus sp.	3	15	12	
130	Juniperus sp.	3	15	12	
130	Juniperus sp.	3	15	12	
130	Juniperus sp.	3	15	12	
130	Juniperus sp.	2	15	12	
130	Juniperus sp.	2	15	12	
130	Juniperus sp.	2	15	12	
130	Juniperus sp.	2	15	12	
304	Juniperus sp.	12			Y
304	Juniperus sp.	10			
304	Juniperus sp.	10			
304	Juniperus sp.	10			
304	Juniperus sp.	8			
305	Juniperus sp.	10	20	10	Y
305	Juniperus sp.	8	20	10	Y
306	Juniperus sp.	14			Y
306	Juniperus sp.	12			Y
307	Juniperus sp.	22			Y
307	Juniperus sp.	20			Y
307	Juniperus sp.	18			Y
307	Juniperus sp.	12			Y
311	Juniperus sp.	6	15	15	Y
311	Juniperus sp.	4	15	15	Y
311	Juniperus sp.	2	15	15	Y
311	Juniperus sp.	2	15	15	Y
318	Juniperus sp.	10	30	20	Y
318	Juniperus sp.	8	30	20	Y
318	Juniperus sp.	8	30	20	Y
318	Juniperus sp.	6	30	20	Y
318	Juniperus sp.	6	30	20	Y
318	Juniperus sp.	6	30	20	Y
318	Juniperus sp.	6	30	20	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
318	Juniperus sp.	3	30	20	Y
321	Juniperus sp.	22			Y
322	Juniperus sp.	20			Y
323	Juniperus sp.	24			Y
324	Juniperus sp.	30			Y
325	Juniperus sp.	18			Y
326	Juniperus sp.	20			Y
327	Juniperus sp.	20			Y
328	Juniperus sp.	20			Y
113	Malus domesticus	3	8	10	
113	Malus domesticus	2	8	10	
113	Malus domesticus	2	8	10	
113	Malus domesticus	2	8	10	
124	Malus domesticus	3	15	12	
124	Malus domesticus	2	15	12	
124	Malus domesticus	2	15	12	
124	Malus domesticus	2	15	12	
124	Malus domesticus	2	15	12	
126	Malus domesticus	3	8	8	
126	Malus domesticus	2	8	8	
126	Malus domesticus	2	8	8	
126	Malus domesticus	2	8	8	
126	Malus domesticus	2	8	8	
269	Myoporum laetum	8	10	8	
269	Myoporum laetum	5	10	8	
269	Myoporum laetum	5	10	8	
269	Myoporum laetum	4	10	8	
269	Myoporum laetum	4	10	8	
285	Myoporum laetum	4	10	6	
286	Myoporum laetum	2	8	4	
287	Myoporum laetum	2	8	4	
288	Myoporum laetum	3	8	4	
289	Myoporum laetum	2	8	4	
290	Myoporum laetum	2	8	4	
291	Myoporum laetum	3	8	4	
292	Myoporum laetum	3	8	4	
74	Picea sp.	8	25	10	Y
21	Pinus sp.	31			Y
22	Pinus sp.	31			Y
22	Pinus sp.	20			Y
23	Pinus sp.	60			Y
29	Pinus sp.	8	20	12	Y
31	Pinus sp.	51			Y
33	Pinus sp.	60			Y
34	Pinus sp.	64			Y
39	Pinus sp.	130			Y
79	Pinus sp.	10	15	10	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
112	Pinus sp.	4	12	8	
115	Pinus sp.	20			Y
121	Pinus sp.	24			Y
129	Pinus sp.	10	15	15	Y
129	Pinus sp.	10	15	15	Y
129	Pinus sp.	7	15	15	Y
129	Pinus sp.	6	15	15	Y
129	Pinus sp.	6	15	15	Y
129	Pinus sp.	6	15	15	Y
129	Pinus sp.	5	15	15	Y
129	Pinus sp.	5	15	15	Y
235	Pinus sp.	12			Y
319	Pinus sp.	8	15	10	
35	Platanus acerifolia	7	20	12	Y
36	Platanus acerifolia	9	20	12	Y
37	Platanus acerifolia	6	20	10	Y
38	Platanus acerifolia	9			
40	Platanus acerifolia	18			Y
41	Platanus acerifolia	26			Y
42	Platanus acerifolia	6	20	15	Y
42	Platanus acerifolia	3	20	15	Y
42	Platanus acerifolia	3	20	15	Y
43	Platanus acerifolia	4	15	6	
43	Platanus acerifolia	3	15	6	
43	Platanus acerifolia	2	15	6	
43	Platanus acerifolia	2	15	6	
44	Platanus acerifolia	8	15	6	
45	Platanus acerifolia	4	15	7	
46	Platanus acerifolia	8	15	20	Y
47	Platanus acerifolia	12			Y
48	Platanus acerifolia	8	20	10	Y
50	Platanus acerifolia	13			Y
51	Platanus acerifolia	22			Y
52	Platanus acerifolia	12			Y
53	Platanus acerifolia	13			Y
54	Platanus acerifolia	10	15	6	
55	Platanus acerifolia	8	15	6	
56	Platanus acerifolia	8	15	12	
57	Platanus acerifolia	14			Y
58	Platanus acerifolia	8	15	12	
59	Platanus acerifolia	12			Y
61	Platanus acerifolia	12			Y
62	Platanus acerifolia	10	15	8	
63	Platanus acerifolia	25			Y
64	Platanus acerifolia	8	12	8	
65	Platanus acerifolia	10	12	15	Y
66	Platanus acerifolia	5	12	8	

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
67	Platanus acerifolia	8	12	12	
68	Platanus acerifolia	8	15	12	
69	Platanus acerifolia	7	15	10	
70	Platanus acerifolia	10	15	20	Y
135	Platanus acerifolia	10	20	12	Y
136	Platanus acerifolia	13			Y
138	Platanus acerifolia	9	15	8	
139	Platanus acerifolia	10	15	10	
108	Poncirus sp.	4	15	10	
108	Poncirus sp.	3	15	10	
108	Poncirus sp.	3	15	10	
108	Poncirus sp.	2	15	10	
109	Poncirus sp.	4	15	10	
109	Poncirus sp.	4	15	10	
109	Poncirus sp.	2	15	10	
109	Poncirus sp.	2	15	10	
109	Poncirus sp.	2	15	10	
198	Populus sp.	20	20	10	Y
198	Populus sp.	6	20	10	Y
199	Populus sp.	14			Y
200	Populus sp.	14			Y
201	Populus sp.	20			Y
202	Populus sp.	12			Y
203	Populus sp.	16			Y
208	Populus sp.	17			Y
209	Populus sp.	12			Y
210	Populus sp.	12			Y
211	Populus sp.	25			Y
212	Populus sp.	14			Y
213	Populus sp.	11			
214	Populus sp.	10	20	6	Y
215	Populus sp.	9	20	6	Y
216	Populus sp.	11	20	6	Y
217	Populus sp.	10	20	6	Y
218	Populus sp.	11	20	6	Y
219	Populus sp.	11	20	6	Y
220	Populus sp.	10	20	6	Y
221	Populus sp.	8	20	6	Y
222	Populus sp.	8	20	6	Y
223	Populus sp.	8	20	6	Y
224	Populus sp.	10	20	6	Y
225	Populus sp.	12			Y
226	Populus sp.	21			Y
227	Populus sp.	18			Y
228	Populus sp.	18			Y
228	Populus sp.	12			Y
229	Populus sp.	15			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
230	Populus sp.	12			Y
231	Populus sp.	19			Y
232	Populus sp.	14			Y
118	Prunus sp.	3	15	12	
118	Prunus sp.	3	15	12	
118	Prunus sp.	3	15	12	
118	Prunus sp.	2	15	12	
118	Prunus sp.	2	15	12	
118	Prunus sp.	2	15	12	
118	Prunus sp.	2	15	12	
118	Prunus sp.	2	15	12	
118	Prunus sp.	2	15	12	
118	Prunus sp.	2	15	12	
118	Prunus sp.	2	15	12	
120	Prunus sp.	3	20	12	Y
120	Prunus sp.	2	20	12	Y
120	Prunus sp.	2	20	12	Y
120	Prunus sp.	2	20	12	Y
30	Pseudotsuga menziesii	2	10	6	
76	Quercus agrifolia	5	15	8	
14	Salix laevigata	20			Y
14	Salix laevigata	14			Y
14	Salix laevigata	12			Y
14	Salix laevigata	12			Y
14	Salix laevigata	10			
15	Salix laevigata	10	10	15	Y
15	Salix laevigata	4	10	15	Y
15	Salix laevigata	4	10	15	Y
15	Salix laevigata	3	10	15	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
4	Salix sp.	2	12	20	Y
80	Sequoia sempervirens	46			Y
81	Sequoia sempervirens	36			Y
81	Sequoia sempervirens	32			Y
84	Sequoia sempervirens	16			Y
85	Sequoia sempervirens	28			Y
86	Sequoia sempervirens	12			Y
88	Sequoia sempervirens	6	20	12	Y
103	Sequoia sempervirens	29			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
103	Sequoia sempervirens	28			Y
103	Sequoia sempervirens	26			Y
104	Sequoia sempervirens	22			Y
105	Sequoia sempervirens	29			Y
105	Sequoia sempervirens	19			Y
105	Sequoia sempervirens	9			
110	Ulmus sp.	6	15	10	
111	Ulmus sp.	7	15	10	
114	Ulmus sp.	2	15	10	
116	Ulmus sp.	5	12	10	
117	Ulmus sp.	5	9	8	
119	Ulmus sp.	5	20	12	Y
122	Ulmus sp.	5	15	8	
123	Ulmus sp.	2	12	8	
125	Ulmus sp.	6	15	12	
128	Ulmus sp.	6	10	6	
298	Ulmus sp.	10	15	25	Y
298	Ulmus sp.	8	15	25	Y
299	Ulmus sp.	3	12	4	
300	Ulmus sp.	2	8	5	
6	Unknown	13			Y
60	Unknown	8	22	30	Y
60	Unknown	7	22	30	Y
60	Unknown	6	22	30	Y
60	Unknown	5	22	30	Y
60	Unknown	4	22	30	Y
90	Unknown	5	20	10	Y
90	Unknown	4	20	10	Y
91	Unknown	6	20	15	Y
91	Unknown	4	20	15	Y
91	Unknown	3	20	15	Y
91	Unknown	3	20	15	Y
91	Unknown	3	20	15	Y
91	Unknown	3	20	15	Y
92	Unknown	8	25	15	Y
92	Unknown	6	25	15	Y
92	Unknown	5	25	15	Y
92	Unknown	4	25	15	Y
93	Unknown	6	20	12	Y
93	Unknown	5	20	12	Y
93	Unknown	2	20	12	Y
94	Unknown	5	20	11	Y
94	Unknown	3	20	11	Y
94	Unknown	3	20	11	Y
94	Unknown	2	20	11	Y
95	Unknown	4	20	10	Y
95	Unknown	4	20	10	Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
95	Unknown	3	20	10	Y
95	Unknown	3	20	10	Y
96	Unknown	8	30	10	Y
96	Unknown	5	30	10	Y
96	Unknown	4	30	10	Y
96	Unknown	4	30	10	Y
96	Unknown	4	30	10	Y
96	Unknown	4	30	10	Y
96	Unknown	3	30	10	Y
97	Unknown	10	25	10	Y
97	Unknown	8	25	10	Y
97	Unknown	4	25	10	Y
97	Unknown	3	25	10	Y
97	Unknown	3	25	10	Y
98	Unknown	3	20	12	Y
98	Unknown	3	20	12	Y
98	Unknown	2	20	12	Y
98	Unknown	2	20	12	Y
98	Unknown	2	20	12	Y
99	Unknown	2	20	12	Y
99	Unknown	2	20	12	Y
99	Unknown	2	20	12	Y
101	Unknown	4	20	10	Y
101	Unknown	3	20	10	Y
144	Unknown	2	12	12	
144	Unknown	2	12	12	
144	Unknown	2	12	12	
144	Unknown	2	12	12	
144	Unknown	2	12	12	
301	Unknown	3	20	10	Y
301	Unknown	3	20	10	Y
301	Unknown	3	20	10	Y
302	Unknown	4	20	15	Y
302	Unknown	3	20	15	Y
302	Unknown	3	20	15	Y
302	Unknown	3	20	15	Y
302	Unknown	2	20	15	Y
302	Unknown	2	20	15	Y
303	Unknown	3	15	8	
303	Unknown	2	15	8	
303	Unknown	2	15	8	
303	Unknown	2	15	8	
303	Unknown	2	15	8	
26	Washingtonia sp.	39			Y
27	Washingtonia sp.	62			Y
32	Washingtonia sp.	22			Y
106	Washingtonia sp.	26			Y

Tree #	Species	DBH	Min. Height (ft.)	Min. Crown Width (ft.)	Significant?
107	Washingtonia sp.	21			Y
132	Washingtonia sp.	20			Y
134	Washingtonia sp.	8	15	6	
204	Washingtonia sp.	32			Y
205	Washingtonia sp.	27			Y
206	Washingtonia sp.	25			Y
207	Washingtonia sp.	34			Y
320	Washingtonia sp.	19			Y

Appendix O There is no appendix associated with Section III.O

Appendix P1 ESA Potential Wind Conditions at Executive Park Development, March 10, 2009

ESA

Technical Memorandum

TO: Michael Li
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FROM: Charles Bennett
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225 Bush Street, Suite 1700
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DATE: May 4, 2009

SUBJECT: Potential Wind Conditions at Executive Park Development
Windsurfing Area Testing
San Francisco, California
ESA 208449

I. Introduction and Overview

A series of wind tunnel tests were performed in February 2009 for the Executive Park development proposed in the southeastern area of the City of San Francisco, near Candlestick Point. The wind tests were performed to study the wind conditions at a windsurfing launch site at the Candlestick Point State Recreation Area (CPSRA) and in the sailing area in the Bay to the southeast of the site. This study considered winds under the Existing development conditions, under the Project scenario, and under the Project with Cumulative development scenario.

The buildings now under construction, as well as the approved, but not yet constructed buildings in the vicinity of the site were considered to be part of the existing setting conditions. The conditions for the Project at the Executive Park site include demolition of 3 existing buildings and the construction of 13 separate buildings (or building clusters) with roof heights ranging from approximately 86 to 293 feet. The cumulative conditions include the Project plus structures proposed as part of the redevelopment of the Candlestick Point area located immediately north of the CPSRA windsurfing launch site.

Background and details of the test methods are presented in this technical memorandum in Section II, Background and Wind Test Protocols. Test results and discussion are presented in Section III, Test Cases and Study Results.

ESA

Summaries of Tests

Three development scenarios were modeled and tested in the atmospheric boundary layer wind tunnel. The scenarios are: 1) Existing Setting, 2) Project, and 3) Project plus Cumulative. Measurements of wind speed and wind turbulence were taken at points within a windsurfing test area defined by a 1,750 ft. by 2,500 ft. downwind measurement grid, anchored at the CPSRA windsurfing launch and landing area and reaching generally toward the South-southwest, covering an area of 100.44 acres of the Bay. With respect to wind testing of windsurfing areas, three of the standard wind test protocols were varied[1], for these reasons:

- Southwest winds blow onshore, across the Project site and toward Bay View Hill. A wind from the Southwest that blows across the Project site could not reach the windsurfing areas that lie to the south of Candlestick Point. Thus, neither the Project nor the Cumulative scenario would have any effect on winds in the windsurfing areas south of Candlestick Point for Southwest wind.

- For the West wind, the most southerly of the test grid locations were not measured. Those test grid locations far south of the launch area are crosswind to the West wind and are well outside of the area that could potentially be affected by development under either the Project or the Project plus Cumulative scenario.

- The windsurfing areas are relatively distant from the Project site, the closest grid point being approximately 2,000 feet distant. Even at the closest of the windsurfing test locations, it cannot reasonably be anticipated that meaningful differences can be found between the wind speed and turbulence measurements for the Project scenario and the measurements for the Alternative scenario. Therefore, both the Project scenario and the Alternative scenario wind conditions are well represented by either test scenario. The physical model used in the test was the Alternative scenario.

Existing Setting

The existing setting consists of the existing buildings on and in the vicinity of the Project site, including the St. Francis Bay development, other developments, including the Signature and Hanover projects, and St. Francis Bay Phase III. The existing setting also includes Candlestick Park stadium.

<u>Wind Speed</u>

- Northwest wind speeds in the test grid closer to shore range from 42% to 50% of overhead wind speed, increasing to between 55% and 60% of overhead wind speeds farther from shore. This pattern, with lower wind speeds nearer the shore, shows the combined "wind shadow" effect[2] of Bay View Hill, existing buildings and the Candlestick Park stadium. With increasing downwind distance, wind speeds recover.

- West-Northwest wind speeds in the test grid are generally between 55% and 60% of overhead wind speeds. A smaller "wind shadow" extends from the shore.

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1 See the section "Model and Wind Testing Protocols" for more detail on these items.

2 The "wind shadow" is due to the local decrease in wind speed that results from redirected winds and drag that effectively decrease the speed of the wind as it passes over and around the hill, other landforms and vegetation, and the structures.

- West wind speeds in the test grid are generally between 55% and 60% of overhead wind speeds. A small "wind shadow" occurs close to the shore.

Wind Turbulence

- Northwest wind turbulence intensity[3] (TI) values between 22% and 26% occur in the test grid nearer the shore, in the "wind shadow", where wind speeds are low. TI values decrease downwind, generally as wind speeds increase. TI values range from 18% to 22% over about half of the grid area. TI values between 14% and 18% occur only in areas farthest downwind.

- West-Northwest wind TI values range from 14% to 18% over most of the test grid, with higher TI values, ranging from 18% to 22% in a 1.5-acre± area[4] near the shoreline at the northwest corner of the test grid. TI values are higher where wind speed is lower.

- West wind, TI values are between 14% and 18% over most of the test grid, with higher TI values, ranging from 18% to 22%, in a 1.5-acre± area near the shore, where wind speed is lower.

Project

This scenario consists of the demolition of three existing buildings and addition of the proposed Executive Park development projects.

Wind Speed

- Northwest wind speeds would decrease by 5% to 10% with the Project, compared to Existing wind speeds, in two areas of the grid well south of the CPSRA windsurfing launching and landing area. These two areas are two bands that extend part way across the grid; one more than 600 ft south and one more than 1,200 ft south-southwest of the CPSRA windsurfing launching and landing area. Northwest wind speeds in other areas of the grid would not decrease by more than 5%; in several patches, Northwest wind speeds would either not change or would increase slightly.

- West-Northwest wind speeds would decrease by 10% or more with the Project, compared to Existing wind speeds, in an area that includes the present CPSRA windsurfing launching and landing area. This 2.5-acre± area would extend as far as approximately 125 ft. from the shoreline. West-Northwest wind speed decreases of 5% to 10% would occur over nearly one-third of the grid area, while wind speed decreases of 0% to 5% would occur over approximately half of the grid area.

- West wind speeds over the entire grid area, except at the northwest tip of the grid, would not decrease by more than 5% from Existing wind speeds due to the Project.

Wind Turbulence

3 Wind turbulence intensity, as defined and used in Planning Code Section 148 is represented here by the abbreviation TI. See the discussion in Section II. Background and Test Protocols

4 The estimates of the test grid areas contained within various wind speed range and turbulence isopleths are approximations; the areas are flagged in this memorandum by the symbol ±, to indicate an approximate value.

- Northwest wind TI values would generally increase, just as wind speeds would generally decrease, under the Project scenario, as compared to Existing TI values. TI values would be between 26% and 30% at three spots in the northwest portion of the grid, generally where Northwest wind speeds would be lower. TI values would decrease downwind, just as wind speeds would increase. TI values would be between 22% and 26% over nearly one-quarter of the grid and between 18% and 22% over about three-quarters of the grid. TI values would range from 14% to 18% at two spots farthest downwind.

- West-Northwest wind TI values with the Project would range from 14% to 18% over a 40-acre± area at the south end of the grid, with higher TI values, ranging from 18% to 22%, over a 37-acre± area to the north. TI values of 22% to 26% would occur in a 10-acre± area along the shoreline, including the present CPSRA windsurfing launching and landing area. TI values would be between 26% and 30% in a 1-acre± area at the northwest corner of the grid, where wind speed would be low.

- West wind TI values between 18% and 22% would occur in a 17-acre±± area along the shoreline with the Project. This area would extend from the CPSRA windsurfing launching and landing area to the northwest corner of the grid. TI values would range from 14% to 18% over the rest of the grid area. Again, TI would be high where wind speed is low.

Project plus Cumulative

This scenario consists of the Project with the addition of Cumulative development proposed in the redevelopment area north of the CPSRA launch site and windsurfing area of the Bay. Candlestick Park Stadium would be demolished.

Wind Speed

- Northwest wind speeds would decrease by 10% to 20% under the Project plus Cumulative scenario, compared to Existing wind speeds, along an 7-acre± shoreline area that includes the present CPSRA windsurfing launching and landing sites and extending more than 300 ft. into the Bay there. Northwest wind speed decreases of 5% to 10% would occur over a nearly 36-acre± area of the grid. Northwest wind speeds in other areas of the grid would not decrease by more than 5%; in a 12-acre± area near the center of the grid, Northwest wind speeds would either not change or would increase slightly.

- West-Northwest wind speeds would decrease by 10% to 20%, compared to Existing wind speeds, along a 10-acre± shoreline area that includes the present CPSRA windsurfing launching and landing area, and would extend from approximately 125 ft. to 500 ft. into the Bay. West-Northwest wind speed decreases of 5% to 10% would occur over a nearly 27-acre± area of the grid, while wind speed decreases of 0% to 5% would occur over a 40-acre± area of the grid. Wind speed increases of 0% to 5% would occur in a nearly 6-acre± area at the south end of the grid

- West wind speeds would decrease by 5% to 10% at one spot on the shoreline at the northwest tip of the grid. West wind speeds over the rest of the grid area would not change by more than 5% from existing wind conditions due to the Project plus Cumulative scenario, compared to Existing conditions.

Wind Turbulence

- Northwest wind TI values would generally increase, just as wind speeds generally decrease, under the Project plus Cumulative scenario, compared to Existing turbulence. TI values would be between 26% and 30% at a more than 2-acre± area at the northwest corner of the grid. TI values would decrease downwind, as wind speeds would increase. TI values would be from 22% to 26% over a 27-acre± area of the grid. TI values would range from 18% to 22% over almost all of the remaining grid area.

- West-Northwest wind TI values with the Project plus Cumulative scenario would range from 14% to 18% over an 47-acre± area at the south end of the grid, with higher TI values, between 18% and 22%, over an 30-acre± area to the north. TI values from 22% to 26% would occur in a 20-acre± area along the shoreline, including the present CPSRA windsurfing launching and landing area. TI values would be between 26% and 30% in a 1-acre± area at the shoreline at the northwest corner of the grid.

- West wind TI values from 18% to 22% would occur in a 17-acre± area along the shoreline with the Project plus Cumulative scenario. This area would extend from the CPSRA windsurfing launching and landing area to the northwest corner of the grid. TI values would be between 14% and 18% over the rest of the grid area. Again, TI would be high where wind speed is low.

Wind Evaluation Criteria

There are no established criteria, in the *Planning Code* or in the California Environmental Quality Act Guidelines or elsewhere, to define the level of reduction in wind speed that would constitute a "significant adverse impact" under CEQA for windsurfing at the CPSRA or in the Bay. Similarly, there are no CEQA criteria to define the level of wind turbulence that would constitute a "significant adverse impact" under CEQA for windsurfing.

II. Background and Test Protocols

Background

The difference in pressure between two points on the earth causes air masses to move over the earth from the area of higher pressure to the area of lower pressure. This movement of large masses of air results in winds. The interaction of a moving air mass with the surface of the earth creates turbulence and slows the motion of that layer of air that is next to the surface. The slower-moving air near the surface, in turn, slows the next layer of moving air just above it. The turbulence propagates upward, with the result that higher wind velocities are associated with air at greater heights above the surface. This relationship between height and velocity is referred to as a wind velocity profile. The shape of the wind velocity profile created depends on the roughness of the surface over which the wind moves. Smooth surfaces, such as flat open ground or water bodies, do not slow wind flow nearly as much as do rough surfaces, such as urban development, so they have different wind speed profiles.

Winds that move over San Francisco encounter differing levels of roughness, and differing wind speed profiles, due to differing topography, vegetation and structures that all act to slow the wind near the ground and create turbulence. However, when those winds reach large areas of smooth, flat surfaces, such as open land or the Bay, wind speeds near the surface of the ground or water will increase and the level of turbulence will decrease. Of particular importance to site wind conditions is the topography of the vicinity, which includes 525-foot high Visitacion Knob, in McLaren Park to the west-northwest, and the ridge that extends from McLaren Park eastward to the 250-foot high Bayview Hill several hundred feet north of the Project site. In addition to the topography, the extensive low-rise development and the US 101 Freeway that lie to the west and northwest, as well as other approved buildings of similar size that will lie immediately north of the site will strongly affect the prevailing winds that reach the Project site. Most of the Project structures would be built on currently vacant land containing parking lots, and some of the proposed buildings would be larger than the three existing on-site buildings that would be demolished. The overall mass of the development and the size of the proposed structures can be large enough to affect ground-level winds nearby and to have some effect on wind conditions downwind in the Bay.

From the perspective of windsurfers, the presence of these existing landforms and buildings that already lie upwind of windsurfing areas represent "roughness" that controls the speed and turbulence of the winds that reach the nearby wind surfing area in the San Francisco Bay. The Project would add additional building masses to the proposed site near the shore of the Bay, and thereby increasing the effective roughness of the site and decreasing the speed of the wind across the site.

Wind tunnel testing was used to document the existing wind conditions in identified windsurfing areas and to determine the extent to which those existing wind conditions would be altered by proposed development.

Existing Climate and Wind Conditions

While the wind conditions at the Project site are not the same as those in downtown San Francisco, wind conditions at the site can be related to the wind conditions at the old San Francisco Federal Building, just over 5 miles to the north, to account for the differences in wind speed. Correction factors have been calculated for the hourly wind speed and direction data collected at the old San Francisco Federal Building to allow the computation of pedestrian wind speeds at the Executive Park site and to allow comparisons of those statistics with the *Planning Code* criteria for pedestrian comfort and safety in the vicinity of the site. In addition to the wind data from the old San Francisco Federal Building, an hourly wind data record is available for the meteorological station at the San Francisco International Airport, approximately 6 miles to the south, where hourly wind speed and direction data also are collected. While the wind conditions of the Executive Park site are not identical to wind conditions at SFO, wind speed information at SFO is helpful in understanding the general wind conditions in the Bay at a location where winds are not as strongly affected by topography and structures.

The time of interest for sail boarding typically extends from the late spring well into fall, April 1st through November 1st, for times of day from 6 am until 7 pm, mainly during daylight hours. The wind data for the old San Francisco Federal Building consider a similar general daily interval, but does not differentiate by season; on the other hand, the summary of the data for the San Francisco Airport meteorological station discusses only the season from April 1st through November 1st. and the times of day from 6 am until 7 pm.

Old San Francisco Federal Building

Average winds speeds in San Francisco are the highest in the summer and lowest in winter. However, the strongest peak winds occur in winter. The highest average wind speeds occur in mid-afternoon and the lowest in the early morning. Westerly to northwesterly winds are the most frequent and strongest winds during all seasons. Of the 16 primary wind directions, four have the greatest frequency of occurrence and subsequently make up the majority of the strong winds that occur. These winds are Northwest, West-Northwest, West, and West-Southwest.

Data describing the speed, direction, and frequency of occurrence of winds were gathered at the old San Francisco Federal Building at 50 United Nations Plaza (at a height of 132 ft.) during the six-year period, 1945 to 1950. Measurements taken hourly and averaged over one-minute periods have been tabulated for each month (averaged over the six years) in three-hour periods using seven classes of wind speed and 16 compass directions. Analysis of these data shows that during the hours from 6:00 a.m. to 8:00 p.m., about 70% of all winds blow from five of the 16 directions as follows: Northwest (NW), 10%; West-Northwest (WNW), 14%; West (W), 35%; West-Southwest (WSW), 2%; Southwest (SW), 9%; and all other winds, 28%. Calm conditions occur 2% of the time. More than 90% of measured winds over 13 mph blow from these directions. Wind speeds and directions in the Project vicinity are altered by the topography of Bayview hill. The steps needed to adjust for these differences are described under the discussion of Wind Speed Profile Adjustments.

San Francisco International Airport

An examination of six years of record (78,638 hourly observations) of the hourly wind speeds and wind directions measured at the weather station at the San Francisco Airport meteorological station was used to establish the general frequency of occurrence of winds during the time of interest for sail boarding. A total of 23,935 hours of record for times of day from 6 am until 7 pm, mainly during the daylight hours, daily for April 1st through November 1st, was used to establish baseline wind conditions for the site vicinity. The highest average wind speeds occur in mid-afternoon and the lowest in the early morning. Westerly to northwesterly winds are the most frequent and strongest winds during all seasons. Of the 16 primary wind directions, four have the greatest frequency of occurrence as well as they make up the majority of the strong winds that occur; these are Northwest, West-Northwest, West and West-Southwest winds.

Analysis of these data shows that during the hours from 6:00 a.m. to 7:00 p.m., about 73.3% of all winds blow from five of the 16 directions, as follows: Northwest (NW), 19.0%; West Northwest (WNW), 27.6%; West (W), 15.9%; West Southwest (WSW), 6.7%; Southwest (SW), 4.0%; and all other winds, 24.4%. Calm conditions occur 2.3% of the time. When only wind speeds of 9 knots (10 mph) or more are considered, these percentages decrease by about 2% for each major direction: Northwest (NW), 17.0%; West Northwest (WNW), 24.6%; West (W), 13.8%; West Southwest (WSW), 4.4%; and Southwest (SW), 2.4%.

Wind Speed Evaluation Criteria

The comfort of pedestrians varies under different conditions of sun exposure, temperature, clothing, and wind speed. Winds from 8 to 13 mph will disturb hair, cause clothing to flap, and extend a light flag mounted on a pole. The top of this speed range marks a boundary beyond which pedestrians generally consider winds to be objectionable. By contrast, comfort seems less an objective and stronger winds are typically more valued in wind-powered activities such as windsurfing. Wind speeds of 13 mph or more are usually considered desirable for wind-powered activities, such as paragliding and hang-gliding, as well as for windsurfing. Typically, the more skilled the participant, the more higher the wind speed desired.

Wind speed effects on land and water-related uses of the Candlestick Point State Recreation Area (CPSRA) shoreline and Bay areas vary with the specific use. Sailing requires wind, and the more proficient the sailor, the more wind seems to be preferred. Wind direction is also important to windsurfing, in that an adverse wind direction can make it more difficult to launch, to reach a desirable sailing area or to return to the launch site. Wind is necessary to launch and land, but if winds are too strong at the launch site, beginners and less-skilled windsurfers could find it difficult to do either.

There appear to be no specific criteria for minimum wind speeds to support "good" sailing. Rather, for highly skilled windsurfers, it appears to be the case that the more wind in the sailing area, the better. If a project were to cause substantial wind speed reductions over much of a major windsurfing area or at an irreplaceable launching or landing site, the utility of the CPSRA and Bay as an important windsurfing area could be adversely affected. Similarly, there are no known criteria to determine the level of wind turbulence acceptable for windsurfing.

San Francisco Planning Code and CEQA Requirements

San Francisco *Planning Code* Section 148, Reduction of Ground-Level Wind Currents, contains requirements that are used for evaluation of wind impacts for the purposes of CEQA in San Francisco. Section 148 defines comfort and hazard criteria for pedestrian areas and defines the wind speeds in terms of equivalent wind speeds[5], an average wind speed (mean velocity), adjusted to include the level of gustiness and turbulence.

5 Equivalent mean wind speed is defined as the mean wind speed, multiplied by the quantity (one plus three times the turbulence intensity) divided by 1.45. This amplifies the equivalent mean wind speed values when turbulence intensity is greater than 15%. The *Planning Code* protocol definition of turbulence intensity differs from that in engineering use. There, the value used by the *Planning Code* (turbulence intensity / mean velocity) is called the "relative intensity of turbulence" or the "turbulence level". Regardless, references to Turbulence Intensity or TI in this Memo will follow the *Planning Code* protocol definition, unless otherwise noted.

There are no established criteria in the *Planning Code* to define the level of reduction in wind speed that would constitute a "significant adverse impact" under CEQA for windsurfing at the CPSRA or in the Bay.[6]

Just as there are no San Francisco criteria to define minimum wind speeds necessary to support windsurfing, nor are there established criteria to define the level of reduction in wind speed that would constitute a "significant adverse impact" under the California Environmental Quality Act (CEQA) for windsurfing at CPSRA or the Bay.

Model and Wind Testing Protocols

A 1:600 scale (1-inch to 50-foot scale) model of the Project site vicinity and a substantial downwind reach into the Bay was constructed in order to simulate the Project and its existing and future contexts. The test model included two configurations of the Project, for the purposes of conducting pedestrian wind testing. See Figures 1 and 2. The test model also included that portion of the Bay, extending southward from the Project site to approximately 1,000 ft. east of the launch area of the Candlestick Point State Recreation Area (CPSRA). The scale model of the Project and surrounding area was constructed by ESA from building plans provided by the Project architects. The windsurfing test area was defined by a 1,750 ft. by 2,500 ft. downwind grid, anchored at the CPSRA launch area and reaching generally toward the South-southwest. The scale models were then tested in an atmospheric boundary layer wind-tunnel facility at the University of California-Davis, under the direction of Bruce White, Ph.D. These wind tests, however, were performed independent of the University.

Three development scenarios were modeled and tested in the atmospheric boundary layer wind tunnel. The scenarios are: 1) Existing Setting, 2) Project, and 3) Project plus Cumulative.

With respect to the wind testing of effects on the wind surfing areas, three of the usual wind test protocols were varied, as follows, for the reasons stated here:

- For windsurfing area testing, the Southwest wind was not tested. The Southwest wind blows onshore toward the flank of Bay View Hill, and parallel to Harney Way at the Project site, so Southwest winds that blow across the Project site could not reach windsurfing areas that lie to the south of Candlestick Point. For that reason, under Southwest wind conditions neither the Project scenario nor the Cumulative scenario could have any effect on winds in the windsurfing areas that lie south of Candlestick Point.

- For the West wind direction, the test grid locations far south of the launch area are crosswind to the West wind and are considered to be well outside of the area that could potentially be affected by either the Project or the Project plus Cumulative scenarios. For that reason, test points that lie more than 1,500 feet south of the launch area were not measured for the West wind. The validity of this reasoning is verified by the test data, which show little north-south variation in the wind speeds for those points measured.

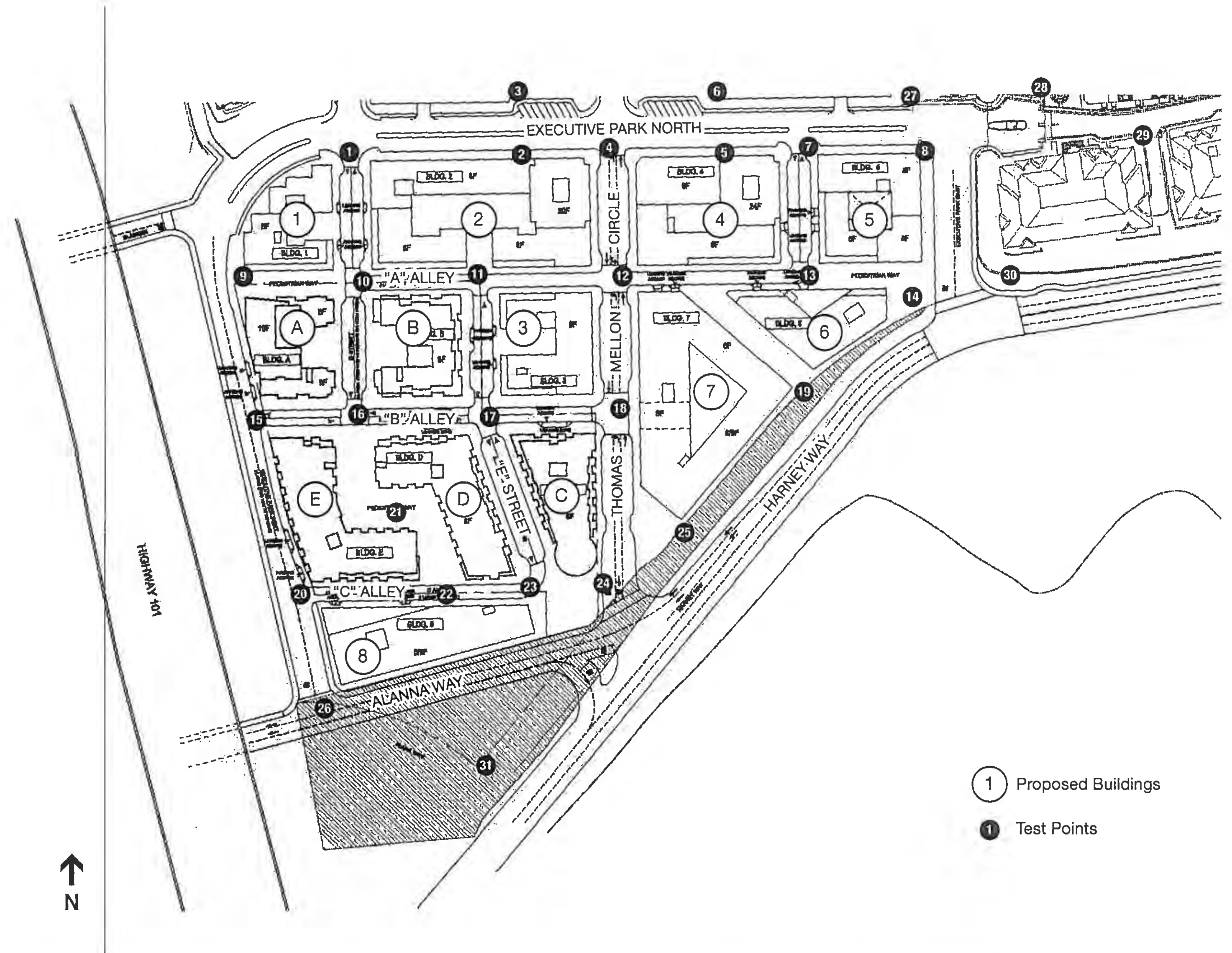
- The windsurfing areas are relatively distant from the Project site, the closest point being approximately 2,000 feet from the Project site boundary. At such distances, even at the closest of the test locations in the

[6] ~~The City of Burlingame, in an EIR that evaluated the effects of a proposed shoreline development on windsurfing, applied the~~ following standard of significance for the purposes of that EIR: "A reduction of 10% or more in wind speeds at irreplaceable launching and landing sites, or a reduction in wind speed of 10% or more over large portions of transit routes or primary board sailing areas would be a significant adverse impact."

ESA

windsurfing area grid, it cannot reasonably be anticipated that meaningful differences can be found between the wind speed and turbulence measurements for the Project scenario and the wind speed and turbulence measurements for the Alternative scenario[7]. For this reason, to determine the possible Project effect on wind in windsurfing areas, both the Project scenario and the Alternative scenario wind conditions are well represented by a single scenario. The physical model used in the test was the Alternative, which is the same as the Project, except that Alanna Way is realigned and there is a revised design for one proposed Project building (Building 8) located in the southwest corner of the Project site.

[7] A simple analysis of the decay of the wind speed reduction *vs.* distance from the center of the site of Building 8 for each of the two scenarios, the Project and the Alternative, shows that the wind speed reductions for each scenario converge to values that differ by less than 20% at a ground distance of less than 900 ft. and to within 4% at a distance of less than 1,200 ft. By extrapolation, these differences between Project and Alternative would be less than 1% at any point in the windsurfing test grid, more than 2,000 ft. from the center of the Building 8 site. This 1% difference cannot be considered to be meaningful, because it is well within the range of uncertainty of the individual wind speed measurements. Therefore the effects of the Project and the Alternative would be the same.

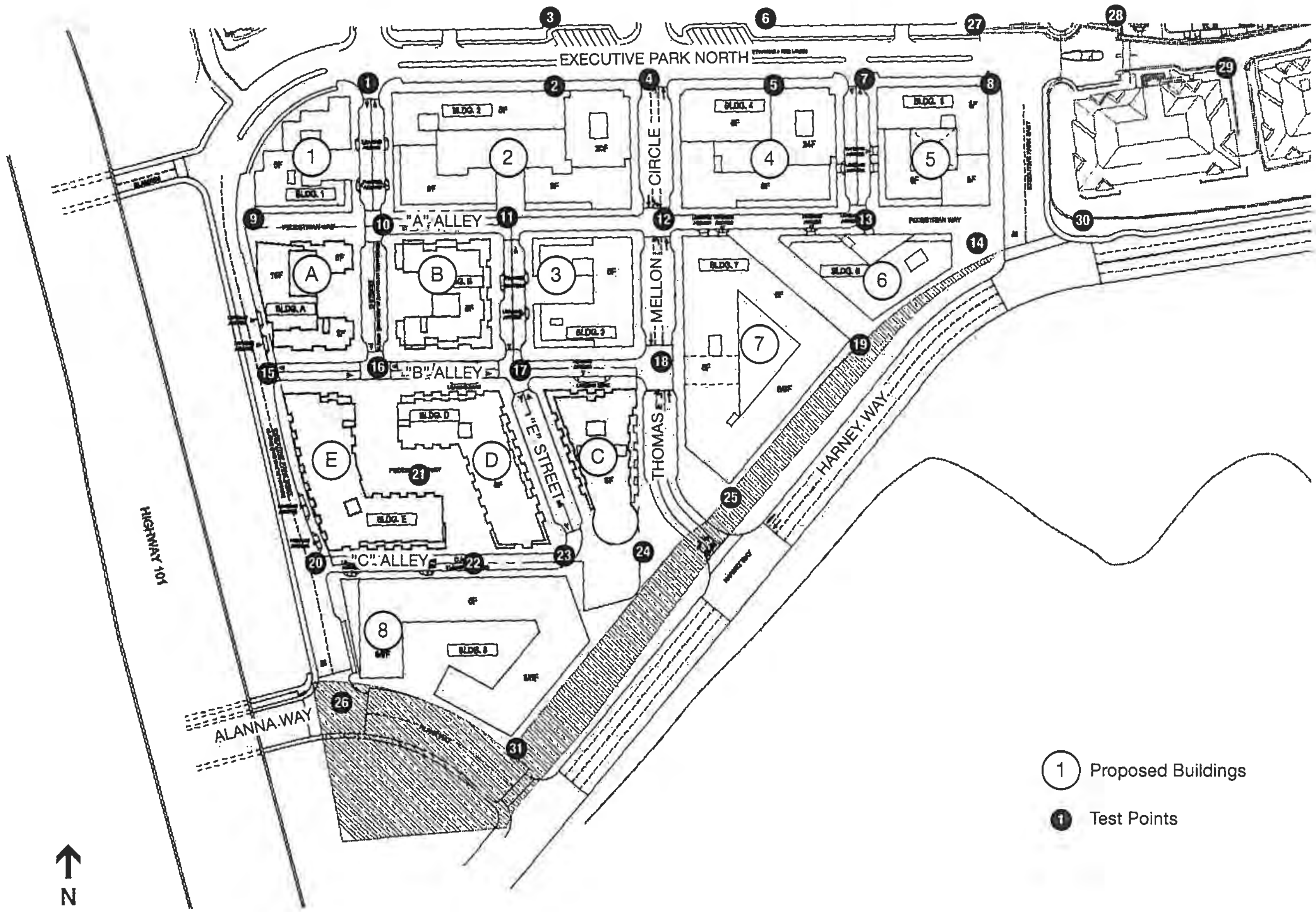


SOURCE: ESA

Executive Park Wind Test . 208449

Figure 1

Wind Test Point Locations: Project - Base



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 2

Wind Test Point Locations: Project - Option 1

Test Procedure

The test procedure consisted of orienting the selected configuration of the model in the atmospheric boundary layer wind-tunnel and measuring the wind speed at each of the test locations with a hot-wire anemometer. Hot-wire measurements were taken at most of the same surface points for all test configurations and wind directions. However, as noted above, test measurement points were varied to suit the specific needs for each wind direction.

The wind tunnel allows testing of natural atmospheric boundary layer flow past surface objects such as buildings and other structures. The tunnel has an overall length of 22 meters (m) (72 feet), a test section of 1.22 m (4 feet) wide by 1.83 m (6 feet) high, and an adjustable false ceiling. The adjustable ceiling and turbulence generators allow speeds within the tunnel to vary from 1 meter per second (m/s) to 8 m/s, or 2.2 mph to 17.9 mph.

Wind-speed measurements at each test location were made with a hot-wire anemometer, an instrument that directly relates rates of heat transfer to wind speeds by electronic signals that are proportional to the magnitude and steadiness of the wind. The hot-wire probe was calibrated to an accuracy of within 2% before the test procedure was begun. The hot-wire probe measured the analog voltage at a rate of 1,000 times per second for approximately 30 seconds at each test location. When converted to digital signals, this measurement provided approximately 30,000 individual voltage samples that were averaged and the root mean square calculated for each test location. These data, when converted to velocity using the calibration curves, provided the mean wind velocity and the turbulence intensity values used to calculate equivalent wind speed under the *Planning Code*. In that calculation, turbulence intensity (TI) is expressed as a percentage of mean velocity[8].

By measuring both the mean wind speeds and corresponding turbulence intensities, high wind speeds and gustiness (changes in wind speeds over short periods of time) could be determined. The ratio of near-surface speed to reference wind speed was calculated from the hot-wire measurements. The inherent uncertainty of measurements made with the hot-wire anemometer close to the surface of the model is ±5% of the true values.

These values were compared with measurements of the free-stream wind, measured at a scale height in excess of 1,500 feet, near the center of the wind tunnel. As a result, each wind tunnel measurement resulted in a ratio that relates the speed of surface-level wind to the speed of the free-stream wind. These wind speed ratios (called R-values here) are the primary output data of wind tunnel tests. The R-values, the ratios, are usually substantially less than 1.00 because, due to boundary layer effects, wind speeds at pedestrian level are usually much less than the speed of the free-stream wind[9].

Note that it is possible to correlate these wind speed ratios for each wind direction to the wind speeds actually measured at the reference elevation, in this case the height of the wind instrumentation at the San Francisco station, and then to convert them into representative values of wind speed on and around the Project site, as is done to compare with wind comfort and safety criteria under the *Planning Code*.

8 The *Planning Code* protocol definition is: Turbulence Intensity, TI = root mean square (velocity) / mean velocity. This definition differs from that in engineering use, as noted in a prior footnote.

9 For the purposes of comparison, in most cases where a wind hazard condition is found at a pedestrian location in San Francisco, at least one or more of the corresponding directional R-values exceeds 0.50. It is extraordinary to find an R-value that exceeds 0.70.

However, for the purposes of this analysis, it is of more use just to make direct comparisons between the ratios obtained for each wind direction and each scenario. Since each windsurfer can know the wind direction under which they sail, the change in the wind speed could be determined by comparing the ratios measured for the Project test with the ratios for Existing Conditions each for the relevant wind direction. The comparisons are made by dividing the ratios for each test point of the Project scenario by the corresponding ratio for the corresponding point of the Existing Condition. When expressed as a percentage, these ratios of the R-values are a simple measure of the percentage change in wind speed that would result from the Project.

In addition to wind speed and turbulence, the energy content of the wind can also be determined from the wind tunnel tests. Just as the wind speed is proportional to the R-values, the energy of the wind is proportional to the third power of the R-values. In a case where the wind speed would be reduced by 10%, the energy in that wind would be reduced by 27%. However, for the purposes of this analysis, R-values are studied because they relate directly to the most commonly used indicator, the speed of the wind.

With respect to the ability of wind tunnel testing to accurately simulate the wind conditions relevant to wind surfing, it has been well documented in the scientific literature that the atmospheric boundary layer wind-tunnel can correctly represent wind velocity, wind turbulence and the power spectrum of the wind.

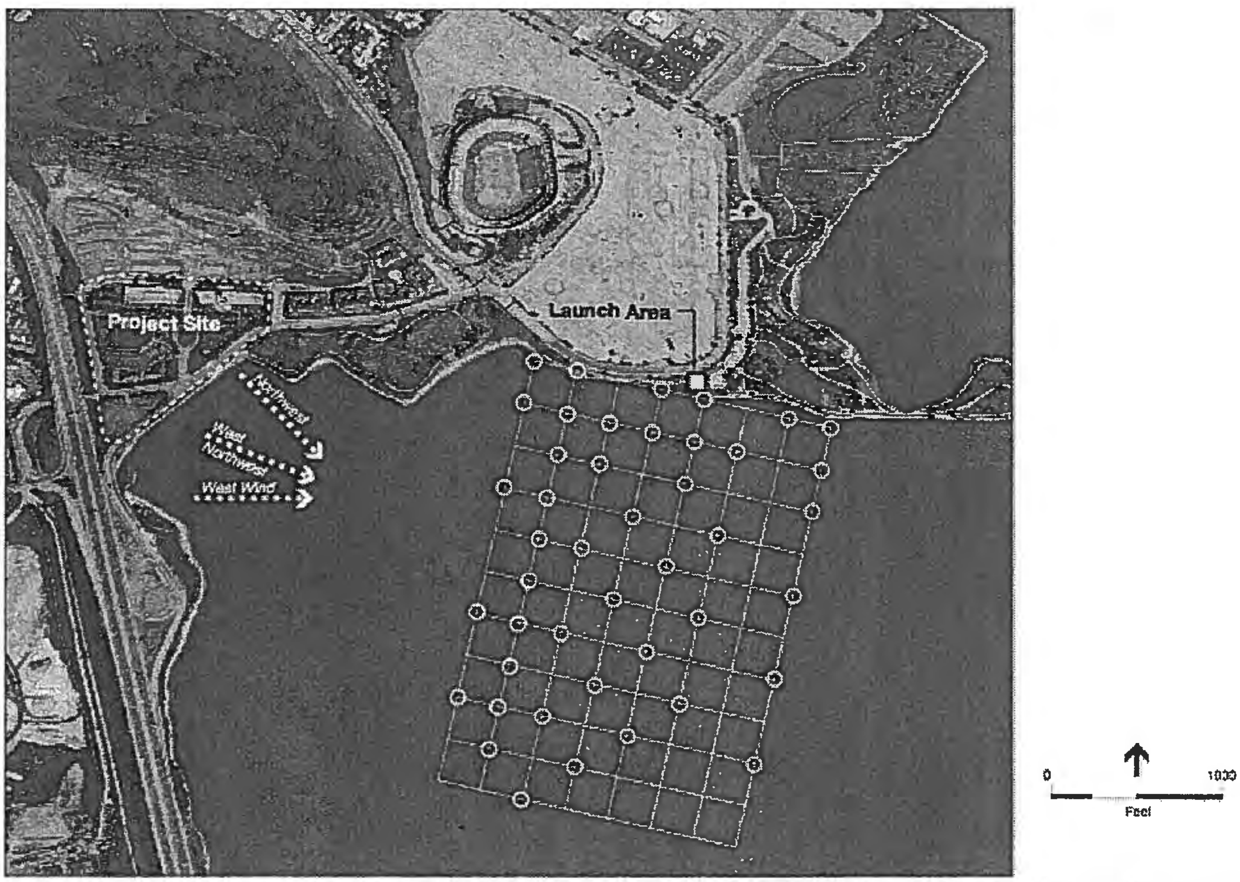
Wind Speed Profile Adjustments

To obtain the proper scaling of calculated pedestrian level equivalent wind speeds, adjustments must be made to correct for differences between the relationship between height above the ground and wind speed (called "the wind speed profile") at the Civic Center weather station and the wind speed profile at the Project site. This study does not involve calculating equivalent wind speeds at pedestrian level, so it is not necessary to make corresponding corrections for the wind speed profile at the Project site. The following wind test cases and study results reflect the use of unadjusted values.

III. Test Cases and Study Results

Introduction

Wind-tunnel tests to measure wind speeds in the windsurfing area were conducted for three scenarios: the Existing Setting, Project, and Project plus Cumulative. As discussed previously in Model and Wind Testing Protocols, both the Project and the Alternative wind conditions are well represented by the same test scenario. The physical model tested was the Alternative scenario. For the reasons discussed previously, all further discussion in this Technical Memorandum will refer to this test scenario as the "Project" scenario.



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 3
Study Area with Wind Tunnel Measurement Points

Up to 44 locations were measured for each of the various scenarios and wind directions. Considering the spatial relationship of the proposed development to the Bay and the windsurfing launch area, the wind tests focused on the effects of west (W), west-northwest (WNW), and northwest (NW) winds, the three wind directions that could be most affected by proposed development. Southwest winds are onshore winds and would not affect wind in the windsurfing areas, so southwest winds were not studied.

Test Locations

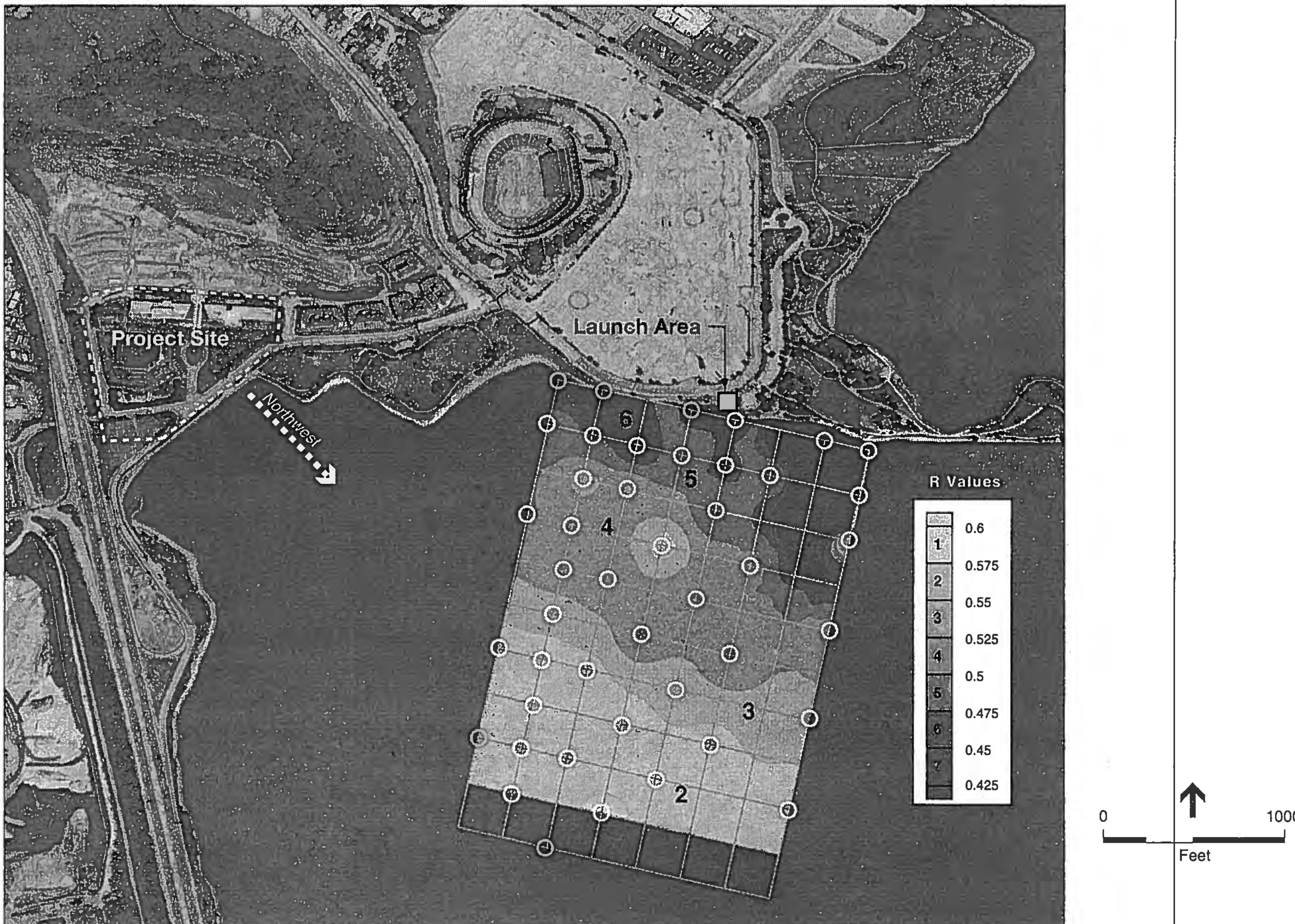
The 44 windsurfing test locations form an 8 by 11 grid, with 250 ft. spacing between each of the possible individual test points (see Figure 3). The test grid is oriented generally north-northeast by south-southwest, with the coordinate origin located approximately 1,000 ft. northwest of the primary windsurfing launch site at CPSRA. Boards launched here proceed in a southwesterly or south-southwesterly direction. The test grid area aligns with the shoreline near the windsurf launch area and covers the area of the Bay described as an important windsurfing area, based on information provided by Mr. Peter Thorner of the San Francisco Boardsailing Association (*Candlestick Sailing Tracks)*, attached to this document). The area within the 1,750 by 2,500 ft. test grid is 100.44 acres.

As described in Test Procedure, hot-wire measurements were taken at selected surface points for each of the three test configurations and three wind directions. As noted previously, the most southerly of the test points were not measured for the West wind direction as these locations are considered to be outside the area potentially affected by the Project scenario and the Project plus Cumulative scenario.

Test Results

The wind tunnel test outputs for each of the three scenarios produced three sets of detailed data tables, one set for each of the three wind directions. Data from these tables were plotted to figures that illustrate the existing conditions and changes that would result from implementation of Project, and also show the effects from cumulative development in the Candlestick Point area.

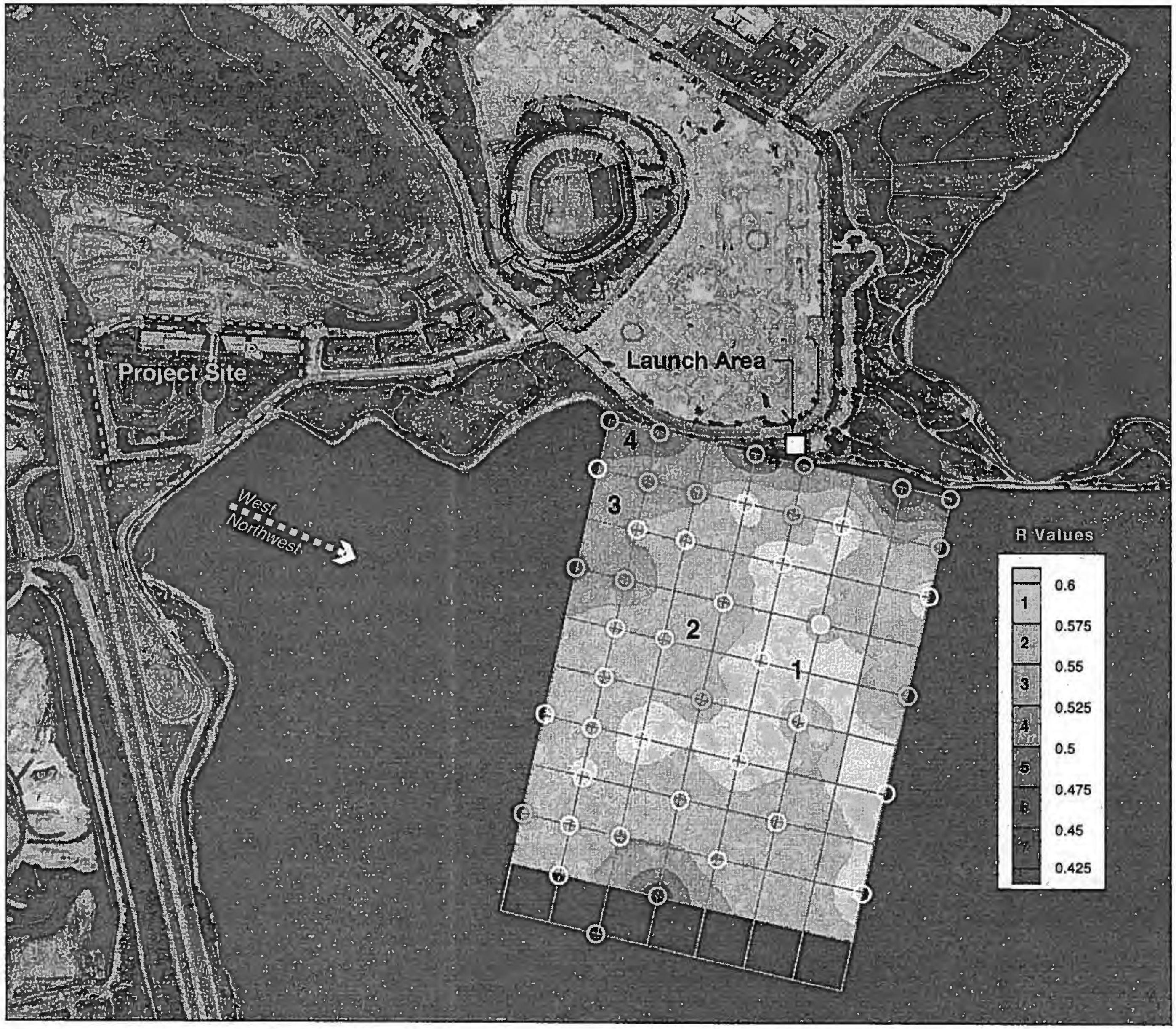
Figure 3 shows the measurement point locations in relation to the Project site and vicinity. Summary information about the wind tunnel test results are illustrated in the figures and details are discussed in the text that follows.



SOURCE: ESA

Executive Park Wind Test . 208449

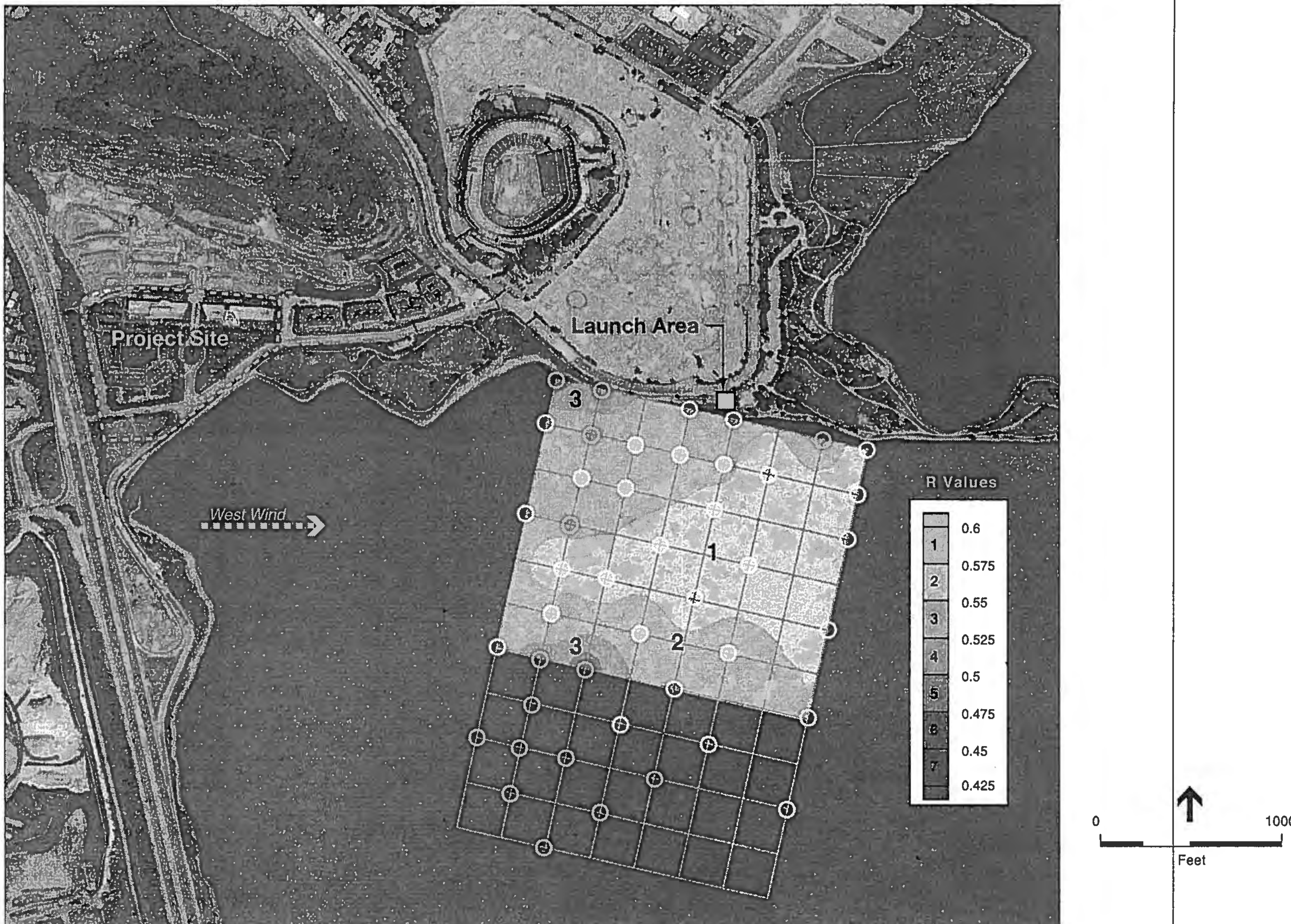
Figure 4
R Values
Northwest Wind
Existing Setting



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 5
R Values
West-Northwest Wind
Existing Setting



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 6
R Values
West Wind
Existing Setting

Test 1: Existing Setting

Wind Speed

The R-values under the Existing Setting for each of three wind directions: Northwest, West-Northwest and West are as follows:

- Northwest wind R-values vary from 0.39 to 0.58, indicating that the wind speed near the surface of the Bay is between 39% and 58% of the speed of the free-stream wind flowing high overhead.
- West-Northwest wind R-values range between 0.47 and 0.60 (47% to 60% of the free-stream wind).
- West wind R-values range from 0.51 to 0.61 (between 51% and 61% of the free-stream wind).

The R-values, as plotted in Figures 4, 5 and 6, are generally lower closer to the shoreline, due to the effects of the topography, rough ground surface and buildings in slowing the wind[10] as it moves over the land. The combined effects are most pronounced for Northwest wind. The depression of the R-values at the northeast corner of the grid defines the existing wind-shadow from the Candlestick Park stadium, located northwest of the CPSRA launch area.

Wind Turbulence

Values of turbulence intensity (TI) were measured for the Existing Setting for each of three wind directions: Northwest, West-Northwest and West. No TI values[11] were found that were less than 14% and no TI values reached 30%. Because the TI values fell close together, and because there was no reason to make finer distinctions, TI values are arbitrarily grouped within four 4%-wide "zones" or "areas" for plotting; each with a numerical identifier, as follows:

Area "1" - TI = 26% to 30%,

Area "2" - TI = 22% to 26%,

Area "3" - TI = 18% to 22%, and

Area "4" - TI = 14% to 18%.

Figures 7, 8 and 9 show plots of based on these isopleths of the turbulence intensity (TI) values measured for the Existing Setting under each of three wind directions: Northwest, West-Northwest and West. In general, the highest values of turbulence occur near the shore with the lower values occurring downwind. The highest peak TI values occur under Northwest winds. Lower peak TI values and smaller coverage areas occur for West-Northwest winds, while still lower peak values and much smaller coverage areas occur for West winds.

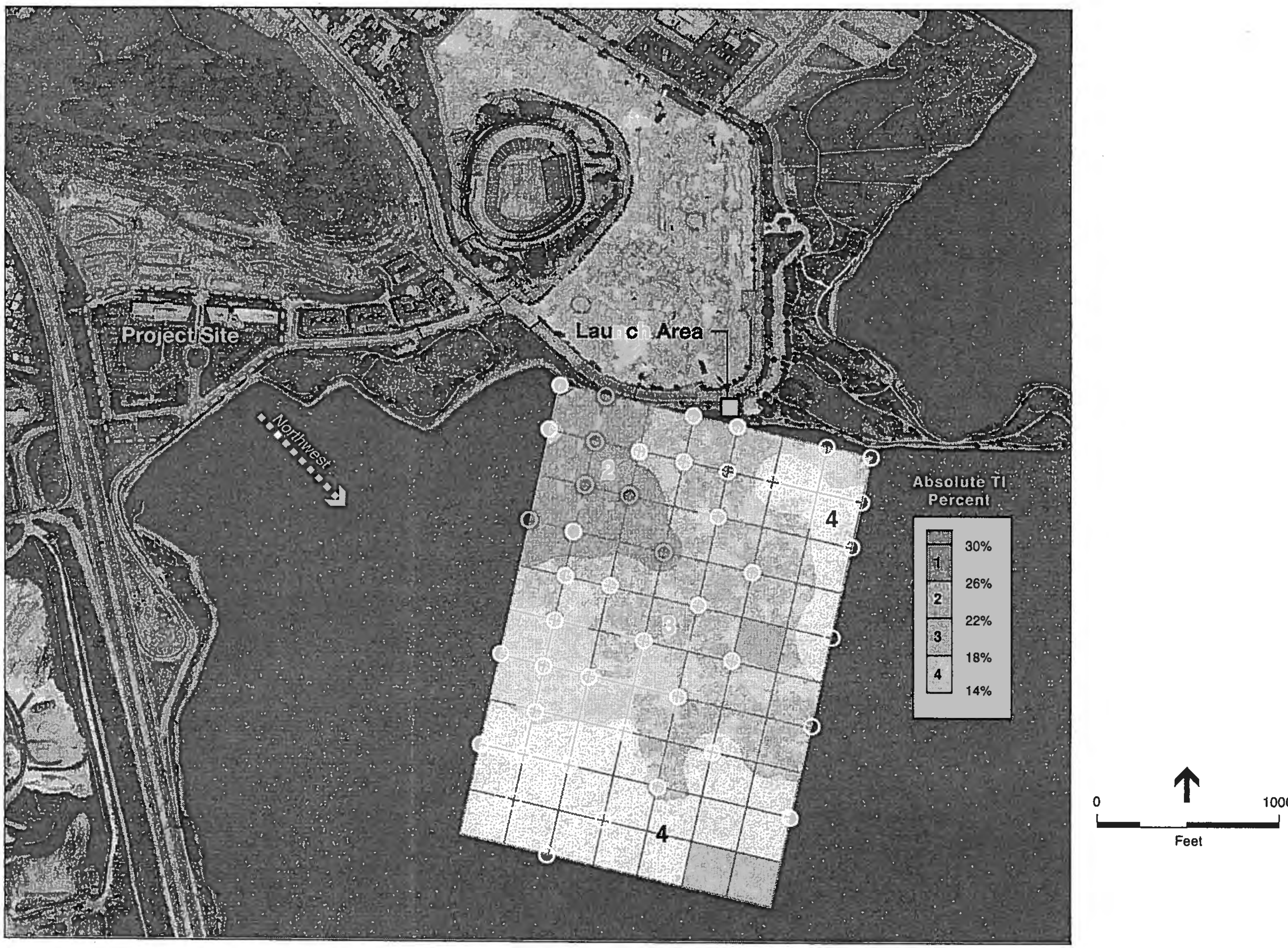
10 Vegetation, which was not included in the wind test model, can further increase wind drag and substantially decrease wind speeds.

11 The formula Planning Code Section 148 uses to compute "equivalent wind speed" assumes a baseline value of 15% for TI. Values of TI from wind testing of buildings in the Downtown typically exceed 15% and TI values in the range of 30% to 50% are not uncommon.

- Northwest wind TI values range from 26% near the shore to 14% downwind. The highest TI values (22% to 26%) cover 13-acre±s at the northwest corner of the grid, near the shoreline. The high TI is likely the result of the downwind "shadow" of the Bay View Hill, existing buildings at Executive Park and the existing Candlestick Park stadium. Lower TI values (18% to 22%) cover approximately half of the grid area, generally extending the downwind shadow of existing features. TI values range between 14% and 18% over the remaining one-third of the grid, in those areas farthest downwind. See Figure 7.

- West-Northwest wind TI values range from 14% to 18% over about three-quarters of the grid area, with TI values between 18% and 22% covering one-quarter of the grid close to shore, and 22% to 26% in a less than half-acre± area at the shoreline at the northwest tip of the grid. See Figure 8.

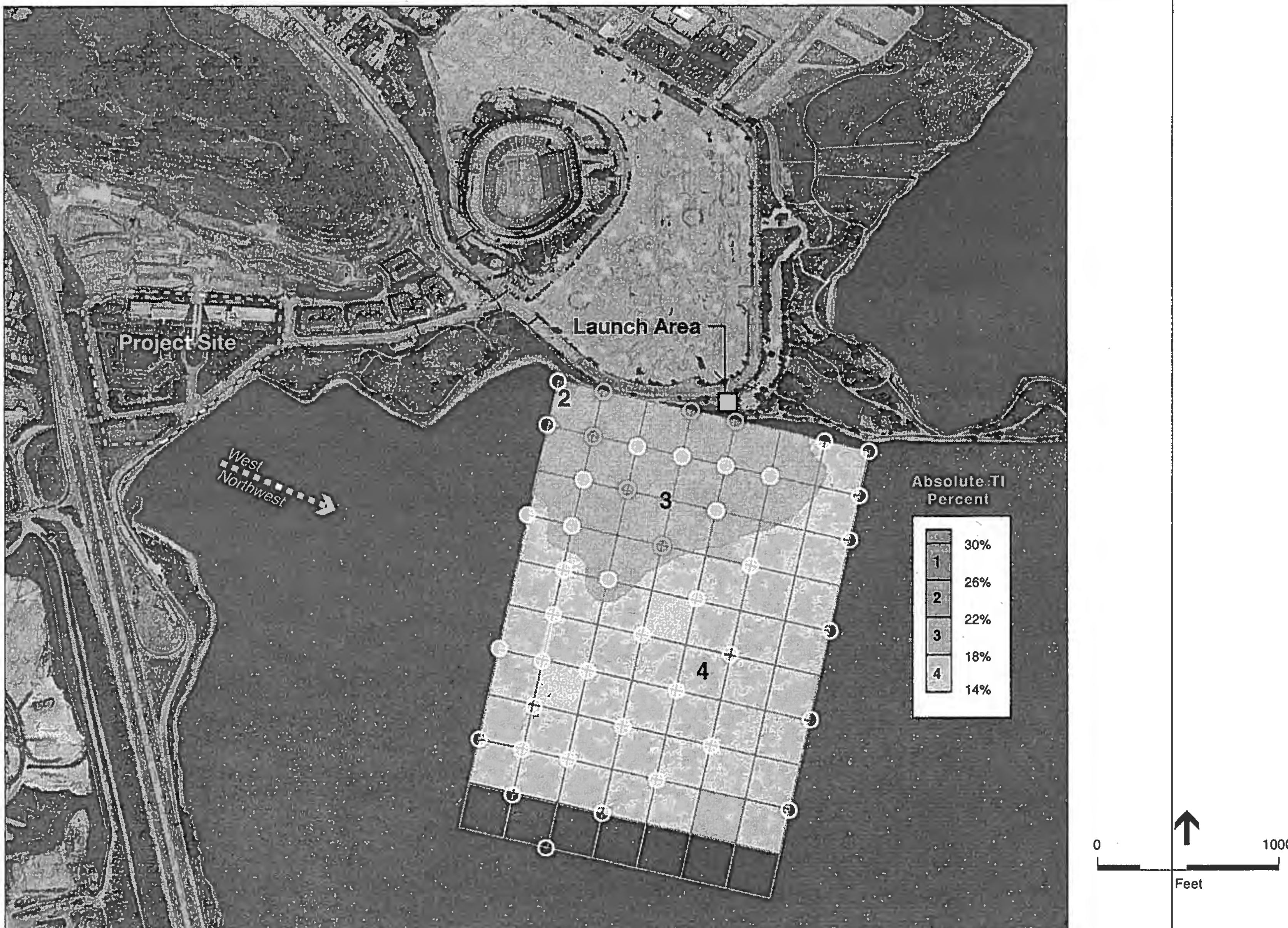
- West wind TI values range from 14% to 18% over almost all of the area, with higher TI values (18% to 22%) in a 1.5 acre± area near the shoreline at the northwest corner of the grid. See Figure 9.



SOURCE: ESA

Executive Park Wind Test . 208449

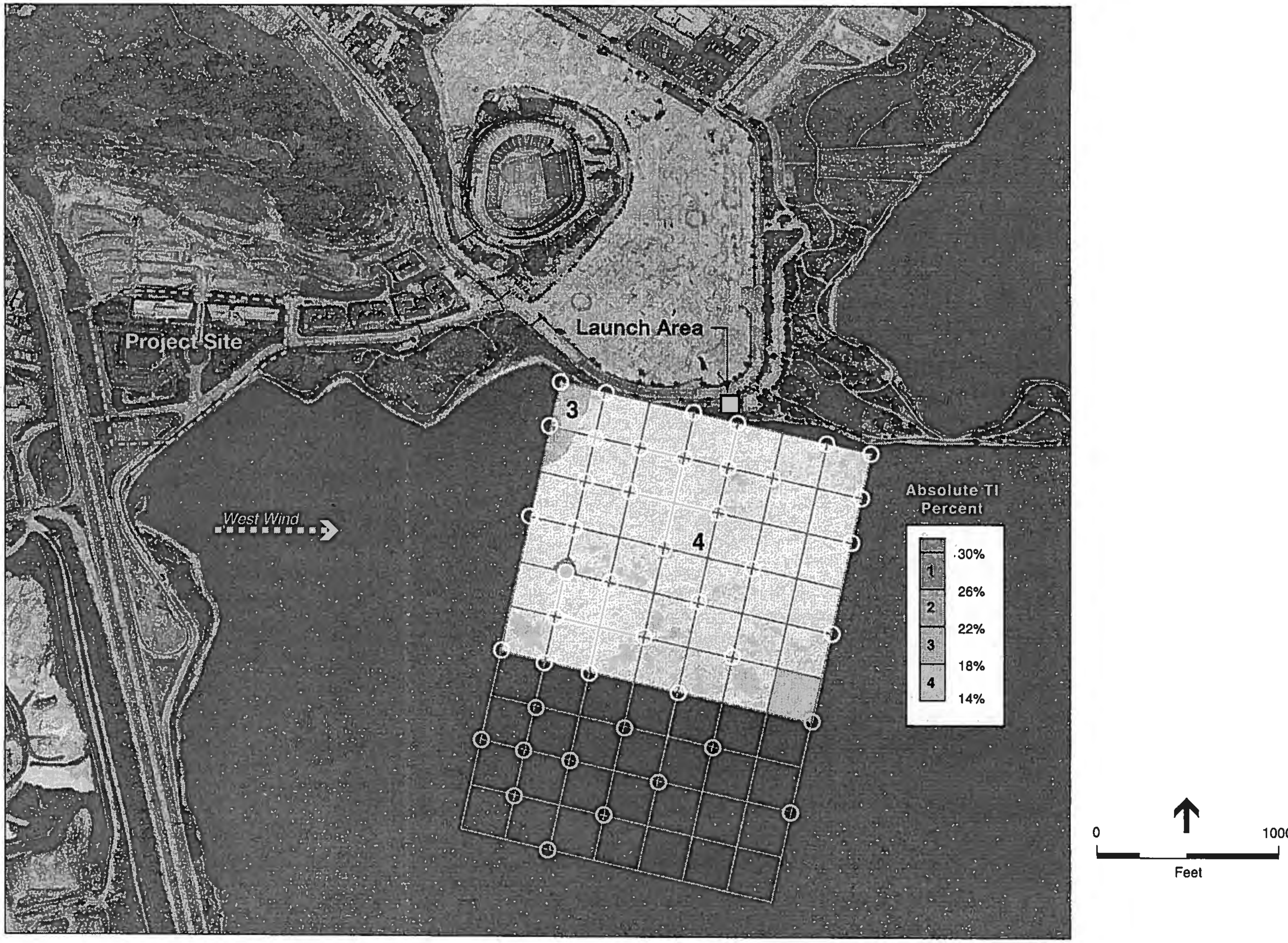
Figure 7
Turbulence Intensity
Northwest Wind
Existing Setting



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 8
Turbulence Intensity
West-Northwest Wind
Existing Setting



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 9
Turbulence Intensity
West Wind
Existing Setting

ESA

Test 2: Project

The Project setting consists of plans provided by the architects that were added to the existing setting. The Project includes the demolition of three buildings in the existing setting and the construction of 13 separate buildings (or building clusters) and would range in height from approximately 86 to 293 feet. Some of the buildings would have internal courtyards, walkways, and other common areas.

Wind Speed

The R-values for each wind direction under the Project scenario[12] are as follows:

- Northwest wind R-values range from 0.40 to 0.57 (compared to Existing R-values of 0.39 to 0.58).
- West-Northwest wind R-values range from 0.39 to 0.59 (compared to Existing R-values of 0.47 to 0.60).
- West wind R-values range from 0.47 to 0.60 (compared to Existing R-values of 0.51 to 0.61).

As is evident above, the actual changes in the ranges of R-values between the Existing conditions and the Project scenario for each wind direction are typically not large. Because it is difficult to interpret the changes in the R-values by visually comparing two R-value plots, such as of Project and Existing conditions, it is more instructive to consider the change[13] between R-values for the Project scenario and the corresponding R-values for the Existing conditions, expressed as a percent of the Existing R-values. This method amplifies and clearly shows the relatively small percentage changes in R-values that occur over the area of the grid. Five isopleth values for percentage change in R-value were selected to cover the range of variation and to show sufficient detail to serve the analysis purposes of this study. The four bands or ranges formed by the five isopleths are as follows:

Area "1" - % Change in R-value = +5% to 0%,

Area "2" - % Change in R-value = 0% to -5%,

Area "3" - % Change in R-value = -5% to -10%, and

Area "4" - % Change in R-value = -10% to -20%.

Plots of these percentage differences in R-values are shown in Figures 10 through 12. Because R-values are proportional to wind speed, these plots also show real percentage changes in wind speed.

- For Northwest wind, the largest increase in measured R-values with the Project was 4.6%. The areas marked "1" and "2" in Figure 10 represent changes in R-values, and in wind speed, ranging from an increase of 4.6% to a decrease of 5%. The next largest, area "3", would undergo a decrease in R-values of 5% to 10% (a change in R-values in the range of -5% to -10%).
- For West-Northwest wind, the largest increase in R-values with the Project was 2.4%. Areas "1" and "2" in Figure 11 represent changes of +2.4% to -5% in R-values, and in wind speed. The next largest, area

[12] Plots of the R-values for each wind direction under the Project scenario are presented in Figures 22, 23 and 24, in Appendix 1.

[13] Difference = (R-value$_{project}$ – R-value$_{existing}$). The "change" is then the difference divided by R-value$_{existing}$.

"3", would undergo changes in R-values of -5% to -10%. Area "4", bordering the shoreline, would undergo changes in R-values of -10% to -20%. Area "4" is 2.5 acres± in size, about 2.5% of the area of the grid.

- For West wind, the largest increase in R-values was 2.9%, in area "1" on Figure 12. However, almost all of the grid, area "2" on Figure 12, shows changes of 0% to -5% in R-values, and in wind speed, with the Project.

In summary, the Project scenario would result in wind speed changes, relative to Existing wind speeds, ranging from an increase of 4.6% to a decrease of 10% for Northwest, West-Northwest and West winds over most of the area of the grid. For West-Northwest winds, an area near the shoreline representing approximately 2.5% of the grid area experiences changes in wind speed from -10% to -20%.

Wind Turbulence Intensity

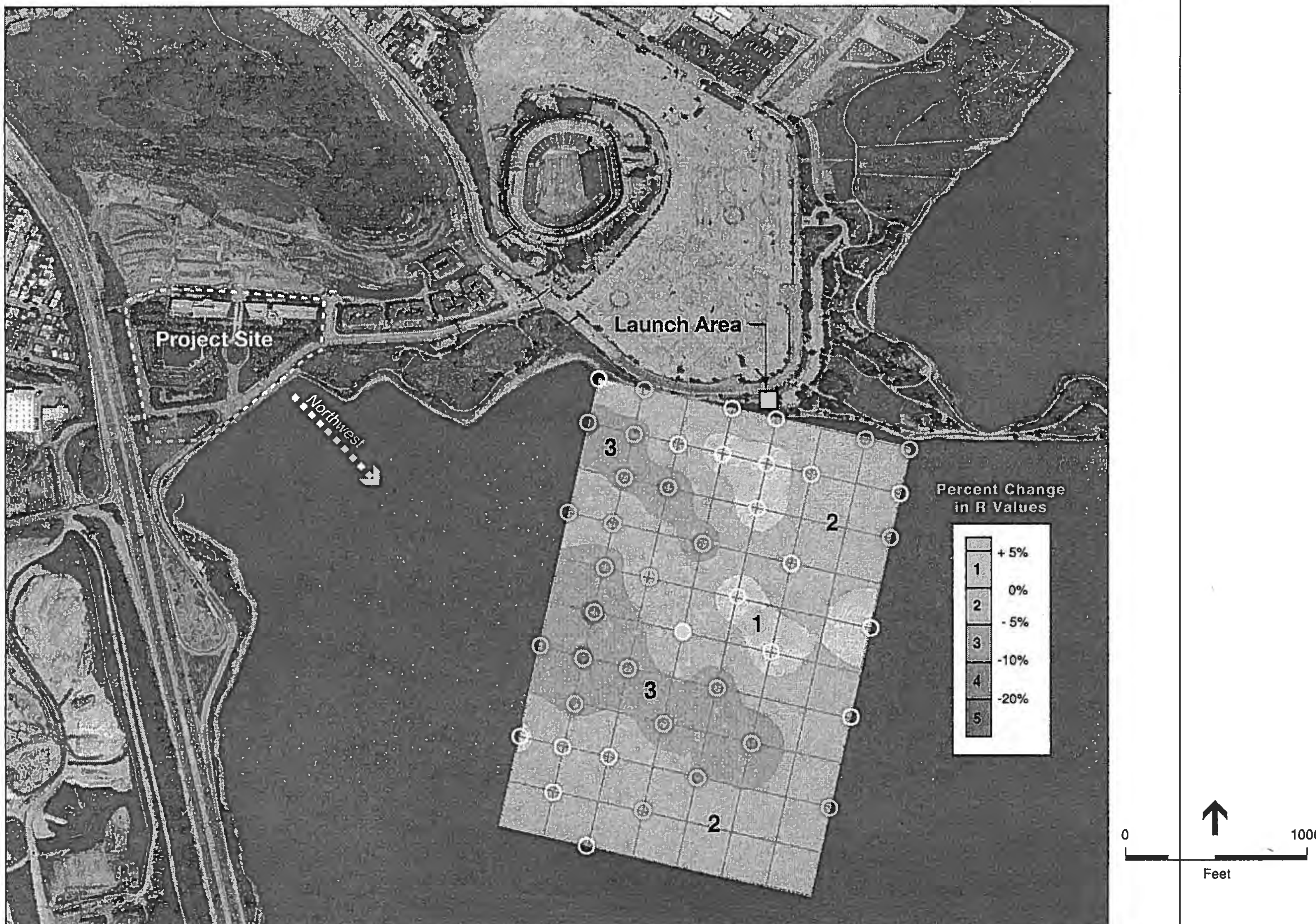
Values of turbulence intensity (TI) were measured for the Project scenario under each of three wind directions: Northwest, West-Northwest and West. No TI values were 14% or less and no TI values were 30% or more.

Figures 13, 14 and 15 show plots that use the predefined TI isopleths, to plot the turbulence intensity (TI) values measured for the Project under each of three wind directions: Northwest, West-Northwest and West. In general, turbulence increases, with the highest values of turbulence occur near the shore and lower values occurring downwind. As in the Existing setting, the highest peak TI values occur under Northwest winds. Lower peak TI values and smaller coverage areas occur for West-Northwest winds, while still lower peak values and much smaller coverage areas occur for West winds.

- Northwest wind TI values with the Project range from 30% near shore to 14% in isolated downwind locations. The highest TI values (22% to 26% and 26% to 30%) cover approximately 25-acre±s along half of the west side of the grid Figure 13, near the shoreline. The Project clearly adds to the high TI of the Existing scenario. Lower TI values (18% to 22%) extend to cover approximately three-quarters of the grid area. TI values range between 14% and 18% over the remaining 3-acre±s of the grid, in two isolated areas far downwind.

- West-Northwest wind TI values with the Project range from 14% to 18% over about half of the grid area, with TI values between 18% and 22% covering over one-third of the grid close to shore, 22% to 26% in more than an 11-acre± area at the shoreline along the northern end of the grid, and reaching 26% to 30% in a half-acre± area at the northwest tip of the grid. See Figure 14.

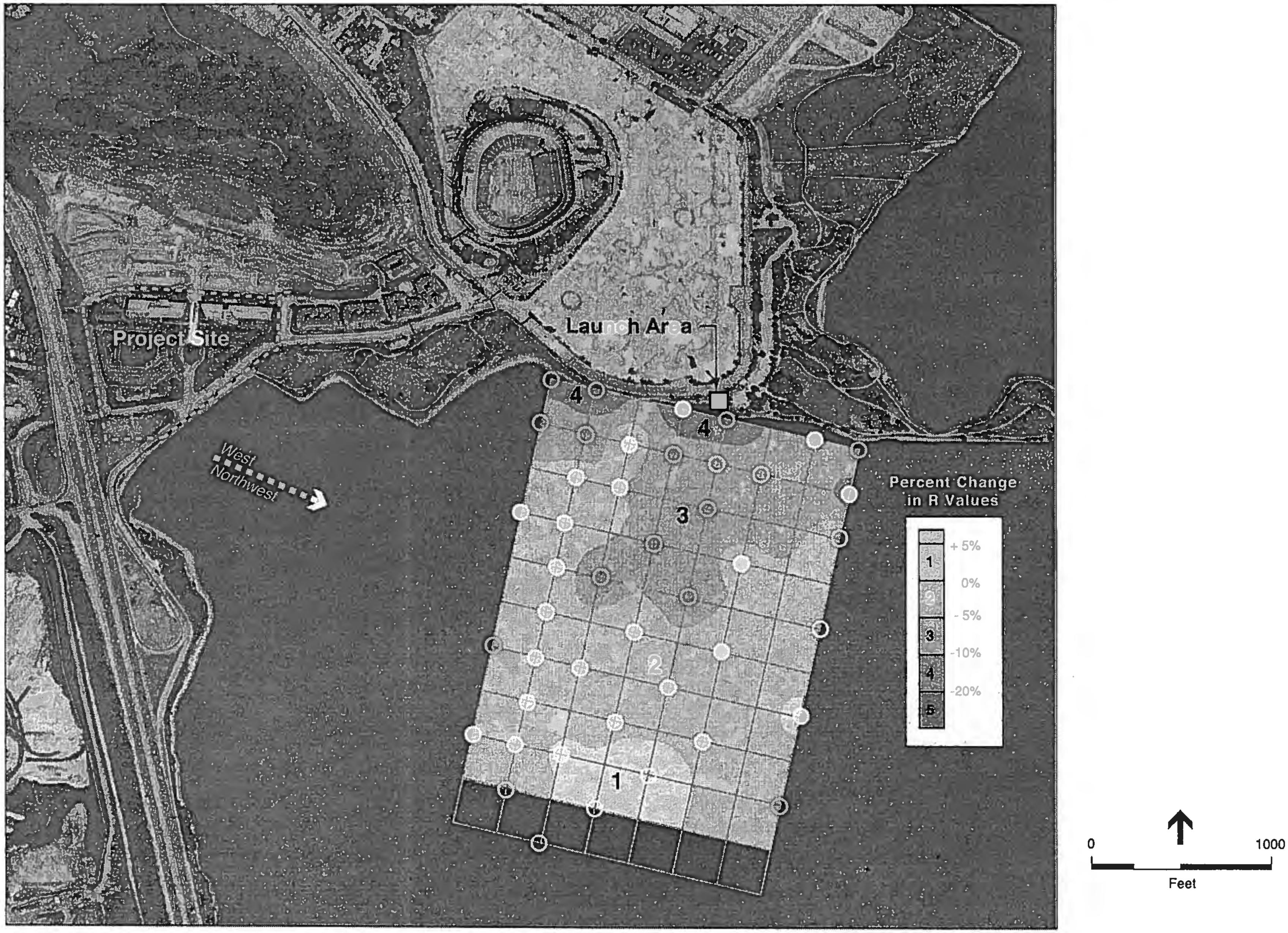
- West wind TI values with the Project were 14% to 18% over about three-quarters of the area, with higher TI values (18% to 22%) in a 23-acre± area at the northwest corner of the grid. See Figure 15.



SOURCE: ESA

Executive Park Wind Test . 208449

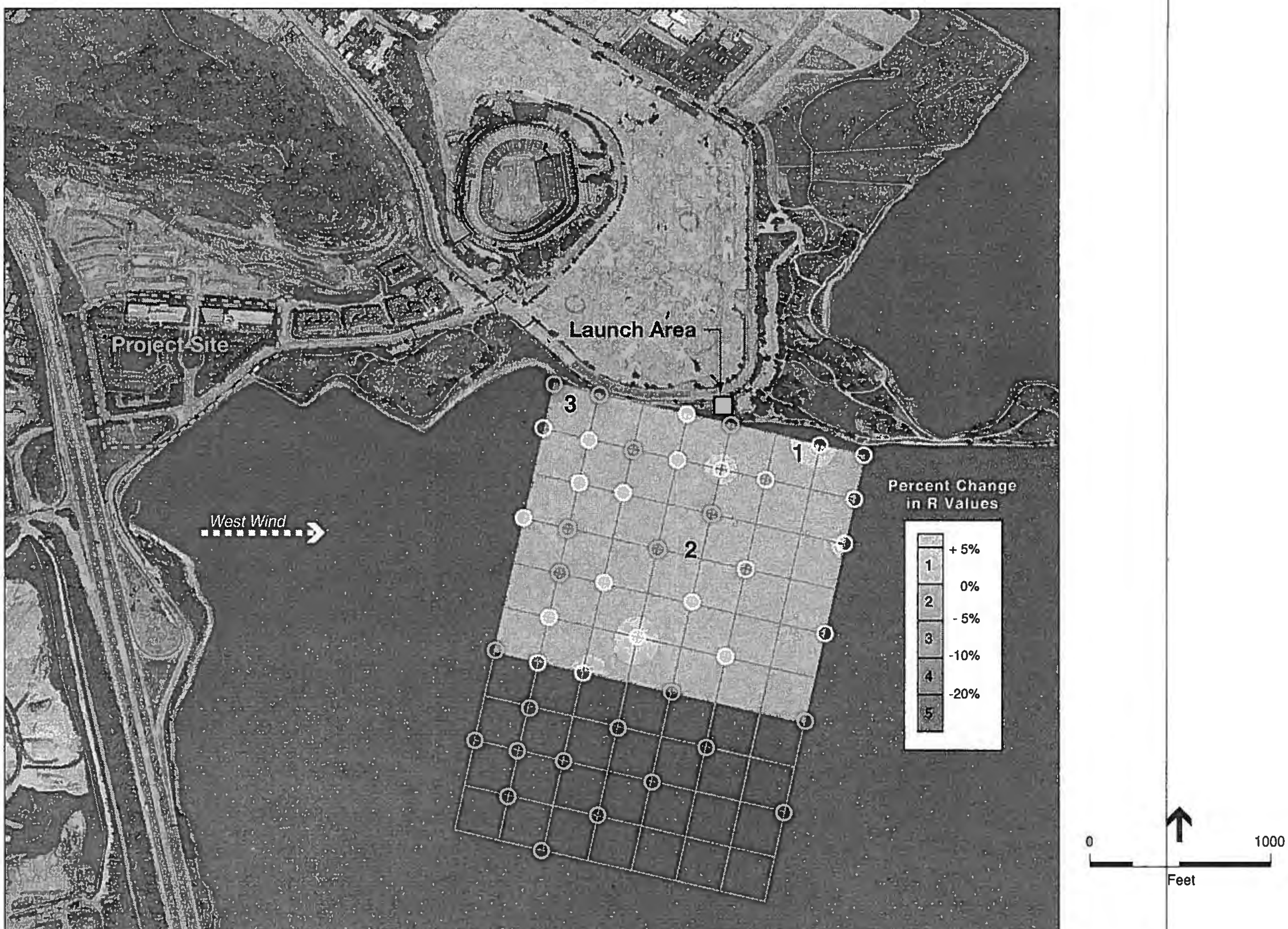
Figure 10
Percentage Change in R Values
Northwest Wind
Project



SOURCE: ESA

Executive Park Wind Test . 208449

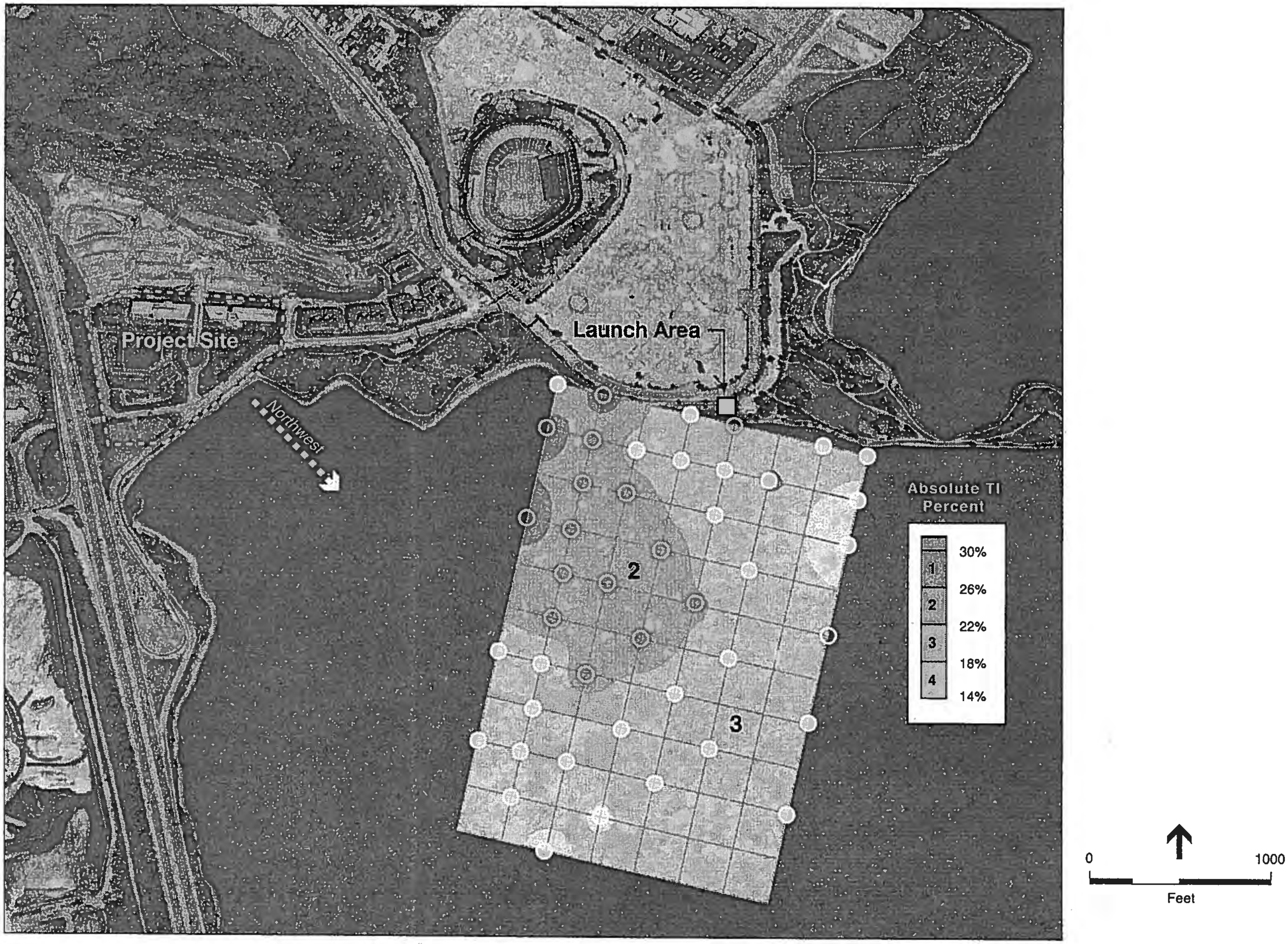
Figure 11
Percentage Change in R Values
West-Northwest Wind
Project



SOURCE: ESA

Executive Park Wind Test . 208449

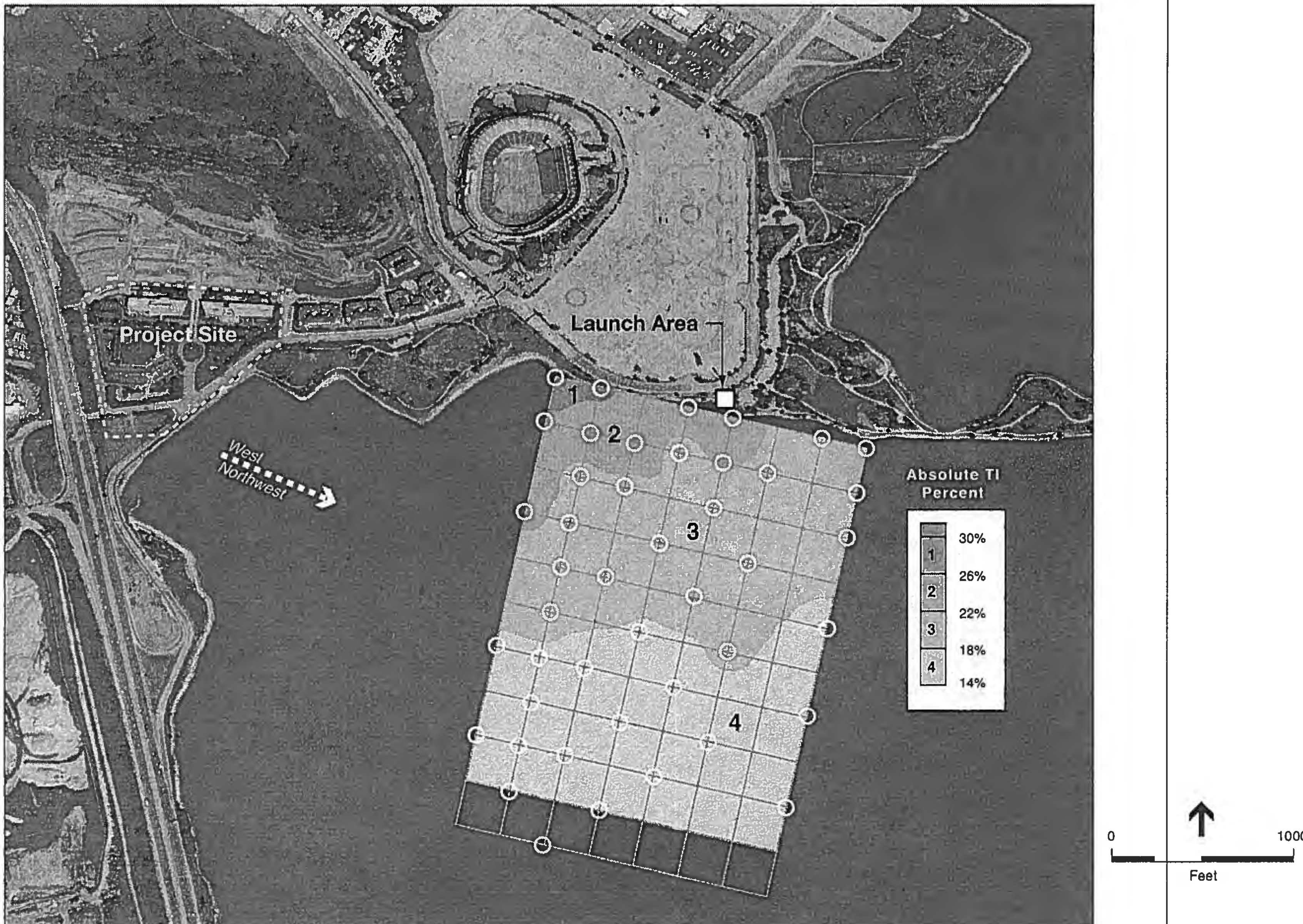
Figure 12
Percentage Change in R Values
West Wind
Project



SOURCE: ESA

Executive Park Wind Test . 208449

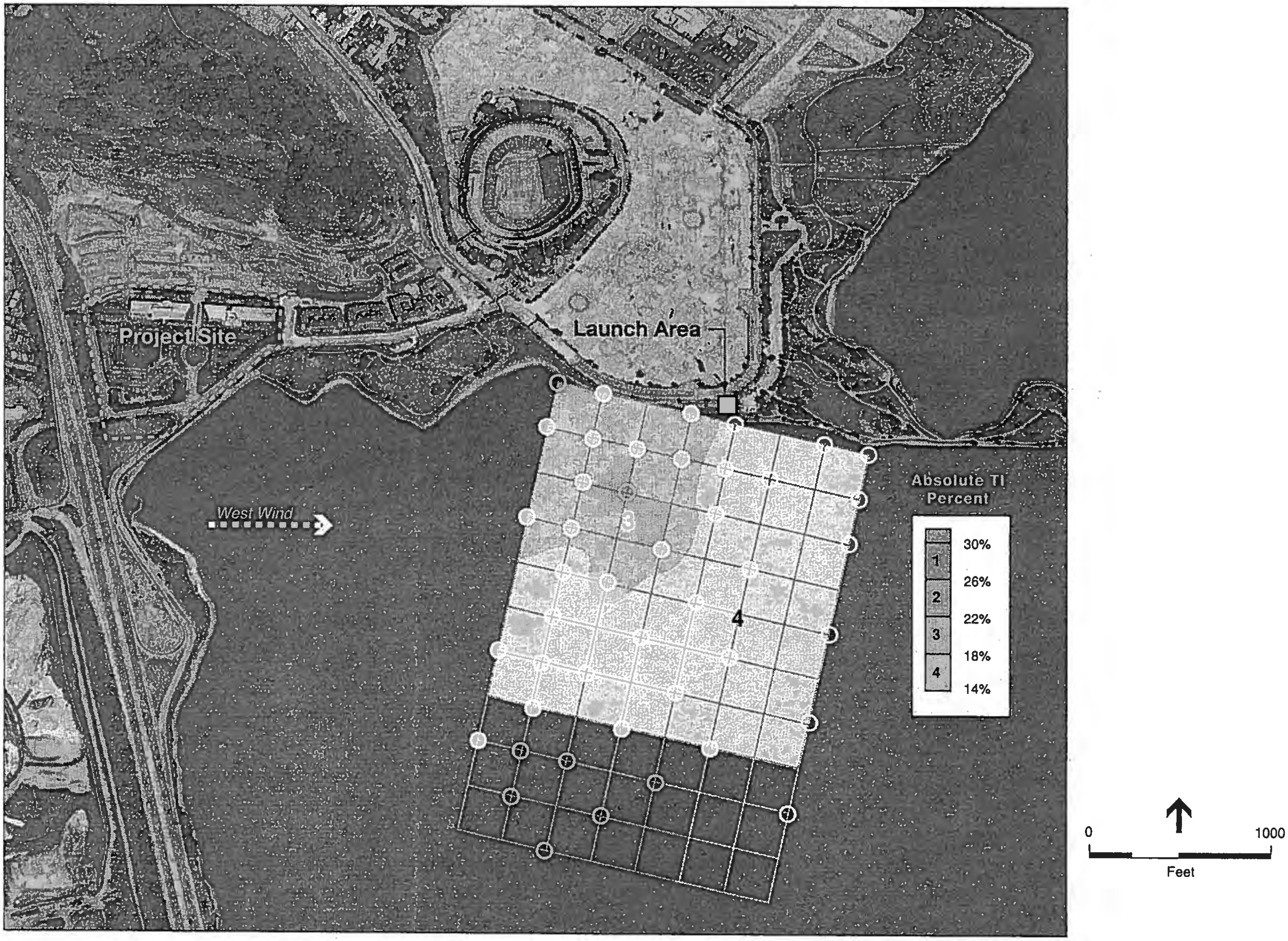
Figure 13
Turbulence Intensity
Northwest Wind
Project



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 14
Turbulence Intensity
West-Northwest Wind
Project



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 15
Turbulence Intensity
West Wind
Project

Test 3: Project plus Cumulative

This scenario consists of the Project together with cumulative development proposed directly north of the windsurfing area in the vicinity of the existing Candlestick Park stadium. In this scenario, the existing Candlestick Park stadium would be demolished.

Wind Speed

The R-values for the Project plus Cumulative scenario[14] for each wind direction are as follows:

- Northwest wind R-values range from 0.35 to 0.57 (compared to Existing R-values of 0.39 to 0.58).
- West-Northwest wind R-values range from 0.40 to 0.59 (compared to Existing R-values of 0.47 to 0.60).
- West wind R-values range from 0.47 to 0.59 (compared to Existing R-values of 0.51 to 0.61).

Comparative plots, showing the ratios of the R-values for the Project plus Cumulative scenario against the R-values for Existing conditions are shown in Figures 16, 17 and 18. These plots clearly show the differences in R-values, as percentage changes. Because of the relationship of R-values to wind speed, Figures 16, 17 and 18 also show true percentage changes in wind speed.

- For Northwest wind, the largest increase in R-values measured was +9.9%. The areas "1" and "2" in Figure 16 show changes that range from +9.9% to -5% in R-values, and in wind speed for the Project plus Cumulative scenario. The next largest, area "3", would undergo changes in R-values of -5% to -10%. Areas marked "4" would undergo changes in R-values of -10% to -20%. Area "4" is also located immediately offshore, but is smaller in comparison to that for the West-Northwest wind. Areas with changes of -10% to -20% for the Northwest wind occupy 7.2 acres±, 7.2% of the grid.
- For West-Northwest wind, the largest increase in R-values measured was +2.4%. The areas marked "1" and "2" in Figure 17 represent changes of +2.4% to -5% in R values, and in wind speed for the Project plus Cumulative scenario. The next largest area, marked "3", would undergo changes in R-values of -5% to -10%. Areas marked "4" would undergo changes in R-values of -10% to -20%. Area 4 extends from the shoreline to approximately 250 feet offshore, occupying a 10 acre± area, 10% of the area of the grid.
- For West wind, the largest increase in R-values measured was +2.7%. Almost the entire grid is area "2" in Figure 18, which shows changes are in the range of 0% to -5% in R-values and in wind speed for the Project plus Cumulative scenario.

In summary, wind speed changes due to the Project plus Cumulative scenario mostly results in wind speed changes ranging from no change to a 10% decrease in wind speed. A 10-acre± area near the shoreline would experience changes in wind speed from -10% to -20% with West-Northwest winds, and a similar 7.2-acre± shoreline area would experience wind speed changes from -10% to -20% with Northwest winds.

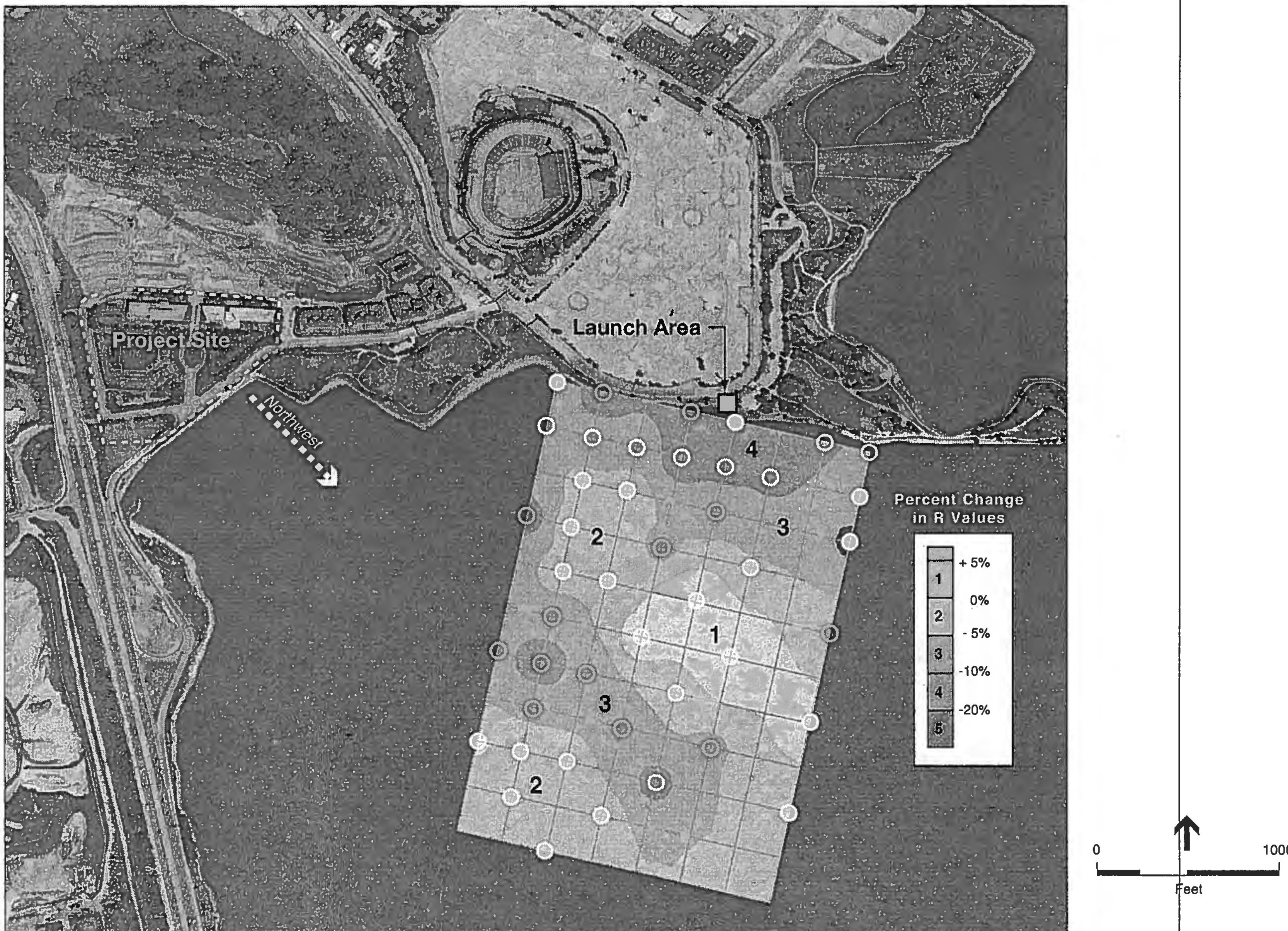
[14] Plots of R-values under the Project plus Cumulative scenario are presented in Figures 25, 26 and 27, in Appendix 1.

Figures 19, 20 and 21 use the five predefined TI isopleths to map the turbulence intensity (TI) values for the Project plus Cumulative scenario and each of three wind directions. In general, turbulence increases, with the highest values of turbulence occur near the shore and lower values occurring downwind.

- Northwest wind TI values range from near 30% near shore to 14% in isolated downwind locations for the Project plus Cumulative scenario. TI values would be between 26% and 30% at a more than 2-acre area at the northwest corner of the grid. TI values from 22% to 26% would cover approximately 27-acres along half of the west side of the grid, near the shoreline. Lower TI values (18% to 22%) would extend to cover the remaining area of the grid.

- West-Northwest wind TI values for the Project plus Cumulative scenario would range from 14% to 18% over a 47-acre± area at the south end of the grid, with TI values between 18% and 22% over a 30-acre± area to the north. TI values from 22% to 26% would occur in a 20-acre± area along the shoreline, including the present CPSRA windsurfing launching and landing area. TI values would be from 26% to 30% in a 1-acre± area at the shoreline at the northwest corner of the grid.

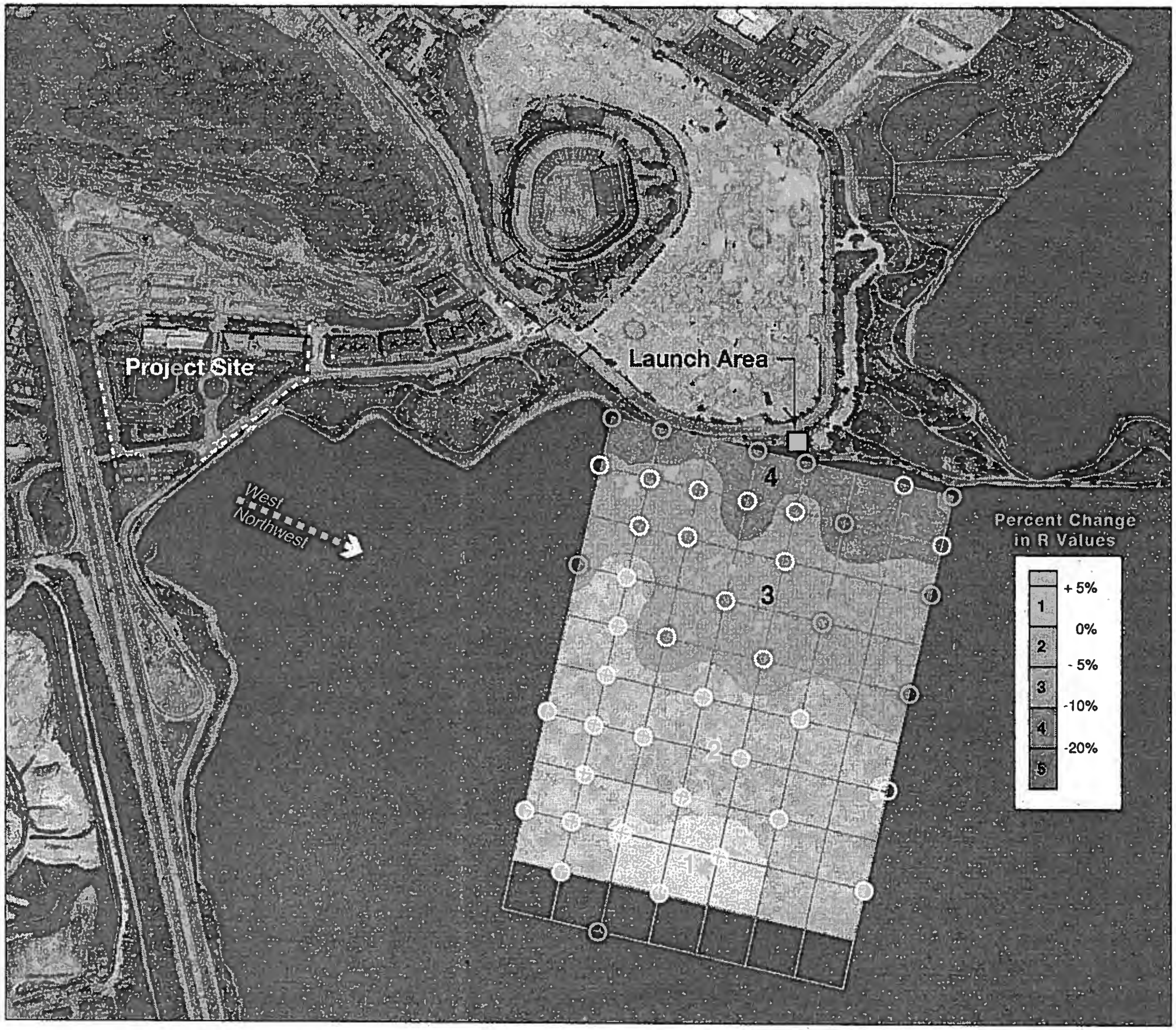
- West wind TI values between 18% and 22% would occur in a 17-acre± area along the shoreline for the Project plus Cumulative scenario. This area would extend from the CPSRA windsurfing launching and landing area to the northwest corner of the grid. TI values would be between 14% and 18% over the rest of the grid area. TI would be high where wind speed is low.



SOURCE: ESA

Executive Park Wind Test . 208449

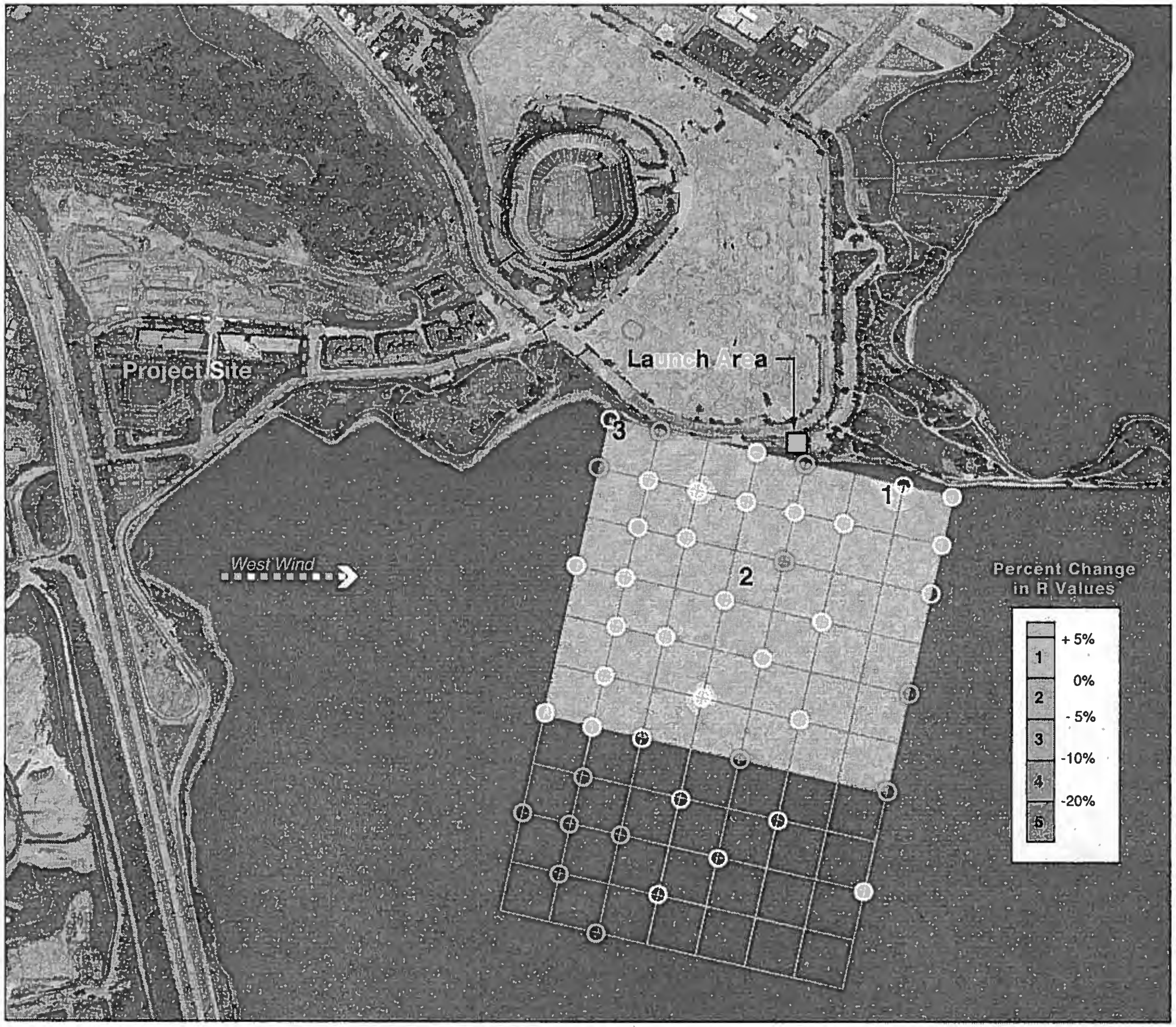
Figure 16
Percentage Change in R Values
Northwest Wind
Project + Cumulative



SOURCE: ESA

Executive Park Wind Test . 208449

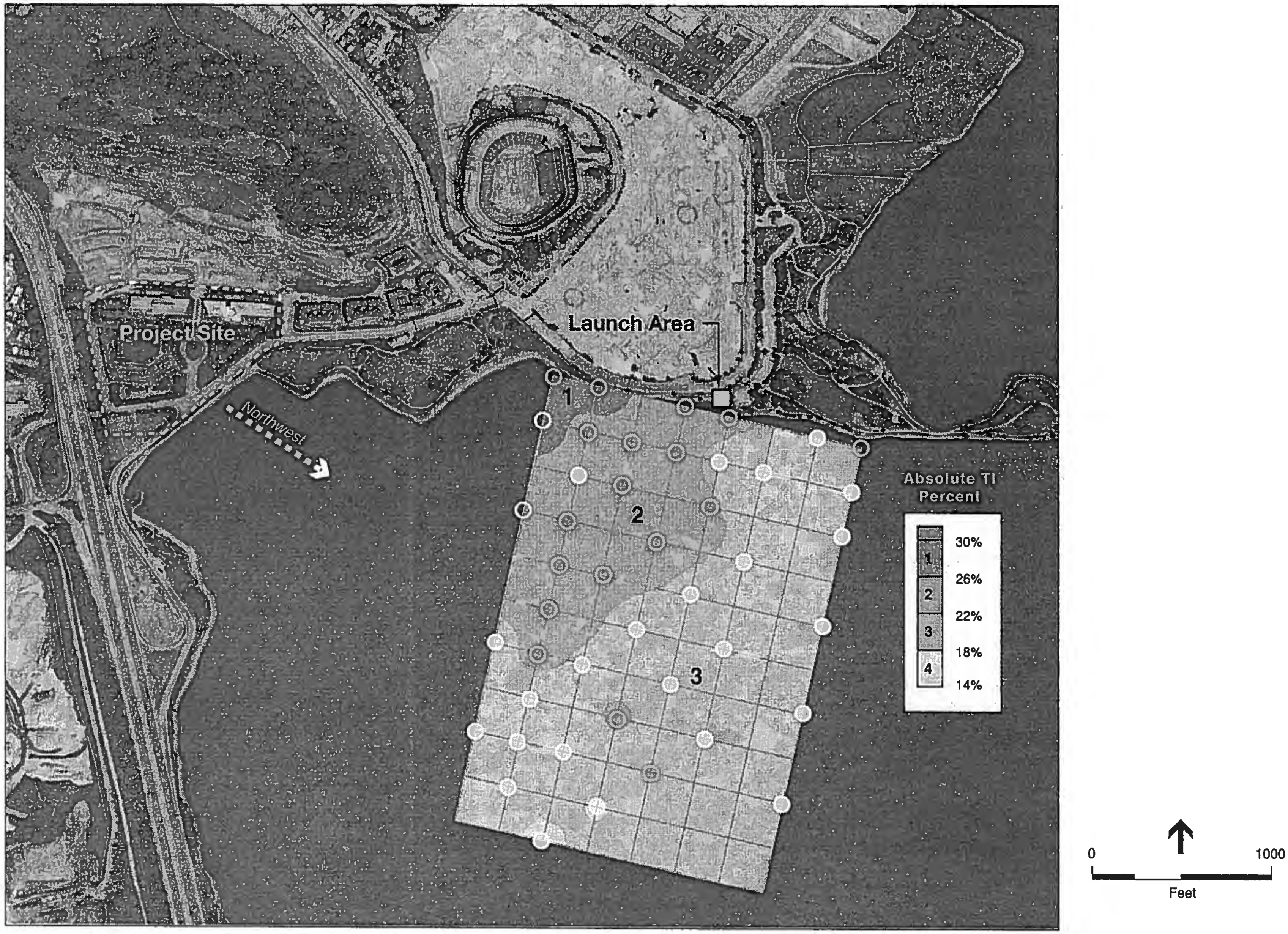
Figure 17
Percentage Change in R Values
West-Northwest Wind
Project + Cumulative



SOURCE: ESA

Executive Park Wind Test . 208449

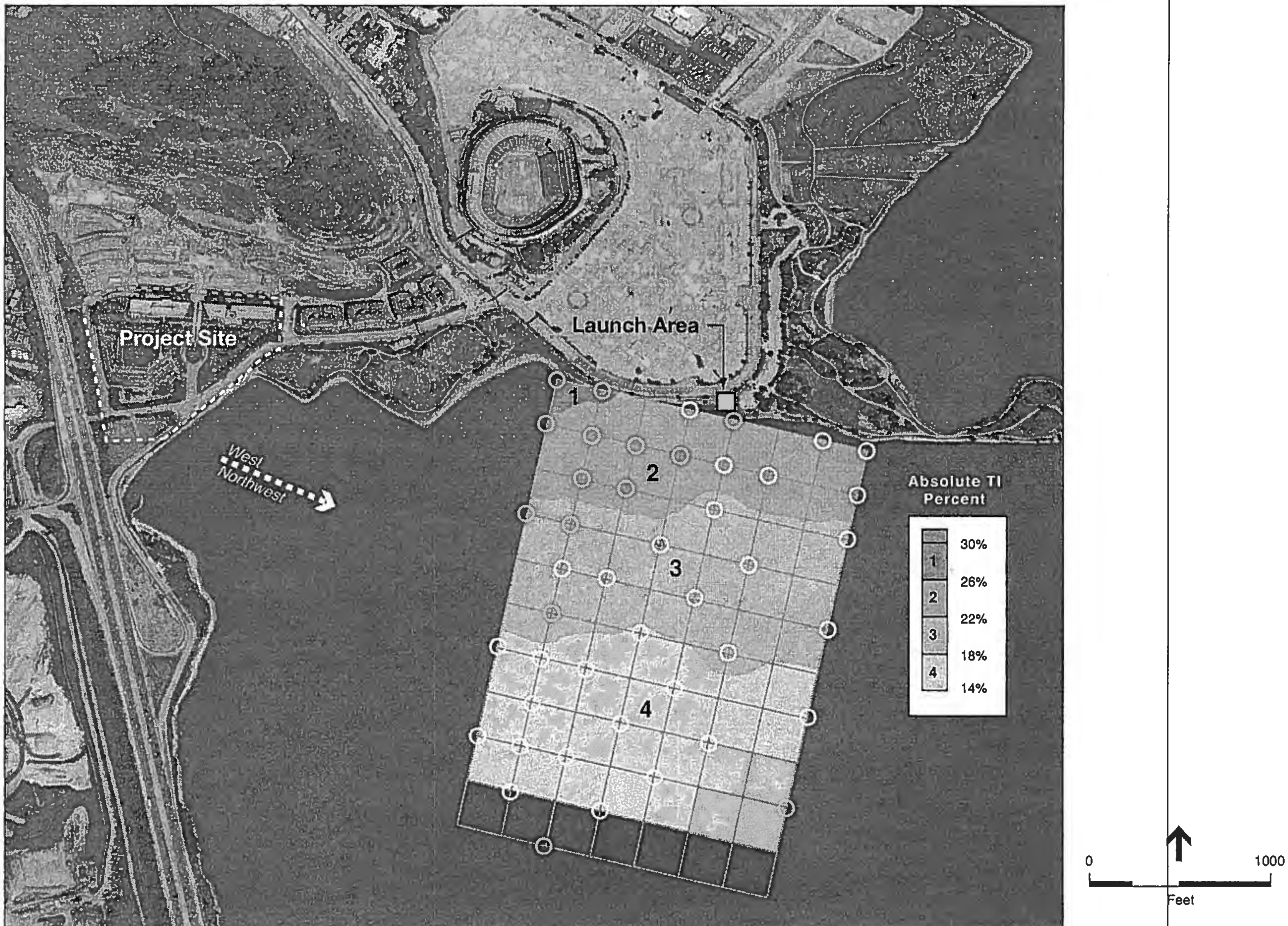
Figure 18
Percentage Change in R Values
West Wind
Project + Cumulative



SOURCE: ESA

Executive Park Wind Test . 208449

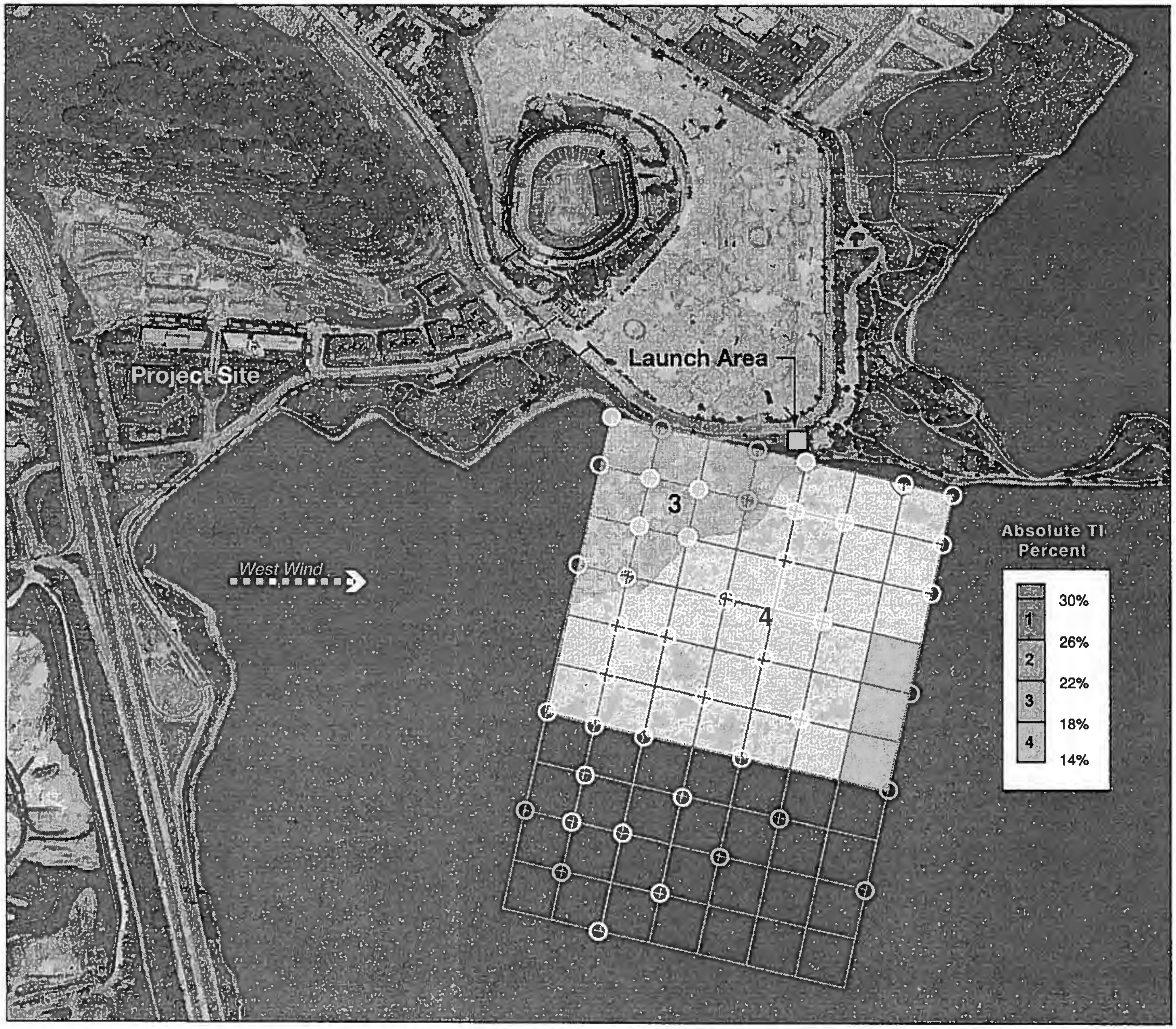
Figure 19
Turbulence Intensity
Northwest Wind
Project + Cumulative



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 20
Turbulence Intensity
West-Northwest Wind
Project + Cumulative



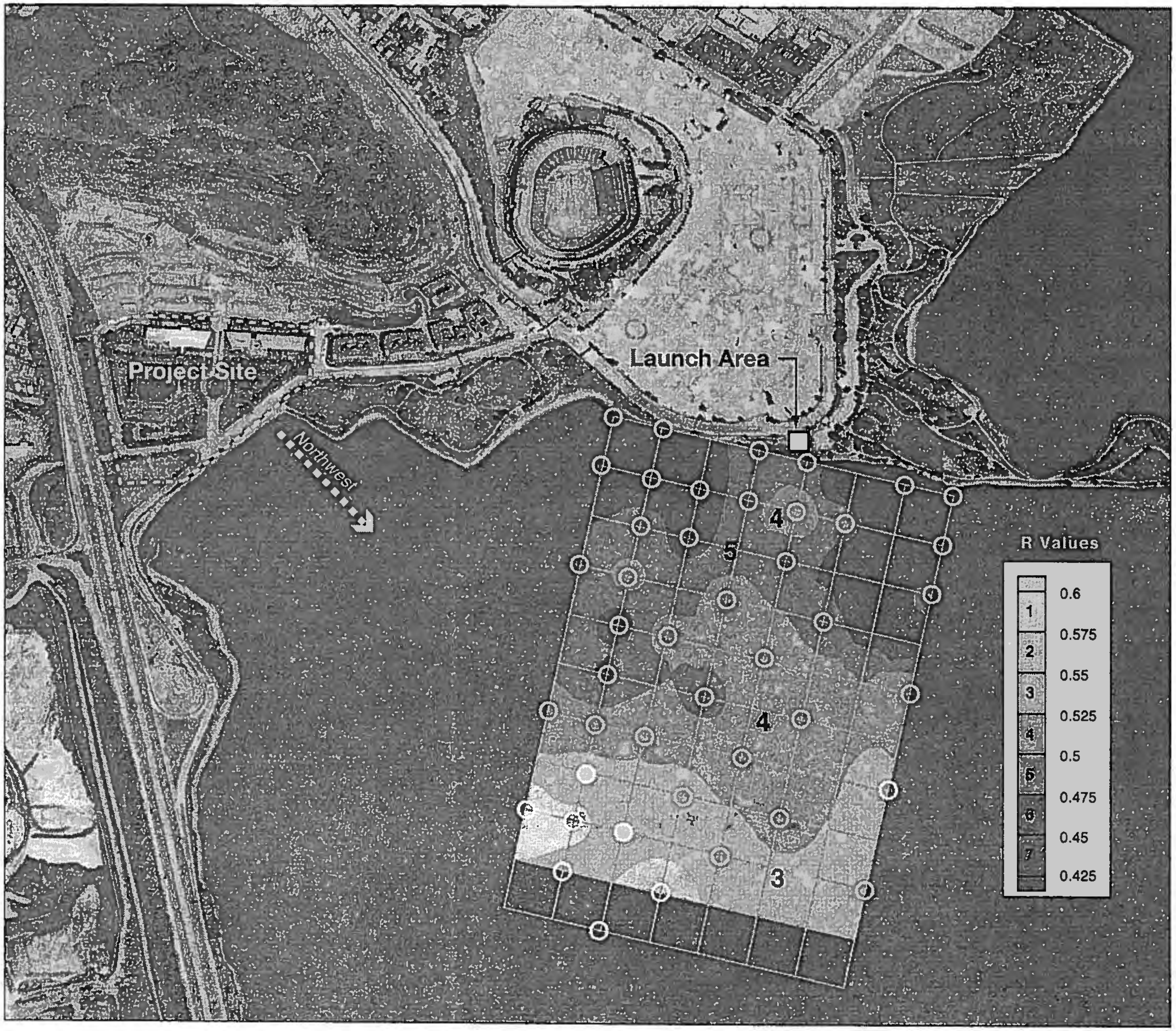
SOURCE: ESA

Executive Park Wind Test . 208449

Figure 21
Turbulence Intensity
West Wind
Project + Cumulative

ATTACHMENT 1 – Supplemental Figures

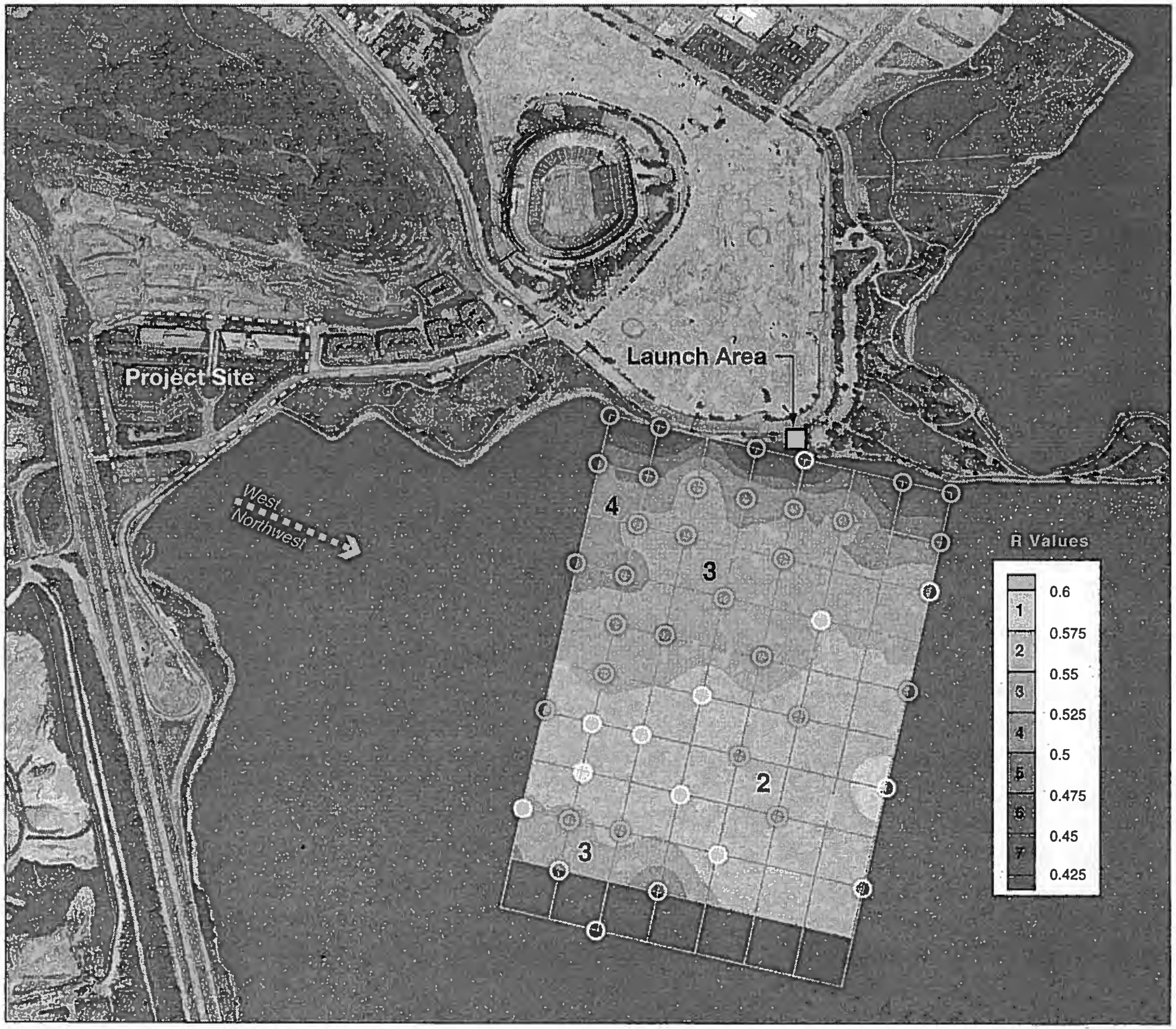
List of Figures



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 22
R Values
Northwest Wind
Project

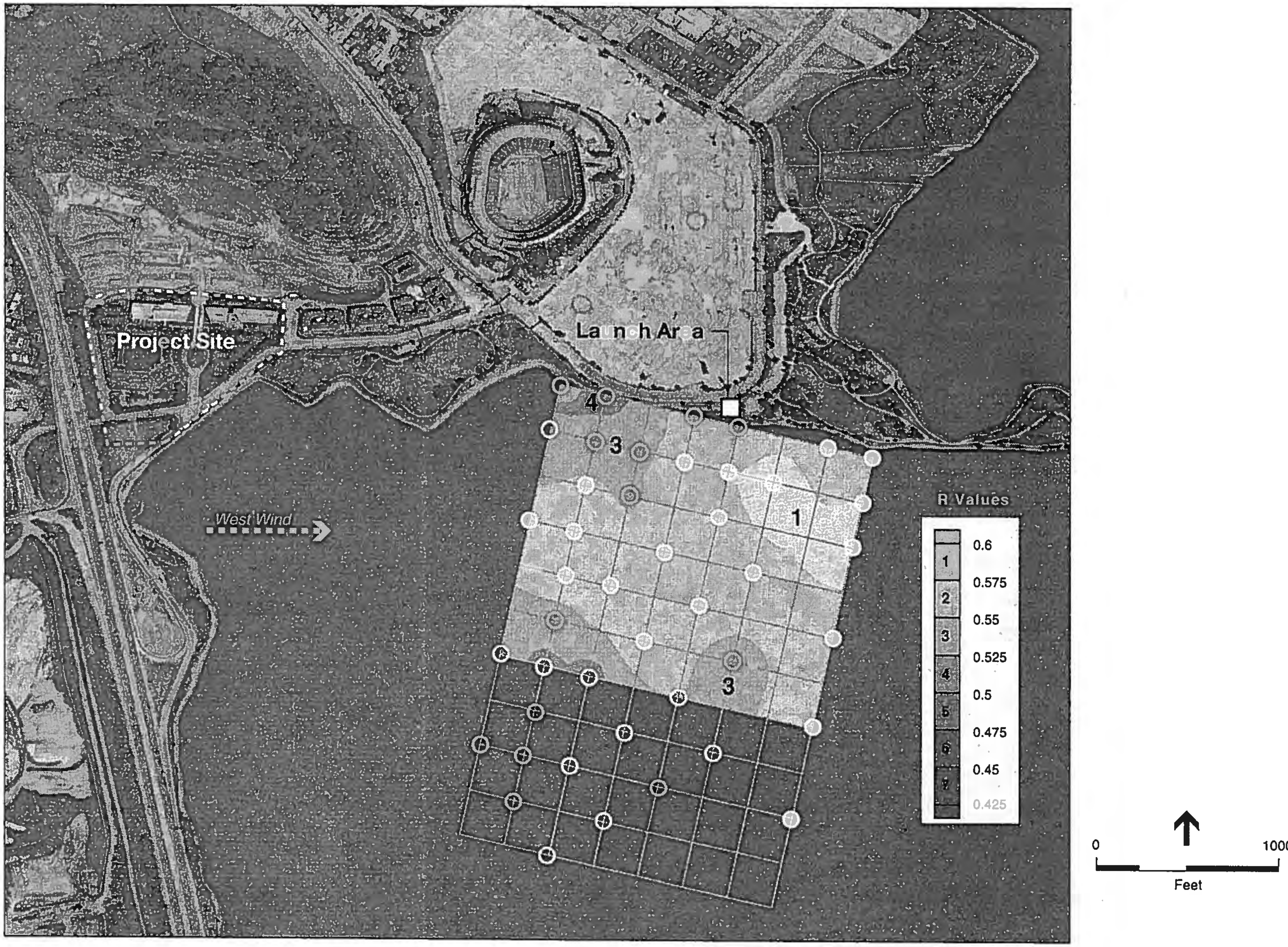


0 1000
Feet

SOURCE: ESA

Executive Park Wind Test . 208449

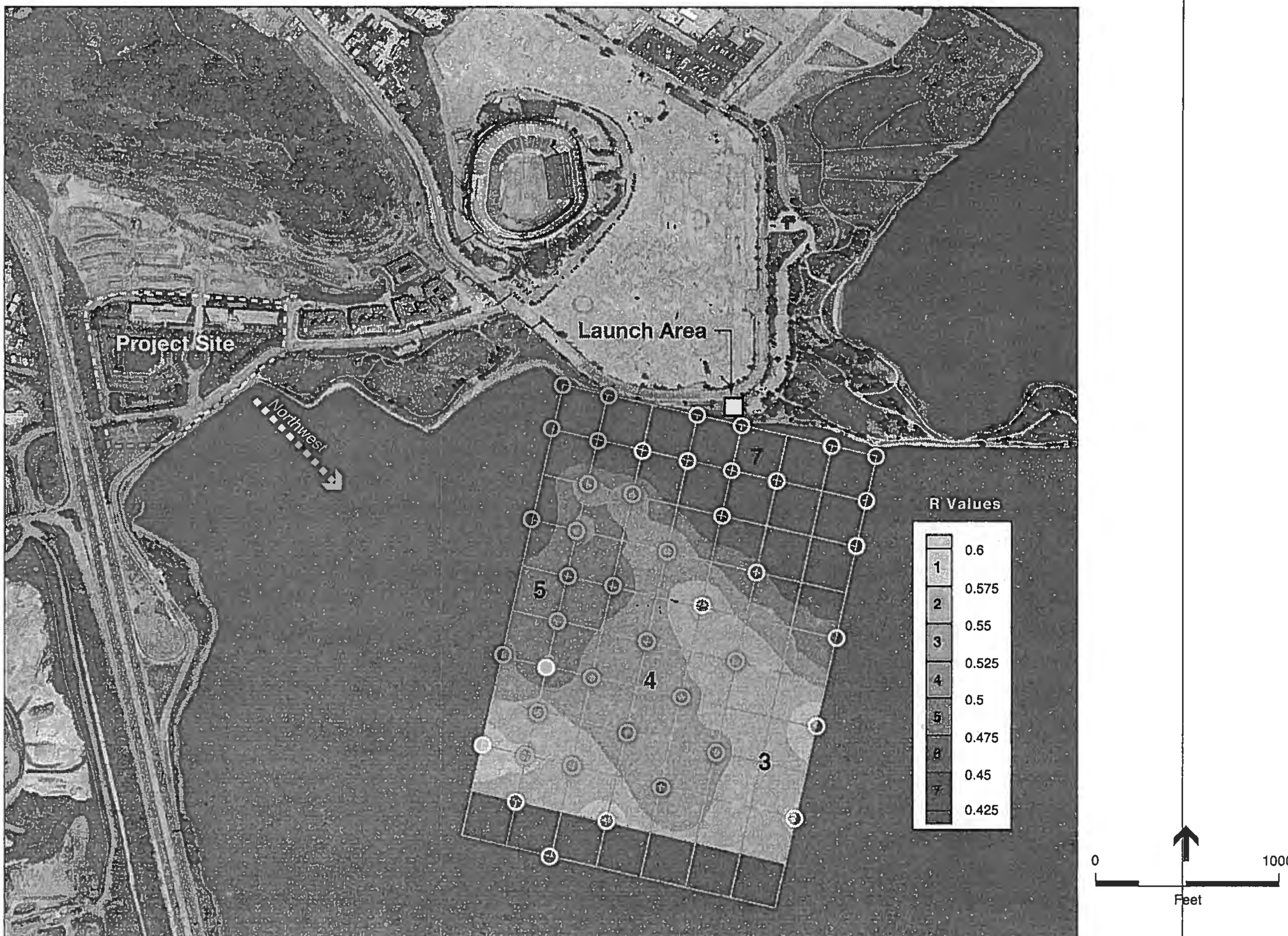
Figure 23
R Values
West-Northwest Wind
Project



SOURCE: ESA

Executive Park Wind Test . 208449

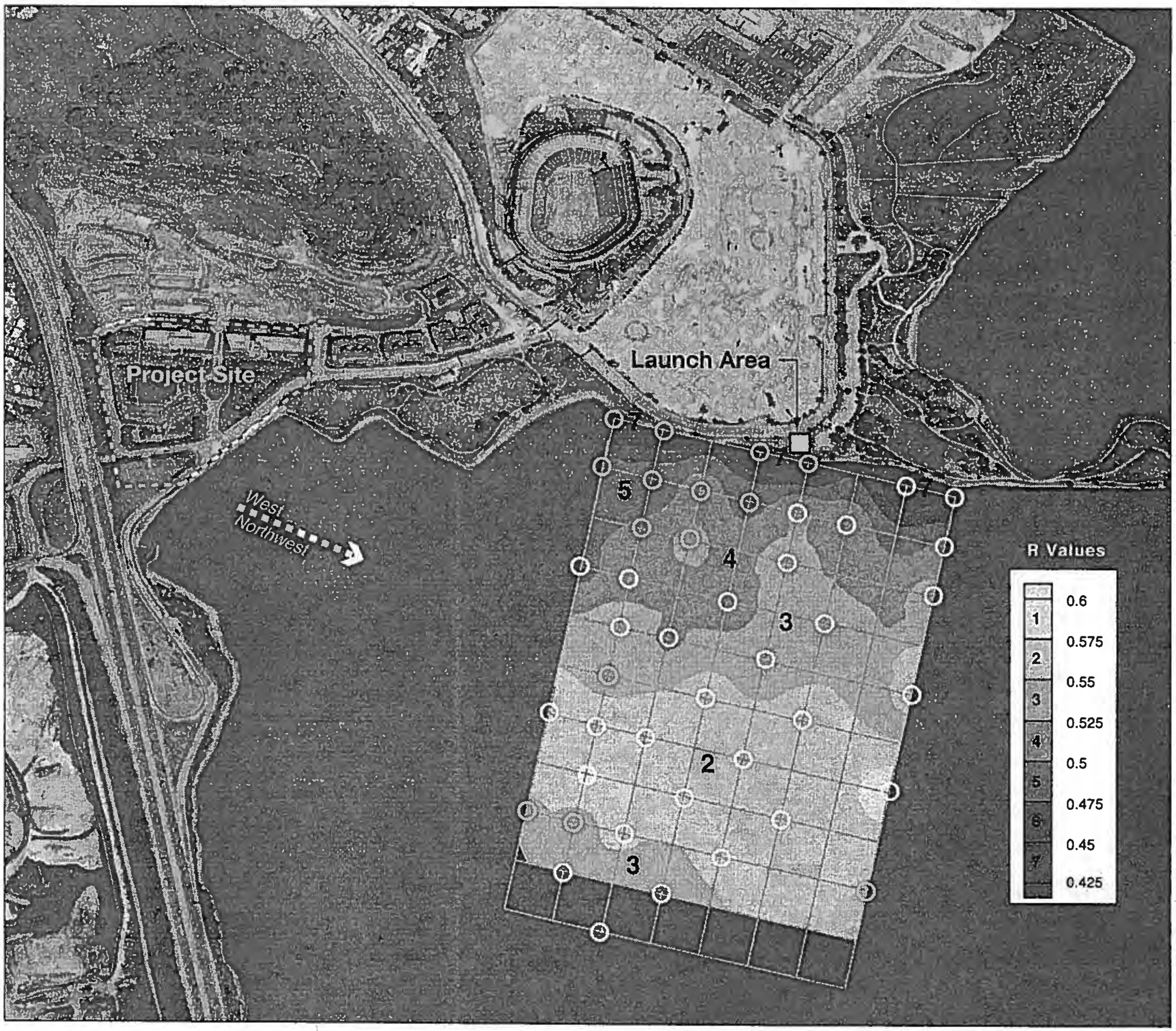
Figure 24
R Values
West Wind
Project



SOURCE: ESA

Executive Park Wind Test . 208449

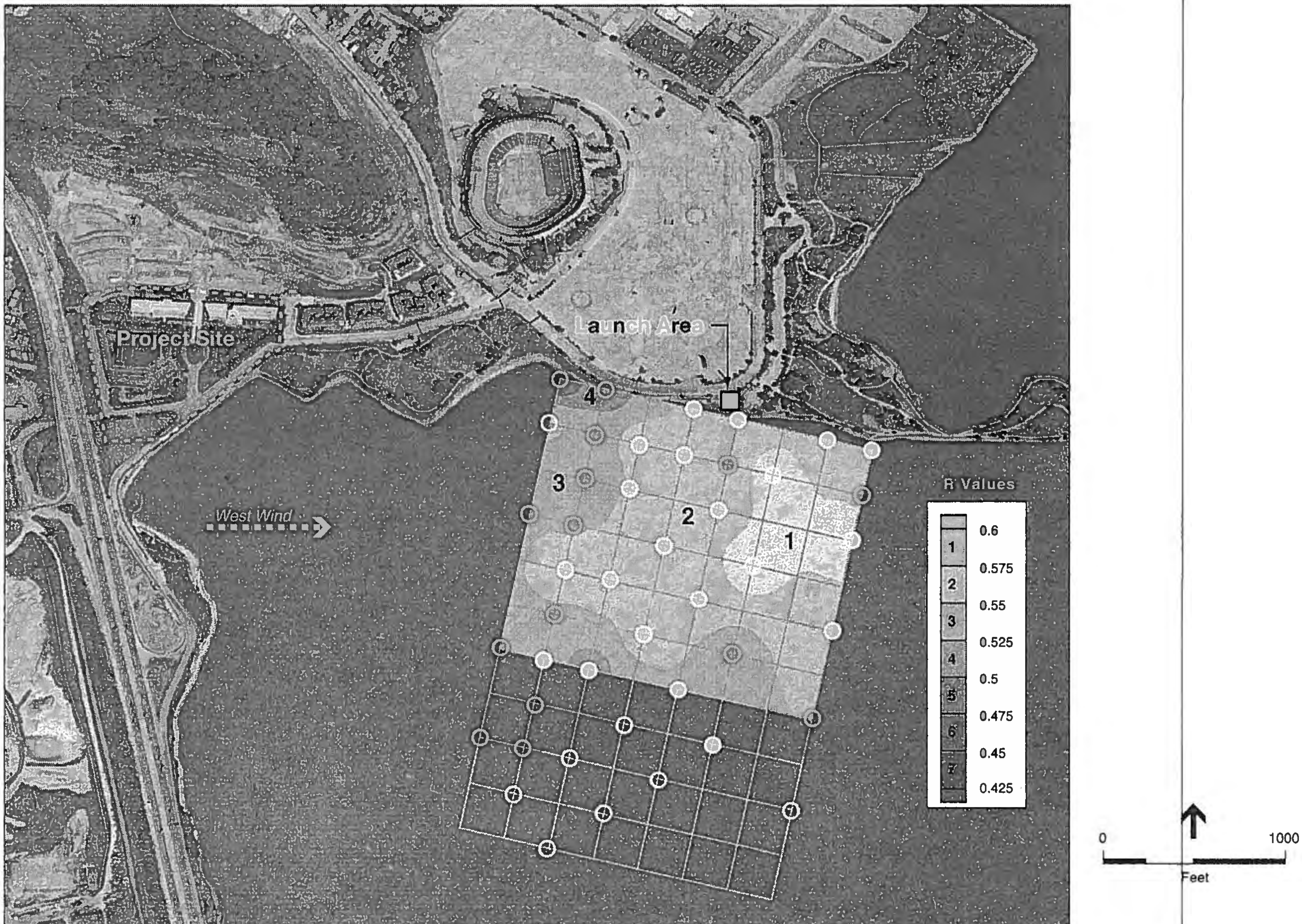
Figure 25
R Values
Northwest Wind
Project + Cumulative



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 26
R Values
West-Northwest Wind
Project + Cumulative



SOURCE: ESA

Executive Park Wind Test . 208449

Figure 27
R Values
West Wind
Project + Cumulative

ATTACHMENT 2 – CANDLESTICK SAILING TRACKS

The following image, showing a GPS-generated track for a board sailor, was provided by Peter Thorner of the San Francisco Boardsailing Association.

ESA

Appendix P2 Senate Bill 792 Tidelands and submerged lands: City and County of San Francisco: Hunters Point Naval Shipyard and Candlestick Point, October 11, 2009

Senate Bill No. 792

CHAPTER 203

An act to repeal Section 5006.8 of the Public Resources Code, to repeal Section 3 of Chapter 2 of the Statutes of 1958 of the First Extraordinary Session, to repeal Chapter 1046 of the Statutes of 1998, to repeal Chapter 464 of the Statutes of 2002, and to repeal Chapter 435 of the Statutes of 2003, relating to tidelands and submerged lands.

[Approved by Governor October 11, 2009. Filed with Secretary of State October 11, 2009.]

LEGISLATIVE COUNSEL'S DIGEST

SB 792, Leno. Tidelands and submerged lands: City and County of San Francisco: Hunters Point Naval Shipyard and Candlestick Point.

(1) Existing law grants to the City and County of San Francisco the right, title, and interest of the State of California in and to certain tidelands and submerged lands in trust for certain purposes. The State Lands Commission has jurisdiction over tidelands and submerged lands of the state.

The Hunters Point Shipyard Conversion Act of 2002 granted to, and vested in, the San Francisco Redevelopment Agency, all of the state's right, title, and interest in the Hunters Point trust lands, and, upon conveyance by the federal government to the agency, in appurtenances located on Hunters Point submerged lands, subject to the public trust and the terms and conditions of the act. The Hunters Point Shipyard Public Trust Exchange Act approved an exchange of public trust lands within the Hunters Point Shipyard, whereby certain trust lands that meet specified criteria and are not useful for public trust purposes are freed from the public trust and may be conveyed into private ownership, and certain other lands that are not public trust lands and that are useful for public trust purposes are made subject to the public trust. Existing law authorizes the Director of Parks and Recreation to enter into agreements concerning the development of a project in the City and County of San Francisco and partly within the Candlestick Point State Recreation Area.

This bill would repeal the Hunters Point Conversion Act of 2002 and the Hunters Point Shipyard Public Trust Exchange Act. The bill would also repeal the provision authorizing the Director of Parks and Recreation to enter into agreements concerning that project in the City and County of San Francisco.

This bill instead would grant to, and vest in, the San Francisco Redevelopment Agency, all of the state's right, title, and interest in Candlestick Point and the former Hunters Point Naval Shipyard trust lands, as revised, and, upon conveyance by the federal government to the agency, in appurtenances located on Hunters Point submerged lands, subject to the public trust, and the terms and conditions of this bill.

This bill would also approve an exchange of public trust lands within the lands conveyed, whereby certain trust lands or interests in lands that meet specified criteria and are not now useful for public trust purposes will be freed from the public trust and may be conveyed into private ownership, and certain other lands or interests in lands that are not now public trust lands and that are useful for public trust purposes will be made subject to the public trust.

The bill would require the agency to deposit all moneys collected by the agency arising out of the use or operation of any of the trust lands into a special fund maintained by the agency. The bill would require the agency to prepare an annual statement of financial conditions and operations and to submit the statement to the State Lands Commission each year on or before October 1.

The bill would authorize the Director of Parks and Recreation to enter in an agreement to transfer to the agency or the City and County of San Francisco an interest in state property held by the department within the Candlestick Point State Recreation Area upon the director making certain findings.

This bill would provide that upon the termination of the redevelopment plan for the project area, consisting of the former shipyard, the Hunters Point submerged lands, and Candlestick Point, or by January 1, 2050, whichever is earlier, the agency shall transfer any trust lands in which it holds fee title to the city, unless the commission approves a later date.

(2) The bill would state findings and declarations of the Legislature regarding the need for special legislation.

The people of the State of California do enact as follows:

SECTION 1. The following definitions apply for purposes of this act:

(a) “1958 Act” means Chapter 2 of the Statutes of 1958 of the First Extraordinary Session.

(b) “Agency” means the San Francisco Redevelopment Agency, or any successor redevelopment agency with jurisdiction over the project area.

(c) “Applicable statutory trust” means either of the following:

(1) Where the agency is the trustee, the terms and conditions of the state’s trust grant to the agency under this act.

(2) Where the city is the trustee, the Burton Act trust.

(d) “BCDC” means the San Francisco Bay Conservation and Development Commission.

(e) “Burton Act” means Chapter 1333 of the Statutes of 1968, as amended.

(f) “Burton Act lands” means all those lands within the project area, or immediately adjacent to the project area, owned in fee by the city and held subject to the Burton Act.

(g) "Burton Act transfer agreement" means that certain agreement dated January 24, 1969, between the state and the city, relating to the transfer of the Port of San Francisco from the state to the city, and any amendments to that agreement in accordance with its terms.

(h) "Burton Act trust" means the statutory trust imposed by the Burton Act, and any additional restrictions on use and alienability created by the Burton Act transfer agreement, by which the state conveyed to the city, in trust and subject to certain terms, conditions, and reservations, the state's interest in certain tidelands, including filled lands, and lands dedicated or acquired by the city as assets of the trust. The Burton Act trust does not include the requirements of Section 12 of the Burton Act.

(i) "Candlestick Point" means all that real property situate in the City and County of San Francisco, State of California, described as follows:

Beginning at the intersection of the northeasterly line of Underwood Avenue (formerly 21st Avenue, 80 feet wide) with the southeasterly line of Arelious Walker Drive (formerly F Street, or Fitch Street, 64 feet wide); thence southwesterly along the southeasterly line of said Arelious Walker Drive 1400 feet to a point laying on the northeasterly line of Bancroft Avenue (formerly 26th Avenue, 80 feet wide), said point being also the most westerly corner of the lands designated and shown as "Parcel 1" on that certain map entitled "Record of Survey – Hunters Point Shipyard" and filed in Book "Z" of Maps, at pages 135 through 147, Document No. 2000-G845126 in the office of the City and County of San Francisco Recorder; thence southeasterly along the northeasterly line of said Bancroft Avenue 2592 feet to the northeasterly extension of the northwesterly line of Boalt Street (formerly B Street, 64 feet wide); thence southwesterly along said extension and said northwesterly line of said Boalt Street 35 feet to a point laying on the boundary of those certain lands commonly known as "Candlestick Point State Recreation Area" and described under Exhibit "1" in that certain Quitclaim Deed from the City and County of San Francisco to the State of California, recorded in the office of County Recorder of said county in Book D633 of Official Records, at Image 1952; thence generally southwesterly, southeasterly, southerly and westerly along said boundary of said "Candlestick Point State Recreation Area", in all of its courses, to a point on the San Francisco – San Mateo County boundary line as said line is shown on that certain Board of Tide Land Commissioners map entitled "Map of the Salt Marsh and Tide Lands and Lands Lying Under Water South of Second Street", a copy of which is filed in Map Book "W", pages 46 and 47, in the office of the City and County of San Francisco Recorder, from which point the point of beginning of said boundary described in said Exhibit "1" bears North 44˚39'58" East 103.85 feet, more or less; thence westerly along said county line 15 feet, more or less, to the southeasterly line of Harney Way as shown on that certain map entitled "Map Showing the Opening of Harney Way from Jamestown Avenue to County Line", filed January 28, 1965, in Map Book "U" at pages 64 and 65, in the office of the City and County of San Francisco Recorder; thence continuing westerly along said county line 178.79 feet; thence leaving said county line

North 44˚39’58” East 592.16 feet; thence North 45˚36’16” East 300.04 feet; thence North 56˚25’37” East 104.39 feet; thence North 61˚40’38” East 137.37 feet; thence North 76˚48’21” East 159.25 feet to a point laying at the westerly terminus of the course labeled “North 86˚19’02” West 87.60 feet” on the northerly line of Harney Way as shown on that certain Final Map entitled “Map of San Francisco Executive Park II”, filed in Map Book “X”, pages 8 through 11, Document No. D168468, in the office of the City and County of San Francisco Recorder; thence easterly along the northerly line of said Harney Way, in all of its courses, to the southwesterly line of the lands of Leonoudakis as described in that certain document filed in the office of the City and County of San Francisco in Reel I751 of Official Records, at Image 599, Document No. 2004-H839983, (Lot 008, Assessor’s Block 5023); thence northwesterly along said southwesterly line to the southeasterly line of the lands of Leonoudakis as described in that certain document filed in the office of the City and County of San Francisco in Reel I751 of Official Records, at Image 598, Document No. 2004-H839982, (Lot 8, Assessor’s Block 4977); thence southwesterly and northwesterly along the southeasterly and southwesterly lines of said lands of Leonoudakis to the most southerly corner of the lands of the City and County of San Francisco designated and shown as Lot 6 on Assessor’s Block 4977; thence northwesterly and northeasterly along the southeasterly and northwesterly lines of said lands of the City and County of San Francisco to the southwesterly corner of Lot 276, as shown on that certain Parcel Map filed in Parcel Map Book 45 at page 10, Document No. 2001-G962714, in the office of the City and County of San Francisco Recorder; thence northwesterly along the boundary of said Lot 276, in all of its courses, to the most northerly corner of said lot, being also a point laying on the southwesterly line of Jamestown Avenue; thence northwesterly along the southwesterly line of Jamestown Avenue 135 feet, more or less, to a point; thence northeasterly and perpendicular to the last course 89 feet to the intersection of the southeasterly line of Coronado Street with the northeasterly line of Jamestown Avenue as shown on that certain map entitled “Map Showing the Widening and Extension of Jamestown Avenue from Hunters Point Expressway to Redondo Street” filed in Map Book “U” at pages 60 through 63, in the office of the City and County of San Francisco Recorder; thence southeasterly along said northeasterly line of Jamestown Avenue 725 feet, more or less, to a point; thence northeasterly along a line laying parallel and 350 feet southeasterly of the southeasterly line of Griffith Street (formerly G Street, 64 feet wide), 660 feet to the Line of Ordinary High Tide of 1869 as said line is shown, but not labeled, on that Board of Tide Land Commissioners Block Map No. 9 filed in Map Book “W” at pages 11 through 13, in the office of the City and County of San Francisco Recorder; thence northeasterly along said line, in all of its courses, to the southwesterly line of the lands of the San Francisco Housing Authority designated and shown as Lot 20 on Assessor’s Block 4884; thence northwesterly along a line laying parallel with and distant 100 feet northeasterly of the northeasterly line of Gilman Avenue (formerly 31st

Avenue, 80 feet wide), being also the southwesterly line of said lands of the San Francisco Housing Authority, to the northwesterly line of Hawes Street (formerly H Street, 64 feet wide); thence northeasterly along said northwesterly line of Hawes Street 1020 feet to the northeasterly line of Carroll Avenue (formerly 27th Avenue, 80 feet wide); thence southeasterly along said northeasterly line of Carroll Avenue 728 feet to a point laying on the southeasterly line of Griffith Street (formerly G Street, 64 feet wide), said point laying also at a deflection in the northwesterly boundary of said “Candlestick Point State Recreation Area”; thence in a general northerly and westerly direction, along the boundary of said “Candlestick Point State Recreation Area” as described under Exhibit “1” in said Quitclaim Deed recorded in the office of the City and County of San Francisco Recorder, in Book D633 of Official Records, at page 1952, the following courses: northeasterly along said southeasterly line of Griffith Street 760 feet to the southwesterly line of Yosemite Avenue (formerly 24th Avenue, 80 feet wide); thence northwesterly along said southwesterly line of Yosemite Avenue to the point of beginning of that parcel of land described in the Quitclaim Deed from the United States of America to Julio and Anita Ricci, recorded March 8, 1961 in Book A235, page 208 of Official Records of the City and County of San Francisco; thence northeasterly, parallel with the southeasterly line of Ingalls Street (formerly I Street), 80 feet to a point laying on the northeasterly line of Yosemite Avenue distant thereon southeasterly 205 feet from said southeasterly line of Ingalls Street, said point being the most westerly corner of that certain parcel of land described as Parcel 3523 in the Grant Deed dated November 30, 1979 from R.C. Scarver and Terese Scarver to the State of California recorded February 8, 1980 as Document No. 73057 in Book C942, page 746 of Official Records of the City and County of San Francisco; thence northeasterly along the northwesterly line of said parcel to the most northerly corner of said parcel, said point laying in the southwesterly line of Wallace Avenue (formerly 23rd Avenue, 80 feet wide); thence northeasterly, parallel with said southeasterly line of Ingalls Street, 80 feet to the most westerly corner of the land described as Parcel 3 in the deed from Hibernia Bank to Mike Garza recorded December 20, 1977 in Book C488, page 303 of Official Records of the City and County of San Francisco, said point laying on the northeasterly line of Wallace Avenue, distant thereon 205 feet southeasterly of said southeasterly line of Ingalls Street; thence southeasterly along said northeasterly line of Wallace Avenue to the southeasterly line of Hawes Street (formerly H Street, 64 feet wide); thence northeasterly along said southeasterly line of Hawes Street, 464 feet to the southwesterly line of Underwood Avenue (formerly 21st Avenue, 80 feet wide); thence leaving said “Candlestick Point State Recreation Area” boundary, northeasterly 80 feet to the northeasterly line of said Underwood Avenue; thence southeasterly along the northeasterly line of said Underwood Avenue 75 feet to a point laying on said “Candlestick Point State Recreation Area” boundary; thence along said “Candlestick Point State Recreation Area” boundary the following courses: northeasterly along a line parallel and distant 75 feet southeasterly from said southeasterly line of Hawes Street, 200 feet to the southwesterly line of Thomas Avenue (formerly 20th Avenue, 80 feet wide); thence southeasterly along said southwesterly line of Thomas Avenue, to the northwesterly line of Griffith Street (formerly G Street, 64 feet wide); thence southwesterly along said northwesterly line of Griffith Street, 200 feet to the northeasterly line of Underwood Avenue (80 feet wide); thence southeasterly along said northeasterly line of Underwood Avenue 664 feet to the northwesterly line of said Arelious Walker Drive; thence leaving said "Candlestick Point State Recreation Area" boundary, northeasterly along said northwesterly line of Arelious Walker Drive, 280 feet to the northeasterly line of said Thomas Avenue; thence southeasterly along said northeasterly line of Thomas Avenue, 64 feet to a point laying on the boundary of said "Candlestick Point State Recreation Area"; thence southwesterly along said boundary and the southeasterly line of said Arelious Walker Drive, 280 feet to the Point of Beginning.

Excepting therefrom any portion lying outside said City and County of San Francisco.

(j) "City" means the City and County of San Francisco, a charter city and county, and includes the City and County of San Francisco acting by and through its Port Commission.

(k) "Commission" means the State Lands Commission.

(*l*) "Community Redevelopment Law" means Part 1 (commencing with Section 33000) of Division 24 of the Health and Safety Code.

(m) "Department" means the Department of Parks and Recreation.

(n) "Director" means the Director of Parks and Recreation.

(o) "Hillside open space" means that area of land so designated as depicted in the diagram in Section 25 of this act.

(p) "Hunters Point submerged lands" means all that real property situate in the City and County of San Francisco, State of California, described as follows:

Beginning at the intersection of the northeasterly prolongation of the southeasterly line of Earl Street (64 feet wide) with the 1948 Bulkhead Line as shown on the map entitled "Real Estate Summary Map NAVFAC Drawing No. 1045757" on file at the Department of the Navy, WESTDIV, San Bruno, California; thence southeasterly along said 1948 Bulkhead Line and the northeasterly line of that certain property conveyed in declaration of taking, Civil Action No. 22147 as shown on said summary map to a line parallel with and 450 feet southeasterly of the southeasterly line of Boalt Street (64 feet wide); thence southwesterly along said parallel line to the northeasterly line of the land described in the deed filed in Book 3677 of Official Records at page 349 in the Office of the County Recorder of said county, said northeasterly line being the arc of a curve, concave southwesterly and having a radius of 1,800 feet; thence southeasterly and southerly along said arc to the southeasterly prolongation of the northeasterly line of Evans Avenue (80 feet wide); thence northwesterly along said prolongation and said northeasterly line of Evans Avenue to the 1941 Bulkhead Line as shown on said summary map; thence southerly along said 1941 Bulkhead Line to the northeasterly line of that certain property conveyed in declaration of taking, Civil Action No. 36272 as shown on said summary map; thence southeasterly along said northeasterly line to said 1948 Bulkhead Line as shown on said summary map; thence southerly along said 1948 Bulkhead Line to the line dividing the City and County of San Francisco from the County of San Mateo; thence easterly along said county line to the United States Pierhead Line as shown on the map entitled “Hunters Point Naval Shipyard, General Development Map, Key Map No. 1174922” on file at the Department of the Navy, Western Division San Bruno, California; thence northeasterly and northwesterly along said Pierhead Line as shown on said General Development Map to said northeasterly prolongation of the southeasterly line of said Earl Street (64 feet wide); thence southwesterly along said prolongation of the southeasterly line of said Earl Street to the said 1948 Bulkhead Line and the point of beginning.

(q) “Project” means the integrated development of a combination of uses on Candlestick Point and the shipyard, including, but not limited to, residential, commercial, public trust, and recreational uses, in accordance with the redevelopment plan.

(r) “Project area” means the shipyard, Hunters Point submerged lands, and Candlestick Point.

(s) ”Proposition G” means Proposition G, also known as the “Mixed Use Development Project for Candlestick Point and Hunters Point Shipyard,” approved by the voters of the city in June 2008.

(t) “Public trust” or “trust” means the common law public trust for commerce, navigation, and fisheries.

(u) “Redevelopment plan” means the Hunters Point Shipyard Redevelopment Plan, and those portions of the Bayview-Hunters Point Redevelopment Plan pertaining to the redevelopment of Candlestick Point, adopted by the agency pursuant to Chapter 4.5 (commencing with Section 33492) of the Community Redevelopment Law, as those plans may be amended from time to time.

(v) “Reserved street area” means a portion of the reserved streets.

(w) “Reserved streets” means all those portions of the trust lands that were reserved to the state for street purposes by the Board of Tidelands Commissioners pursuant to the “Act to survey and dispose of certain salt marsh and tide lands belonging to the State of California,” Chapter 543 of the Statutes of 1868, as depicted on the map entitled “Map of the Salt Marsh and Tide Lands and Lands Lying Under Water South of Second Street and Situate in the City and County of San Francisco” prepared by the Board of Tide Land Commissioners and dated March 19, 1869.

(x) “Shipyard” or “Hunters Point Shipyard” means all that real property situate in the City and County of San Francisco, State of California, described as follows:

Beginning at the intersection of the southeasterly line of Fitch Street (64 feet wide) with the northeasterly line of Palou Avenue (80 feet wide), said intersection also being in the southerly line of the Lands of Lowpensky as described in that document filed in the Office of the County Recorder of said County in Book D238 Official Records at page 80; thence easterly along the southerly line of said Lands of Lowpensky to the southeasterly corner of the said Lands of Lowpensky being also the southwesterly corner of the Lands of the Regents of University of California as described in that document filed in the Office of the County Recorder of said County in Book C562 Official Records at page 582; thence easterly, northerly and northwesterly along the southerly, easterly and northeasterly lines of said Lands of the Regents to the northwesterly corner of said Lands of the Regents and also being the northeasterly corner of said Lands of Lowpensky. Thence northwesterly along the northeasterly line of said Lands of Lowpensky to the most westerly corner of said Lands of Lowpensky, being also a point in the northeasterly line of said Palou Avenue; thence northwesterly along the northeasterly line of said Palou Avenue to the southeasterly line of Griffith Street (64 feet wide); thence northeasterly along the southeasterly line of said Griffith Street 200 feet to the southwesterly line of Oakdale Avenue (80.00 feet wide); thence northwesterly along the southwesterly line of said Oakdale Avenue, 32 feet to the centerline of said Griffith Street; thence northeasterly along the centerline of said Griffith Street 600 feet to the centerline of McKinnon Avenue (80 feet wide); thence southeasterly along the centerline of said McKinnon Avenue 664 feet to the centerline of said Fitch Street (64 feet wide); thence northeasterly along the centerline of said Fitch Street 320 feet to the northeasterly line of La Salle Avenue (80 feet wide); thence southeasterly along the northeasterly line of said La Salle Avenue, 632 feet to the northwesterly line of Earl Street (64 feet wide) and an angle point in the northwesterly boundary of Inchon Village as shown on the “Map of Inchon Village” filed in the Office of the County Recorder of said County in Book 17 of Condominium Maps at pages 112 through 130; thence southwesterly along the northwesterly boundary of said Inchon Village to the centerline of McKinnon Avenue (80 feet wide) and the most northerly corner of the Lands of Crisp Building, Inc., described in that certain document filed in the Office of the County Recorder of said County in Book D767 Official Records at page 1051; thence southwesterly, southeasterly and northeasterly along the northwesterly, southwesterly and southeasterly lines of said Lands of Crisp Building, Inc. to the most easterly corner of said Lands of Crisp Building, Inc., being also the most southerly corner of the land shown on the “Parcel Map of Inchon and Solomon Village” filed in the Office of the County Recorder of said County in Book 17 of Parcel Maps at page 77 and the centerline of said McKinnon Avenue; thence northeasterly along the southeasterly line of said Inchon and Solomon Village to the most easterly corner of said Inchon and Solomon village and the southwesterly line of Innes Avenue (80.00 feet wide); thence northwesterly along the southwesterly line of said Innes Avenue 641 feet to the centerline of said Earl Street (64 feet wide); thence northeasterly along the centerline of said Earl Street 40 feet to the centerline of said Innes Avenue; thence southeasterly along the centerline of said Innes Avenue 32 feet to the southeasterly line of said Earl Street; thence northeasterly along the southeasterly line of said Earl Street and its prolongation 3,151 feet to the 1948 Bulkhead Line as shown on the map entitled “Real Estate Summary Map NAVFAC Drawing No. 1045757” on file at the Department of the Navy, WESTDIV, San Bruno, California; thence southeasterly along said 1948 Bulkhead Line and the northeasterly line of that certain property conveyed in declaration of taking, Civil Action No. 22147 as shown on said summary map 2,553 feet more or less to a point on a line parallel with and 450 feet southeasterly of the southeasterly line of Boalt Street (64 feet wide), thence southwesterly along said parallel line a distance of 52 feet more or less to the northeasterly line of the land described in the deed filed in Book 3677 of Official Records at page 349 in the Office of the County Recorder of said County, said northeasterly line being the arc of a curve, concave southwesterly and having a radius of 1,800 feet; thence southeasterly and southerly along said arc to the southeasterly prolongation of the northeasterly line of Evans Avenue (80 feet wide); thence northwesterly along said prolongation and said northeasterly line of Evans Avenue, to the 1941 Bulkhead Line as shown on said summary map; thence southerly along said 1941 Bulkhead Line, to the northeasterly line of that certain property conveyed in declaration of taking, Civil Action No. 36272 as shown on said summary map; thence southeasterly along said northeasterly line to said 1948 Bulkhead Line as shown on said summary map; thence southerly along said 1948 Bulkhead Line to the line dividing the City and County of San Francisco from the County of San Mateo; thence westerly along said county line 127 feet more or less to the southeasterly prolongation of the northeasterly line of Bancroft Avenue (80 feet wide); thence northwesterly along said prolongation and said northeasterly line of said Bancroft Avenue 7,484 feet more or less to the southeasterly line of said Fitch Street (64 feet wide); thence northeasterly along the southeasterly line of said Fitch Street 2,800 feet to the point of beginning.

(y) “State” means the State of California.

(z) “State property” means the property or interests in property owned by the state located within the project area, and includes both proprietary land and sovereign land.

(aa) “State recreation area” means the Candlestick Point State Recreation Area.

(ab) “Tidelands” means tide and submerged lands.

(ac) “Trustee” means the owner and trust administrator of trust lands granted pursuant to this act or the Burton Act, and is either the agency, with respect to lands owned by the agency, or the city, with respect to lands owned by the city.

(ad) “Trust lands” means all lands, including tide and submerged lands, within the project area that are presently, or upon conveyance out of federal ownership will be, subject to the public trust. Following a trust exchange, trust lands shall include all lands within the project area that have been impressed with the trust pursuant to the exchange, and shall not include any lands that have been removed from the trust pursuant to the exchange.

SEC. 2. The Legislature finds and declares all of the following:

(a) The purpose of this act is to facilitate the productive reuse of the lands within the areas of San Francisco known as Candlestick Point and the former Hunters Point Naval Shipyard in a manner that furthers the purposes of the public trust and the Community Redevelopment Law. To effectuate this purpose, this act grants the state's sovereign interest in the lands comprising the shipyard to the agency upon the transfer of those lands out of federal ownership, and approves and authorizes the commission, provided that it makes the necessary findings supporting the exchange, to carry out an exchange of lands that will place or confirm the public trust on lands within the project area with substantial value for the public trust, and terminate the public trust in project area lands that are no longer useful for trust purposes. This act also authorizes the director on behalf of the department to enter into an agreement to transfer certain lands within the Candlestick Point State Recreation Area to the agency or the city, provided that the agreement provides an overall benefit to the state recreation area and meets certain other conditions set forth in this act.

(b) The project area, including both the shipyard and Candlestick Point, encompasses lands that were historically tidelands subject to the public trust, as well as historic uplands that were not subject to the trust. Beginning in 1861, certain of the area's tidelands were conveyed into private ownership by the state pursuant to various state statutes. Portions of those tidelands were subsequently filled and reclaimed. The trust status of portions of the reclaimed tidelands is uncertain. Due to differences in the various statutes authorizing the conveyance of certain portions of the tidelands into private ownership, as well as other historical circumstances, some of the reclaimed tidelands, including lands located well inland from the current shoreline, have remained subject to the public trust, while other reclaimed tidelands, including most of the lands adjacent to the shoreline, may have been freed from the trust. In addition, a portion of the lands that are subject to the trust consist of reserved streets that were mapped but never built, and a railroad right-of-way, forming a grid pattern that is not consistent with the existing or planned street system for the lands, and most of these lands are no longer useful for trust purposes.

(c) In 1939, the United States began acquiring lands for purposes of constructing and operating what came to be known as the Hunters Point Naval Shipyard. The shipyard was used primarily as a United States Navy industrial operation for the modification, maintenance, and repair of ships. The shipyard was closed in 1974, resulting in adverse economic impacts on the economic base of the surrounding Bayview Hunters Point neighborhood. Pursuant to Section 2824(a) of the National Defense Authorization Act for fiscal year 1991, as amended by Section 2834 of the National Defense Authorization Act for fiscal year 1994, the United States Navy is authorized to convey the shipyard, or portions of the shipyard, to the city or to a local reuse authority approved by the city. The agency is the approved local reuse authority for the shipyard. Pursuant to a 2004 conveyance agreement with the agency, the United States Navy has conveyed a portion of the shipyard to the agency and has agreed to transfer the remainder to the agency following hazardous materials remediation.

(d) The state's sovereign interest in the filled tidelands at Candlestick Point consists primarily of reserved streets and portions of a former railroad right-of-way. In 1958, the state, through the 1958 Act, authorized the sale of a portion of these lands to the city for the purpose of developing a sports stadium. The state received consideration for the sale. The intent of the 1958 Act was to terminate the public trust on the transferred lands, but the statute required that the lands be used only for purposes of general statewide interest. Pursuant to the 1958 Act, the city acquired the lands free of the trust and constructed the stadium commonly referred to as Candlestick Park, which is now nearing the end of its useful life.

(e) In 1968, the Legislature enacted the Burton Act, which granted the state's remaining interest in tidelands within the city, including the state's sovereign interests in the portion of Candlestick Point outside of the stadium site, to the city, subject to the public trust and the Burton Act trust. In 1973, the Legislature authorized the department to acquire and develop real property at Candlestick Point for the state park system. The state subsequently acquired private lands along the shoreline of Candlestick Point to create the Candlestick Point State Recreation Area. In 1984, the city conveyed back to the state those lands within the state recreation area boundaries that the city had acquired under the 1958 Act and the Burton Act. The state recreation area was the first California state park unit developed in an urban environment and is a critical component of the state park system. At present, however, much of the state recreation area is underutilized and in need of substantial restoration and improvement.

(f) The shipyard and Candlestick Point are adjacent to one another and are located on either side of South Basin, with a common boundary at Yosemite Slough. Together, they comprise approximately 760 acres and make up the largest area of underused land in the city. The shipyard, once a source of economic opportunity for the surrounding Bayview Hunters Point community, has stood dilapidated and abandoned for over 30 years and now stands as a barrier to public health, open space, and the waterfront, and a blight on one of San Francisco's poorest communities. The revitalization of Candlestick Point has been contemplated for over 10 years to create much needed economic and public benefits, affordable housing for Bayview Hunters Point residents, and other tangible benefits to the Bayview Hunters Point community. The stadium at Candlestick Point is nearing the end of its useful life and is in need of replacement, the nearby public housing development at Alice Griffith requires a complete rebuilding, and the restoration and improvement of the adjoining state recreation area has been a long-time goal of the state, the city, and the Bayview Hunters Point community.

(g) Until 2007, efforts to redevelop the shipyard and Candlestick Point proceeded separately from one another. In 1997, the agency and the city adopted the Hunters Point Shipyard Redevelopment Plan to provide for the economic revitalization of the shipyard upon its transfer out of federal ownership. In anticipation of the transfer of the shipyard to the agency, the Legislature enacted the Hunters Point Shipyard Conversion Act of 2002 (Chapter 464 of the Statutes of 2002), and the Hunters Point Shipyard Public Trust Exchange Act (Chapter 435 of the Statutes of 2003), which together granted in trust to the agency all of the state's sovereign interest in certain lands within and adjacent to the shipyard and authorized a shipyard-wide public trust exchange, subject to certain terms and conditions.

(h) Chapter 1046 of the Statutes of 1998, which repealed and added Section 5006.8 of the Public Resources Code, was enacted for the purpose of facilitating the redevelopment of Candlestick Point in accordance with Propositions D and F, which were approved by voters of the city on June 3, 1997. Those measures authorized development of a stadium, retail and entertainment center, and associated support uses on the site. In 2006, the city and the agency adopted the Bayview Hunters Point Redevelopment Plan, which included provision for a stadium project consistent with Propositions D and F. Subsequently, the primary tenants of the stadium, the San Francisco Forty Niners, announced their intention to build a new stadium in a location other than Candlestick Point.

(i) In 2007, the city and the agency undertook a new, integrated planning effort for the shipyard and Candlestick Point, which resulted in the adoption of a conceptual framework for development. The conceptual framework calls for a mixed use project on the project area that will provide, among other things, much needed parks and open space, including a major renovation of the state recreation area to enhance access by residents and visitors to the waterfront; new business and employment opportunities; new housing opportunities affordable for residents of the neighboring Bayview Hunters Point community; a site for a new sports stadium on the shipyard, with alternative uses if the San Francisco Forty Niners elect to build a new stadium elsewhere; and other economic and public benefits for the community and the city as a whole and the statewide public.

(j) In June 2008, the voters of the city approved Proposition G, the "Mixed Use Development Project for Candlestick Point and Hunters Point Shipyard." Proposition G repealed Propositions D and F and promulgated city policy encouraging the timely development of the project area with a mixed-use project including: over 300 acres of public park and open space; between 8,500 and 10,000 homes; about 700,000 square feet of retail space; about 2,150,000 square feet of green office, science and technology, research and development, and industrial space; a possible arena or other public performance site; a site in the shipyard for a new stadium for the San Francisco Forty Niners; and additional green office, science and technology, research and development, and industrial space, or additional housing, if a new stadium is not built. Proposition G specifically contemplated a mix of stacked flats, attached town homes and, in appropriately selected locations, low-rise, mid-rise, and high-rise towers, to help ensure the economic feasibility of the development and provide a varied urban design. Proposition G also made it city policy that the project be consistent with the following objectives: producing tangible community benefits for residents of the

Bayview Hunters Point neighborhood and the city; reconnecting the shipyard and Candlestick Point with the Bayview Hunters Point neighborhood and protecting the Bayview Hunters Point neighborhood character for existing residents; producing substantial new housing, both affordable and market-rate, and encouraging the rebuilding of the Alice Griffith Housing Development; incorporating environmental sustainability; encouraging the San Francisco Forty Niners to remain in San Francisco; and requiring the project to be financially sound, with or without a new stadium.

(k) This legislation is necessary for the successful redevelopment of the project area and to realize the resulting public benefits, including, but not limited to, the elimination of blight, the provision of affordable housing, the creation of new public open space, and increased public access to the waterfront. This legislation is also needed to improve the configuration of the public trust lands in furtherance of trust purposes.

(*l*) The existing configuration of trust and nontrust lands within the project area is such that the purposes of the public trust cannot be fully realized. A substantial portion of the reclaimed trust lands are interior lands that have been cut off from access to navigable waters, or are reserved streets laid out in a grid pattern that is not useful to the trust. Most of these lands are no longer needed or required for the promotion of the public trust. Other lands within the project area adjacent to the waterfront or otherwise of high value to the public trust are currently not subject to the public trust. Absent a trust exchange, substantial portions of the lands within the shipyard that are located along the waterfront or are otherwise of high value to the public trust would be free of the public trust, would not be required to be put to uses consistent with the public trust, and could be cut off from public access. In addition, certain interior lands not useful for trust purposes would be restricted and could not be used for residential or other nontrust uses essential to the redevelopment of the project area.

(m) A trust exchange resulting in the configuration of trust lands substantially similar to that depicted on the diagram in Section 25 of this act maximizes the overall benefits to the trust, without interfering with trust uses or purposes. Following the exchange, the entire waterfront within the project area, as well as certain interior lands that have high trust values, will be subject to the public trust. The lands that will be removed from the trust pursuant to the exchange have been cut off from navigable waters, are no longer needed or required for the promotion of the public trust, and constitute a relatively small portion of the granted lands within the city. This act requires the commission to ensure that the lands added to the trust pursuant to the exchange have a monetary value equal to or greater than the monetary value of the lands taken out of the trust.

(n) Several historic buildings in the shipyard have been identified by the State Historic Preservation Officer as contributors to the Hunters Point Commercial Drydock Historic District. These contributor buildings convey a sense of the shipyard's early maritime history, enhance the open-space experience along the waterfront, and should be preserved and restored. Uses of the contributor buildings that support their preservation and restoration, but which are not otherwise consistent with the trust, may be authorized under certain conditions set forth in this act.

(o) The hillside open space provides substantial value to the trust as an open space and recreational resource affording exceptional views of San Francisco Bay and the waterfront. To protect the trust value of the hillside open-space area, it is important that significant view corridors to the waterfront be protected and adequate public access be provided in the manner set forth in this act.

(p) The state recreation area is presently in need of substantial improvement, restoration, and reconfiguration. A substantial portion of the park currently serves as a parking area for stadium events. In other areas, the park does not contain enough land adjacent to the shoreline to provide the desired level of public access. The park lacks needed improvements, and many of the improvements that do exist are in a state of disrepair. Proposition G calls for improving and restoring the state recreation area, including enhancing access to the waterfront for public use, providing views of San Francisco Bay, and extending the Bay Trail system through the park. This act approves a reconfiguration of the state recreation area and to that end authorizes the director to enter into an agreement for the transfer of state recreation area lands to the agency or the city in exchange for park improvements, funding for park operation and maintenance, lands to be added to the state recreation area, and other consideration, provided the agreement will result in an overall benefit to the park and meets the other requirements of this act regarding the transfer of state recreation area lands.

(q) This legislation advances the statewide purposes of the Community Redevelopment Law and the public trust, and is in the best interests of the people of this state.

SEC. 3. Section 5006.8 of the Public Resources Code is repealed.

SEC. 4. Chapter 464 of the Statutes of 2002, The Hunters Point Shipyard Conversion Act of 2002, as amended by Chapter 435 of the Statutes of 2003, is repealed.

SEC. 5. Chapter 435 of the Statutes of 2003, The Hunters Point Shipyard Public Trust Exchange Act, is repealed.

SEC. 6. (a) All of the state's right, title, and interest, acquired by virtue of its sovereignty, in any trust lands in which the agency holds or acquires fee title, is hereby granted to and vested in the agency, subject to the public trust and the terms and conditions of this act.

(b) Upon conveyance by the federal government to the agency of any piers or other appurtenances located in part on Hunters Point submerged lands, the grant of the state's right, title, and interest in the Hunters Point submerged lands to the city pursuant to the Burton Act is revoked, and all of the state's right, title, and interest in those lands is granted to and vested in the agency, subject to the public trust and the terms and conditions of this act.

(c) The agency shall hold the trust lands in trust for the benefit of all the people of the state for purposes of commerce, navigation, and fisheries, and for other public trust purposes, subject to the terms and conditions of this act. Any trust lands held by the agency pursuant to this act shall not be subject to the Burton Act trust.

SEC. 7. Notwithstanding Section 6359 of the Public Resources Code or any other provision of law, the grant of the state's interest in trust lands to the agency pursuant to this act shall be deemed effective as follows:

(a) On January 1, 2010, with respect to trust lands held in fee by the agency on that date.

(b) With respect to trust lands acquired by the agency after January 1, 2010, upon the agency's acquisition of those lands.

(c) With respect to the Hunters Point submerged lands, upon conveyance by the federal government to the agency of any piers or other appurtenances located in part on the Hunters Point submerged lands, at which time any prior grant of the state's right, title, and interest in the Hunters Point submerged lands to the city pursuant to the Burton Act shall be deemed revoked and the lands shall cease to be subject to the Burton Act trust.

SEC. 8. (a) The agency may use, conduct, operate, maintain, manage, administer, regulate, improve, lease, and control (collectively referred to as "use") the trust lands and do all things necessary in connection with that authority that conform with the terms of this act and the public trust. Except as provided in this act, the agency shall use the trust lands only in a manner that is consistent with, necessary and convenient for, or incidental or ancillary to, the purposes of the public trust.

(b) In the management, conduct, operation, and control of the trust lands, or any improvements, betterments, or structures on the trust lands, the agency shall make no discrimination in rates, tolls, or charges for a use or service in connection with that management.

SEC. 9. The agency shall not grant, convey, give, or alienate the trust lands, or any part of the lands, to an individual, firm, corporation, or governmental agency (not including the commission) for any purpose, except as provided in this act or as otherwise provided by statute.

SEC. 10. There is reserved in the people of the state the right to hunt and fish in and over the waters on the trust lands, together with the right of convenient access to the waters over the trust lands for those purposes.

SEC. 11. The state shall reserve from the grant made in Section 6 of this act, and from any other conveyance pursuant to this act of the state's interest, or any portion of the state's interest, in any lands, all minerals and all mineral rights in the lands of every kind and character now known to exist or hereafter discovered, including, but not limited to, oil and gas and rights thereto, together with the sole, exclusive, and perpetual right to explore for, remove, and dispose of those minerals by any means or methods suitable to the state or to its successors and assignees, except that, notwithstanding the Burton Act or Section 6401 of the Public Resources Code, this reservation shall not include the right of the state or its successors or assignees in connection with any mineral exploration, removal, or disposal activity, to do either of the following:

(a) Enter upon, use, or damage the surface of the lands or interfere with the use of the surface by a grantee or by the grantee's successors or assignees.

However, a lease, franchise, permit, or license of the property shall contain a provision specifying at least one point from which, and the manner in which, the right of ingress or egress to the subsurface deposits may be exercised, which point or points may be outside the area of the leasehold, franchise, permit, or license, as long as the point or points are adequate to permit the rights reserved to the state to be exercised.

(b) Conduct any mining activities of any nature whatsoever above a plane located 500 feet below the surface of the lands without the prior written permission of a grantee of the lands or the grantee's successors or assignees.

SEC. 12. The state has the right to use, without charge, any transportation, land or storage improvements, wharves, docks, piers, slips, quays, or other improvements constructed upon the trust lands, for a vessel or other watercraft, aircraft, or railroad owned or operated by the state.

SEC. 13. (a) The state reserves the right to amend, modify, or revoke any and all rights in the trust lands granted to the agency under this act.

(b) No amendment or revocation, in whole or in part, of the granted rights in the trust lands, or any transfer of trust lands between the agency and the city, shall impair or affect the rights or obligations of third parties, including debt, security, or bond holders, lessees, lenders for value, and holders of contracts conferring the right to the use or occupation of, or the right to conduct operations upon or within, the trust lands, arising from leases, contracts, or other instruments lawfully entered into prior to the effective date of the amendment, revocation, or transfer. For purposes of this section, the term "bonds" includes, without limitation, tax increment bonds, revenue bonds, certificates of participation, and any other bonds or forms of indebtedness secured by or payable from, in whole or in part, revenues derived from trust lands.

(c) If a lease, contract, or other instrument described in subdivision (b) is in effect on the effective date of an amendment or revocation of the granted rights in the trust lands, the state, at its option exercised by and through the commission, may succeed to the agency's interest in the lease, contract, or instrument. Otherwise, the agency's interest in the instrument, property, and revenue shall continue during the term or other period during which the instrument shall remain in effect. If a lease, contract, or other instrument described in subdivision (b) is in effect on the effective date of a transfer of trust lands between the agency and the city, the transferee shall succeed to the transferor's interest in the lease, contract, or other instrument, unless the agency and the city agree otherwise. An action taken by the state, or a transfer of trust lands between the agency and the city, shall not cause the agency or the city to breach or default under a lease, contract, or instrument in effect on the effective date of an amendment or a revocation. All bonds or securities issued by the agency or the city and payable out of revenues from the trust lands shall continue to be so payable, directly or indirectly, and secured in all respects as provided in the proceedings for their issuance, and the revenues of the trust lands shall be pledged and applied to the payment of the bonds or securities in all respects as though no amendment or revocation had taken place.

SEC. 14. The agency may grant franchises, permits, privileges, licenses, easements, or leasehold interests (leases) in connection with the trust lands, or any part of the trust lands, each for a term not exceeding 66 years. A lease of the trust lands shall be solely for uses that are consistent with, necessary and convenient for, or incidental or ancillary to, the purposes of the public trust, except that a lease may be entered into for other uses if the agency has made all of the following determinations:

(a) There is no immediate trust-related need for the property proposed to be leased.

(b) The proposed lease is of a duration of no more than five years and provides that the agency shall have the right to terminate the lease in favor of trust uses as trust needs arise.

(c) The proposed lease prohibits the construction of new structures or improvements on the subject property that, as a practical matter, could prevent or inhibit the property from being converted to a permissible trust use if necessary.

(d) The proposed use of the leased property would not interfere with commerce, navigation, fisheries, or any other existing trust use or purpose.

SEC. 15. (a) Notwithstanding any other provision of this act or the Burton Act, the buildings, or any portion of a building, identified by the State Historic Preservation Officer as contributors to the Hunters Point Commercial Drydock Historic District, commonly known as the Gatehouse (Building 204), Pumphouse 2 (Building 205), Pumphouse 3 (Building 140), and the Tool and Paint Building (Building 207), may be used or leased for purposes not otherwise consistent with the public trust, provided the trustee makes a finding that there are no trust uses available that would allow for the restoration and preservation of the space. A lease renewal, extension, or granting of a new lease for a nontrust purpose shall require a new finding that no trust uses are then available that would allow for the restoration and preservation of the building, or a part of it.

(b) If a building described in subdivision (a) is used for a nontrust purpose, and is remodeled, renovated, or used in a manner that is inconsistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings, the building shall be put to a public trust use from the commencement of the inconsistent remodel, renovation, or use, unless the continued nontrust use is authorized to continue under Section 14 of this act, if the agency is the trustee, or under the Burton Act, if the city is the trustee.

(c) If a building described in subdivision (a) is demolished, subsequent use of the land and any replacement structure shall be consistent with the public trust and the applicable statutory trust.

SEC. 16. (a) The agency shall deposit all moneys collected by the agency arising out of the use or operation of any of the trust lands, including all revenues derived from leases or other rights to use or occupy the lands, into a special fund maintained by the agency. The agency shall use the money in or belonging to the fund only for uses and purposes consistent with the public trust and the requirements of this act.

(b) The agency shall prepare an annual statement of financial conditions and operations and submit it to the commission each year on or before October 1. The statement shall include a statement of all revenues and expenditures related to trust lands and trust assets, including obligations incurred, but not yet paid.

(c) The requirements of this section implement and do not supersede the requirements of Section 6306 of the Public Resources Code.

SEC. 17. (a) The agency may exchange portions of the trust lands with a state agency, political subdivision, person, entity, or corporation, or the United States or a political subdivision of the United States, for other lands, if the agency determines, and the commission adopts a resolution finding and declaring, all of the following:

(1) The portions of the trust lands or interests in lands to be exchanged out of the trust have been filled and reclaimed, are cut off from access to the waters of San Francisco Bay and are no longer in fact tidelands or submerged lands or navigable waterways, are relatively useless for trust purposes, and constitute a relatively small portion of the granted lands within the city.

(2) The lands or interests in lands to be acquired by the agency have a monetary value equal to or greater than the value of the lands for which they are to be exchanged and are useful for the particular trust purposes authorized by this act.

(3) No substantial interference with trust uses and purposes, including public rights of navigation and fishing, will ensue by virtue of the exchange.

(4) The lands or interests in lands to be acquired by the agency in the exchange will provide a significant benefit to the public trust.

(5) The exchange is otherwise in the best interest of the state.

(b) Upon adoption of the resolution by the commission, the lands conveyed by the agency shall be free from the public trust, and the lands received by the agency in exchange shall be held subject to the public trust and to the terms of this act.

(c) The exchange authority granted by this section shall be in addition to, and shall not operate as a limitation on, the exchange authority granted by Sections 20 to 25, inclusive, of this act.

SEC. 18. Upon written agreement between the agency and the city, acting by and through its Port Commission, the agency may transfer to the city some or all of the trust lands in which the agency holds fee title, provided that the commission has approved the transfer. All of the right, title, and interest granted to the agency under this act in any lands transferred to the city under this section shall, upon transfer, be granted to and vest in the city. The city shall hold the transferred lands subject to the public trust and shall assume authority as trustee over those lands. Lands transferred to the city pursuant to this section shall be subject to the Burton Act trust and shall cease to be subject to the terms and conditions of this act, except that Sections 13 and 15 of this act shall remain applicable to those lands. Nothing in this section shall preclude the city from including trust lands held by the city as part of an exchange authorized by this act.

SEC. 19. (a) Notwithstanding the restriction on alienation in the Burton Act or any other provision of law, upon approval by the commission, the city may transfer to the agency some or all of the Burton Act lands. All of the right, title, and interest granted to the city under the Burton Act in any lands transferred to the agency under this section shall, upon transfer, be granted to and vest in the agency. The agency shall hold the transferred lands subject to the public trust and the requirements of this act, and shall assume authority as trust administrator over those lands. Lands transferred to the agency under this section shall cease to be subject to the Burton Act trust.

(b) Notwithstanding subdivision (a), no later than the date on which the redevelopment plan terminates as to the entirety of the project area or January 1, 2050, whichever is earlier, the agency shall transfer any trust lands in which it holds fee title to the city and the city shall become the sole grantee of the trust lands, unless the commission approves a later date by which the agency shall transfer trust lands to the city. The city shall hold the transferred trust lands subject to the Burton Act trust and the lands shall cease to be subject to the terms and conditions of this act, except that Sections 13 and 15 of this act shall remain applicable to those lands. This subdivision shall not apply to any trust lands for which fee title is held by the state. This subdivision shall not affect the rights and obligations of the agency pursuant to the Community Redevelopment Law.

SEC. 20. The Legislature hereby approves an exchange of public trust lands within the project area, whereby certain trust lands that meet the criteria set forth in this act and therefore are not now useful for public trust purposes will be freed from the public trust and of the associated restrictions on use and alienation, and certain other lands that are not now public trust lands and that are useful for public trust purposes will be made subject to the public trust, provided that the commission determines that the exchange furthers the public trust and approves the exchange and that all of the following conditions are met:

(a) The exchange results in a configuration of trust lands substantially similar to that shown on the diagram in Section 25 of this act.

(b) The lands to be subject to the public trust are configured so as to be accessible from the streets as finally configured in the project area.

(c) The exchange otherwise complies with the requirements of this act.

(d) The exchange is consistent with and furthers the purposes of the public trust and this act.

SEC. 21. All lands exchanged into the trust under this act shall be held by the trustee subject to the public trust and the applicable statutory trust, and all lands exchanged out of the trust under this section shall be free of the public trust and the applicable statutory trust.

SEC. 22. The precise boundaries of the lands to be taken out of the trust and the lands to be put into the trust pursuant to the exchange shall be determined by the trustee or trustees with authority over the lands to be exchanged, subject to the approval of the commission. The commission is authorized to settle by agreement with the trustees any disputes as to the location of the mean high tide line in its last natural state, the boundaries of tidelands conveyed into private ownership pursuant to various statutes, and any other boundary lines which the commission deems necessary to effectuate the exchange.

SEC. 23. (a) The commission is authorized to approve an exchange of public trust lands within the project area that meets the requirements of this act. Pursuant to this authority, the commission shall establish appropriate procedures for effectuating the exchange. The procedures shall include, but are not limited to, provisions for ensuring that lands or interests in lands at the shipyard are not exchanged into the trust until either of the following has occurred:

(1) All remedial action necessary to protect human health and the environment with respect to the hazardous substances on the land has been completed as determined by the United States Environmental Protection Agency, the California Department of Toxics Substances Control, and the regional water quality control board, pursuant to the Federal Facilities Agreement for the shipyard dated January 22, 1992, as amended, and the United States has provided a warranty in accordance with Section 9620(h)(3)(A) of Title 42 of the United States Code.

(2) The United States has obtained a warranty deferral, approved by the Governor in accordance with Section 9620(h)(3)(C) of Title 42 of the United States Code, involving land for which the commission has determined to execute a certificate of acceptance of title, and the commission finds that sufficient liability measures and implementation measures will be in place upon the completion of the exchange. Prior to approving a warranty deferral, the Governor and the Department of Toxic Substances Control, the regional water quality control board, or other appropriate state oversight agency with expertise in hazardous materials remediation shall confer and consult with the commission to reasonably ensure that the terms of the warranty deferral and underlying documents and agreements provide sufficient standards and financial assurances to ensure that the remediation of any affected trust lands will be completed in a manner consistent with the intended public trust use of these lands and in a reasonable period of time.

(b) The commission may not approve the exchange of any trust lands unless it finds all of the following:

(1) The portions of the trust lands or interests in lands to be exchanged out of the trust have been filled and reclaimed, are cut off from access to the waters of San Francisco Bay and are no longer in fact tidelands or submerged lands or navigable waterways, are relatively useless for public trust purposes, and constitute a relatively small portion of the granted lands within the city.

(2) The lands or interests in lands to be impressed with the public trust have a monetary value equal to or greater than the monetary value of the lands or interests in lands to be exchanged out of the trust. In the event that the monetary value of the lands or interests in lands to be exchanged out of

the trust is greater than the monetary value of the lands or interests in lands to be exchanged into the trust, the commission may consider a deposit of funds into the Land Bank Fund established pursuant to Section 8610 of the Public Resources Code to be held solely for acquisition of property, in an amount equal to the difference in value.

(3) No substantial interference with trust uses and purposes, including public rights of navigation and fishing, will ensue by virtue of the exchange.

(4) The lands or interests in lands impressed with the public trust will provide a significant benefit to the public trust and are useful for the particular trust purposes authorized by this act.

(5) The configuration of trust lands within the project area upon completion of the exchange is substantially similar to the configuration shown on the diagram in Section 25 of this act, includes all lands within the project area that are presently below mean high tide, and consists of lands suitable to be impressed with the public trust.

(6) The final layout of streets in the project area will provide access to the public trust lands and be consistent with the beneficial use of the public trust lands.

(7) Streets and other transportation facilities located on public trust lands shall be designed to be compatible with the public trust and to serve primarily public trust purposes of access to shoreline improvements and shoreline circulation rather than serving nontrust purposes.

(8) Any surveys or legal descriptions required for the parcels in conjunction with the exchange shall be approved by the commission.

(9) Each trustee who owns or will own fee title in any of the lands to be exchanged has approved the exchange.

(10) The exchange otherwise complies with the requirements of this act.

(11) The exchange is consistent with and furthers the purpose of the public trust and this act.

(12) The exchange is otherwise in the best interest of the statewide public.

(c) The commission may impose additional conditions on the exchange authorized by this act if the commission determines that these conditions are necessary to protect the public trust. At a minimum, the commission shall ensure all of the following:

(1) The streets and other transportation facilities located on trust lands are designed to be compatible with the public trust.

(2) The trust values of the hillside open space are preserved. To this end, the commission shall ensure all of the following:

(A) The final trust configuration maintains reasonable public pedestrian and vehicular access between the hillside open space and the waterfront, and in addition, between the top of the hillside open space and other areas of the city.

(B) View corridors are maintained and protected so that visitors to the hillside open space can enjoy substantial vistas of San Francisco Bay.

(C) Direct vehicular and pedestrian access from the lower portions of the shipyard to the top of the hillside open space area is provided.

(D) No liability to owners of adjacent upslope property, for subjacent support or otherwise, is created by virtue of the trustee's taking title to the hillside open space.

(E) No moneys from the trust fund described in Section 16 of this act may be used to provide direct benefit to the residential development or to other uses of the nontrust portion of the hilltop area adjacent to the hillside open space, or to offset or mitigate impacts caused by those uses.

(F) Street parking on the parkway adjacent to the top of the hillside open space may not be restricted for residential parking and shall remain accessible to the public for regional and statewide use. In addition, adequate parking areas accessible to the public to support regional and statewide use of the hillside open space shall be dedicated in an area adjacent to the lower portion of the hillside open space. Public access to the hillside open space and the availability of parking accessible to the public shall be publicized with appropriate signage.

(d) For purposes of effectuating the exchange authorized by this section, the commission is authorized to do all of the following:

(1) Receive and accept on behalf of the state any lands or interest in lands conveyed to the state by the parties to the exchange agreement, including lands that are now and that will remain subject to the public trust.

(2) Convey by patent all of the right, title, and interest of the state in lands that are to be free of the public trust and applicable statutory trust, upon completion of an exchange of lands as authorized by this act and as approved by the commission.

(3) Convey to the trustee or trustees by patent all of the right, title, and interest of the state in lands that are to be subject to the public trust and the applicable statutory trust upon completion of an exchange of lands as authorized by this act and as approved by the commission, subject to the terms, conditions, and reservations as the commission may determine are necessary to meet the requirements of this act.

(4) Receive and accept from the department any lands or interests in lands within the state recreation area, as it may be reconfigured by the director pursuant to Section 26, that are to be subject to the public trust upon completion of an exchange of lands as authorized by this act and as approved by the commission.

(5) Transfer to the department any lands or interests in lands within the state recreation area, as it may be reconfigured by the director pursuant to Section 26, that are to be free of the public trust upon completion of an exchange of lands as authorized by this act and as approved by the commission.

(e) The exchange authorized by this section may include lands adjacent to the project area to the extent consistent with the purposes of this act and approved by the commission. Lands outside the project area that are impressed with the trust as part of an exchange authorized by this act shall be deemed trust lands for purposes of this act.

(f) If the department holds an interest in any of the lands to be received or conveyed by the exchange authorized by this section, the department shall be a party to the exchange agreement.

(g) Nothing in this act shall be construed as conditioning or otherwise limiting the authority of the state, the city, or the agency to undertake a public trust exchange or other conveyance authorized by any other provision of law, including, but not limited to, Section 17 of this act.

SEC. 24. An exchange of public trust land pursuant to Section 23 of this act may proceed in multiple phases, provided that with respect to each phase, the commission, in addition to the findings required by Section 23 of this act, finds both of the following:

(a) The cumulative monetary value of all of the lands or interests in lands exchanged into the trust in the proposed phase and completed phases is equal to or greater than the cumulative monetary value of all of the lands or interests in lands exchanged out of the trust in the proposed phase and completed phases. If, in connection with the approval of the exchange agreement or a completed phase of the exchange, the commission has previously determined the value of any lands that have been or are proposed to be exchanged, the commission, for purposes of making the finding required by this subdivision, shall utilize the value of those lands as previously determined by the commission, adjusted for inflation using an appropriate inflation index as determined by the commission.

(b) The lands or interests in lands exchanged into the trust at each phase are configured in a way that furthers the purposes of the overall exchange, including, but not limited to, having access to streets as finally configured in the project area.

SEC. 25. The following diagram is a part of this act:

PRINTER PLEASE NOTE: TIP-IN MATERIAL TO BE INSERTED

SEC. 25.2. If the commission has not approved the trust exchange authorized by Section 23 of this act by January 1, 2020, Section 20 and Sections 22 to 25, inclusive, of this act shall terminate and shall no longer be effective, unless an extension not to exceed five years is approved by the commission.

SEC. 25.5. (a) For purposes of Section 3 of Article X of the California Constitution, the Legislature hereby finds and declares that the reserved streets in Candlestick Point were reserved to the state solely for street purposes, and that those portions of the reserved streets that are found by the commission to meet the criteria set forth in paragraph (1) of subdivision (b) are no longer useful or necessary for navigation purposes.

(b) The trustee may, pursuant to Section 3 of Article X of the California Constitution, sell any portion of the reserved street areas within Candlestick Point free of the public trust and the applicable statutory trust. A sale made pursuant to this section shall not be effective unless and until the commission, at a regular open meeting with the proposed sale as a properly scheduled agenda item, finds all of the following:

(1) The reserved street area has been filled and reclaimed, is cut off from access to the waters of San Francisco Bay, and is no longer needed or required for the promotion of the public trust, and no substantial interference with the public trust uses and purposes will ensue by virtue of the sale.

(2) Termination of the trust in the reserved street area occurs in conjunction with or subsequent to a land exchange authorized by this act and approved by the commission.

(3) Termination of the trust in the reserved street area is substantially consistent with the proposed trust land configuration depicted in Section 25 of this act, as finally approved by the commission.

(4) The trustee will receive consideration for the sale equal to or greater than the fair market value of the land or interest sold.

(c) Any moneys received by the trustee for a sale pursuant to this section shall be deposited in a separate account in the fund required by Section 16 of this act or Section 4 of the Burton Act, and shall be expended only for acquisition of lands by the trustee or public access improvements on trust lands, or other uses and purposes consistent with the public trust and applicable statutory trust as determined by the commission. The funds in the special account may not be expended for overhead or administration costs by the trustee.

(d) The total reserved street area sold pursuant to this section shall not be more than 20 percent of the total reserved street areas in Candlestick Point.

(e) For purposes of this section, the term “sale” includes, without limitation, a sale, lease, transfer, or other conveyance of land or interest in land.

(f) Nothing in this section shall be construed as imposing additional requirements or limitations on the conveyance of reserved street areas free of the public trust and applicable statutory trust as part of an exchange authorized by this act or otherwise authorized by law.

(g) The Legislature hereby finds that the conditions set forth in this section will protect the public interest in accordance with Section 3 of Article X of the California Constitution.

SEC. 26. (a) The Legislature hereby approves a reconfiguration of the state recreation area in substantial conformance with the diagram included as Section 27 of this act, provided that the requirements of this section are met. Notwithstanding any other provision of law, the director may authorize the removal of land from the state recreation area, and may enter into an agreement to convey to the agency or the city an interest in the state property so removed, provided that the director makes in writing all of the following findings:

(1) (A) The state will receive consideration consisting of the forms set forth in paragraph (2) and having a value that equals or exceeds the greater of either of the following:

(i) The fair market value of the state property conveyed.

(ii) Fifty million dollars ($50,000,000). If the state property is to be conveyed in phases pursuant to paragraph (3) of subdivision (h), the minimum consideration under this clause shall be prorated for the state property conveyed at each phase, in proportion to the total area of state property to be conveyed under the agreement.

(B) The consideration referenced in clause (ii) of subparagraph (A) is not intended to be reflective of the fair market value of the property and shall not be used as a basis for determining value in any appraisal of the property.

(2) The form of consideration for the state property conveyed pursuant to paragraph (1) consists of the following:

(A) The provision of future funding for the operation and maintenance of the state recreation area.

(B) The cost of planning and constructing improvements to the state recreation area that enhance its use as a public park, which may include, without limitation, walking and biking trails, picnic facilities, recreational equipment, piers, overlooks, visitor centers, amphitheaters, entryways, restrooms, concession facilities, site furnishings, landscaping, habitat restoration, infrastructure, and improvements to protect the state recreation area from the effects of sea level rise, provided that these sea level rise improvements primarily benefit the state recreation area.

(C) Land within the project area to be added to the state recreation area.

(D) The amount of any reimbursement paid to the state by or on behalf of the city or the agency for the state's legal, transactional, planning, or other costs associated with actions carried out pursuant to this section.

(E) Monetary consideration, if determined appropriate by the director and if the monetary consideration received under this paragraph is dedicated and used for planning, improvement, maintenance, or operation of the state recreation area.

(3) The agreement will provide an overall benefit to the state recreation area and will further the objective of preserving the park's natural, scenic, cultural, and ecological values for present and future generations.

(4) The reconfiguration of the state recreation area will substantially conform to the configuration shown on the diagram included as Section 27 of this act, and as more particularly illustrated on the map on file with the city's planning department entitled "Proposed State Park Land Exchange" and dated September 3, 2009, for the area depicted on the map; provided, however, that the director may agree to additional modifications of the park configuration if the modifications are consistent with the overall financial feasibility of the project and the director determines that the modifications are necessary to fulfill the state recreational purposes of the state recreation area, taking into account public access, circulation and parking needs; wildlife habitat values; future sea level rise and the proposed responses thereto; and other relevant factors.

(5) The project, including the reconfiguration of the state recreation area, will not result in a significant adverse effect on biological resources, and will include habitat enhancement measures to benefit migratory birds and other wildlife. In making this determination, the director shall take into consideration any mitigation measures incorporated into the project during the environmental review process pursuant to the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code).

(6) Any applicable requirements of the Land and Water Conservation Fund Act of 1965 (16 U.S.C. Sec. 460l-4 et seq.) have been satisfied.

(7) It is the intent of this act that approximately 20 percent of the total consideration value required by paragraph (1) be in the form of operation and maintenance funding pursuant to subparagraph (A) of paragraph (2). If the agreement contains a lower amount of operation and maintenance funding, the director shall provide a report to the Legislature explaining the reasons for determining that the lower amount is appropriate in light of the overall benefits of the agreement.

(b) The director shall modify the boundaries of the state recreation area as necessary to reflect any conveyances made pursuant to this section.

(c) Notwithstanding any other provision of law, the director, on behalf of the department, and the commission, may acquire, convey, or transfer real property pursuant to the agreement authorized by this section, provided that the other requirements of this section are met, and the fair market value of any real property acquired or transferred has been determined by an appraisal prepared by the commission or an appraisal approved by the commission or the Real Estate Services Division of the Department of General Services and prepared by an independent appraiser certified by the Office of Real Estate Appraisers pursuant to Part 3 (commencing with Section 11300) of Division 4 of the Business and Professions Code. For purposes of compliance with this subdivision, the director may rely on an appraisal prepared in connection with a trust exchange authorized by this act.

(d) If the commission holds an interest in any of the lands to be removed from the state recreation area, the commission shall be a party to any agreement authorized by this section.

(e) The agreement authorized by this section may be combined with a trust exchange agreement authorized by this act. Pursuant to a trust exchange agreement, the department may transfer to the commission any lands or interests in lands within the reconfigured state recreation area that are to be subject to the public trust, and may receive and accept from the commission lands within the reconfigured state recreation area that are to be free of the public trust. Notwithstanding any other provision of law, the commission may lease to the department for state park purposes any trust lands it owns within the reconfigured state recreation area for a term not exceeding 66 years.

(f) The requirements of this section shall govern an agreement entered into, or conveyance made pursuant to the agreement, and shall supersede any other provision of law pertaining to the department's authority to acquire or transfer real property, or to enter into an agreement to acquire or transfer real property, including, but not limited to, Article 1 (commencing with Section 11000) of Chapter 1 of Part 1 of Division 3 of Title 2 of the Government Code, Part 11 (commencing with Section 15850) of Division 3 of Title 2 of the Government Code, and Chapter 1 (commencing with Section 5001) and Chapter 1.695 (commencing with Section 5096.500) of Division 5 of the Public Resources Code, or as those provisions may be hereafter amended.

(g) Notwithstanding anything to the contrary in Section 5002.2 of the Public Resources Code, the department is not required to revise the general plan for the state recreation area prior to taking any action pursuant to this section, including, but not limited to, the approval of an agreement authorized by this section, the acquisition, conveyance or transfer of interests in real property pursuant to such agreement, or the modification of the state recreation area boundary. Nothing in this act shall be construed as exempting the development of new facilities within the state recreation area from compliance with the general plan revision requirements of Section 5002.2 of the Public Resources Code.

(h) (1) Neither the director, on behalf of the department, nor the commission shall convey out-of-state ownership an interest in land within the state recreation area pursuant to this section prior to the receipt by the state of consideration meeting the value requirements of paragraph (1) of subdivision (a), except as provided in this subdivision.

(2) For consideration in the form of construction of future park improvements or in the form of the provision of future funding for operation and maintenance, a binding and enforceable commitment to construct the improvements or to provide the funding shall be deemed to satisfy the requirements of this subdivision if the director determines that adequate financial assurances have been provided to ensure that work will be completed or the funds will be provided, as specified in the agreement. Financial assurances under this paragraph may include, without limitation, performance or other surety bonds, insurance, or financial guarantees.

(3) (A) The agreement may provide for phased conveyances if the total consideration received by the state, or committed in accordance with

paragraph (2) of this subdivision, at or before each phase meets the value requirements of paragraph (1) of subdivision (a) with respect to the state property conveyed in that phase and any prior phases. For purposes of implementing this paragraph, if the consideration is based on fair market value, the director shall use the fair market value of the state recreation area lands as determined by the director at the time the agreement is approved.

(B) If the agreement provides for phased conveyances, the consideration tendered to the state at each phased closing may be in any of the forms set forth in paragraph (2) of subdivision (a), or any combination of those forms, as may be established by the agreement, if the agreement requires consideration meeting all of the requirements of paragraph (2) of subdivision (a) to be tendered prior to the final closing. For purposes of this subparagraph, final closing means a closing after which all of the state property within the state recreation area to be conveyed under the agreement will have been conveyed.

(i) Any monetary consideration received by the department pursuant to an agreement authorized by this section shall be deposited in a separate account maintained by the department and shall be expended only for planning, improvement, maintenance, or operation of the state recreation area.

(j) In order to allow public review of and comment on the findings required by subdivision (a), the director shall cause proposed findings to be published in the California Regulatory Notice Register no less than 30 days prior to making final findings. The director shall also cause the final findings to be published in the California Regulatory Notice Register.

SEC. 27. The following diagram is a part of this act:

PRINTER PLEASE NOTE: TIP-IN MATERIAL TO BE INSERTED

SEC. 27.5. Nothing in this act shall be construed as requiring the director or the commission to enter into any agreement authorized by this act.

SEC. 28. (a) The Legislature finds that the lands conveyed to the city pursuant to the 1958 Act have been cut off from water access, are relatively small in area, have been filled and reclaimed as part of a highly beneficial program of harbor development, and are no longer useful for public trust purposes. The Legislature further finds and confirms that the lands conveyed pursuant to the 1958 Act are free from the public trust.

(b) The Legislature finds and declares that the project will further the important statewide interests in redevelopment, the elimination of blight, the provision of affordable housing opportunities, the generation of new sales tax revenues, property taxes and other tax revenues to the state and state agencies, the creation of thousands of new jobs, and enhanced access of the public to use and enjoy the state recreation area, and that the development of the project will further the statewide purposes contemplated in Section 3 of the 1958 Act. The Legislature further finds and declares that it is necessary and in furtherance of important statewide interests for any restrictions or other encumbrances on title arising from Section 3 of the 1958 Act to be eliminated so as to facilitate disposition of property within the project area in furtherance of development of the project.

(c) At the request of the city or the agency, the executive officer of the commission shall, on behalf of the state, reasonably cooperate with the requesting parties to cause to be prepared and recorded any necessary deeds, patents, agreements, or other instruments for the purpose of removing any deed restrictions or other encumbrances on title arising from Section 3 of the 1958 Act.

SEC. 29. Section 3 of Chapter 2 of the Statutes of 1958 of the First Extraordinary Session is repealed.

SEC. 30. Chapter 1046 of the Statutes of 1998 is repealed.

SEC. 31. An exchange or other agreement made pursuant to this act is hereby found to be of statewide significance and importance. Therefore, no ordinance, charter provision, or other provision of local law inconsistent with this act applies to that exchange or agreement.

SEC. 31.5. (a) Notwithstanding any other provision of law, the requirements of subdivision (f) of Section 10310 of Title 14 of the California Code of Regulations shall be deemed satisfied for any part of the project requiring a BCDC permit if the agency submits in a form acceptable to BCDC an approved development and disposition agreement for the project, any required amendments to the redevelopment plan, and city final approval of all conforming amendments to the city's general plan, planning code, and zoning maps.

(b) Notwithstanding any other provision of law, the requirement of subdivision (g) of Section 66605 of the Government Code and of Section 11721, Appendix F of Title 14 of the California Code of Regulations, that an applicant for a BCDC permit demonstrate adequate legal interest in the underlying property shall be deemed satisfied if the agency submits in a form acceptable to BCDC an agreement authorized by Section 23 or 26 of this act, provided the agreement is fully executed, all parties with an interest in the property are parties to the agreement, and the terms of the agreement allow the applicant to undertake the proposed construction and uses for which the permit is sought.

(c) This section does not affect BCDC's jurisdiction and authority, or its discretion to approve, disapprove, or condition a permit application subject to this section in accordance with applicable law.

SEC. 32. (a) Nothing in this act may be construed to nullify the city or the agency's obligations for increasing, improving, and preserving the community's supply of low- and moderate-income housing imposed by the Community Redevelopment Law, including, but not limited to, the requirements of Sections 33334.2 and 33413 of the Health and Safety Code.

(b) Nothing in this act shall be construed as creating an exemption from or in any way modifying the requirements of the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code).

SEC. 33. Nothing in this act may be construed to authorize residential uses or other nontrust uses on public trust land except as provided in Sections 14 and 15.

SEC. 33.5. This act shall not be construed as creating a cloud on title to any real property within the project area in which the state has no claim of interest.

SEC. 34. A deed, patent, agreement, or other instrument executed in furtherance of this act, or an action of the city, state, or agency, to approve the use, lease, or conveyance of a city, state, or agency property subject to this act, or any portion thereof, or to approve project agreements, grant entitlements or permits, or issue bonds or other indebtedness in connection with the use and development of that property, shall be conclusively presumed to be valid unless held to be invalid in an appropriate proceeding in a court of competent jurisdiction to determine the validity of the agreement commenced within 60 days after the recording of the agreement.

SEC. 35. (a) An action may be brought under Chapter 4 (commencing with Section 760.010) of Title 10 of Part 2 of the Code of Civil Procedure to establish title to any lands conveyed pursuant to this act, or by the parties to any agreement entered into pursuant to this act to confirm the validity of the agreement. Notwithstanding Section 764.080 of the Code of Civil Procedure, the statement of decision in the action shall include a recitation of the underlying facts and a determination as to whether the conveyance or agreement meets the requirements of this act, Sections 3 and 4 of Article X of the California Constitution, if applicable, and any other law applicable to the validity of the agreement.

(b) For purposes of Section 764.080 of the Code of Civil Procedure and unless otherwise agreed in writing, an agreement entered into pursuant to this act shall be deemed to be entered into on the date it is executed by the executive officer of the commission, or, if the commission is not a party, by the director, who shall be the last of the parties to sign prior to the signature of the Governor. The effective date of the agreement shall be deemed to be the date on which it is executed by the Governor pursuant to Section 6107 of the Public Resources Code.

(c) An action may be brought under Chapter 9 (commencing with Section 860) of Title 10 of Part 2 of the Code of Civil Procedure to determine the legality and validity of a deed, patent, agreement, or other instrument executed in furtherance of or authorized by this act, or an action of the city or agency to use, lease, or convey any property, or to approve project agreements, grant entitlements or permits, or issue bonds or other indebtedness in connection with the use and development of that property. Before the filing of an action, the Attorney General, the director, and the executive officer of the commission shall be provided written notice of the action and a copy of the complaint. An action authorized by this subdivision may be combined with an action authorized by subdivision (a).

SEC. 36. If a provision of this act, or its application to a person, property, or circumstance, is held invalid by a court, the invalidity or inapplicability of that provision shall not affect any other provision of this act or the application of that provision to any other person, property, or circumstance, and the remaining portions of this act shall continue in full force and effect, unless enforcement of this act as so modified by and in response to that invalidation would be grossly inequitable under all of the circumstances, or would frustrate the fundamental purposes of this act.

SEC. 37. It is the intent of the Legislature that the department shall give strong consideration to keeping open Candlestick Park State Recreation Area any time the department undertakes the process of identifying state parks or state recreation areas for closure, whether seasonal, partial, full, or otherwise. This consideration is based upon the funding provided in Section 26 for operation and maintenance of Candlestick Park State Recreation Area.

SEC. 38. The Legislature finds and declares that, because of the unique circumstances applicable only to the lands described in this act, a statute of general applicability cannot be enacted within the meaning of subdivision (b) of Section 16 of Article IV of the California Constitution. Therefore, this special statute is necessary.

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Appendix Q1 PBS&J SFPUC Water Supply Assessment for the Proposed Candlestick Point–Hunters Point Shipyard Phase II Project, October 27, 2009

Final

Water Supply Assessment

for the

Proposed Candlestick Point - Hunters Point Shipyard Phase II Project

Adopted October 27, 2009

Prepared by:

PBS&J

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1.0 INTRODUCTION

The City of San Francisco (City or San Francisco), and San Francisco Redevelopment Agency are conducting an environmental review under the requirements of the California Environmental Quality Act (CEQA) for the proposed Candlestick Point-Hunters Point Shipyard Phase II Project (proposed project or CP-HPS II). This water supply assessment (WSA) will provide information for use in the CEQA analysis for this proposed project. The environmental review for the proposed project includes an assessment of the available water supply to serve the proposed project. The requirements for a WSA are set forth in the California Water Code (Water Code) Sections 10910 et seq.

A WSA connects water supply and land use planning with the environmental review process. The law also reflects the growing awareness of the need to incorporate water supply and demand analysis at the earliest possible stage in the land use planning process. The core of this law is an assessment of whether available water supplies are sufficient to serve the demand generated by a project, as well as the reasonably foreseeable cumulative demand in the region over the next 20 years under a range of hydrologic conditions.

This WSA provides information on the available water supply to serve the proposed project based on Water Code Sections 10631, and 10910 et seq.

This document is divided into six sections: Introduction, Water Supply Sources, Demand Analysis, Supply and Demand Comparison, Conclusion of Analysis and Findings. The Introduction describes the proposed project and water supply planning under Water Code 10910 et al.

1.1. Project Location, Land Use, Zoning and Characteristics

1.1.1. Project Location

Candlestick Point and Hunters Point Shipyard project sites comprise approximately 702 acres in the southeastern portion of San Francisco (see Figure 1-1 for the regional and local project location). Taken together, they are bordered by major features such as India Basin on the north, the Executive Park area and San Mateo County line on the south; Bayview Hill, the Bayview neighborhood, Yosemite Slough, and Hunters Point Hill on the west; and, San Francisco Bay on the north and the east.

1.1.2. Project Sites

1.1.2.1. Candlestick Point

The Candlestick Point area is immediately east of Executive Park, with the Bayview neighborhood to the north, the Hunters Point Shipyard to the northeast, and Candlestick Point State Recreation Area (SRA) along the Bay frontage generally on the east. The Candlestick Point site is generally bounded by Hawes Street to the northwest and Jamestown Avenue to the southwest, and the Candlestick Cove and South Basin areas of the Bay comprise the south and east boundaries, respectively.

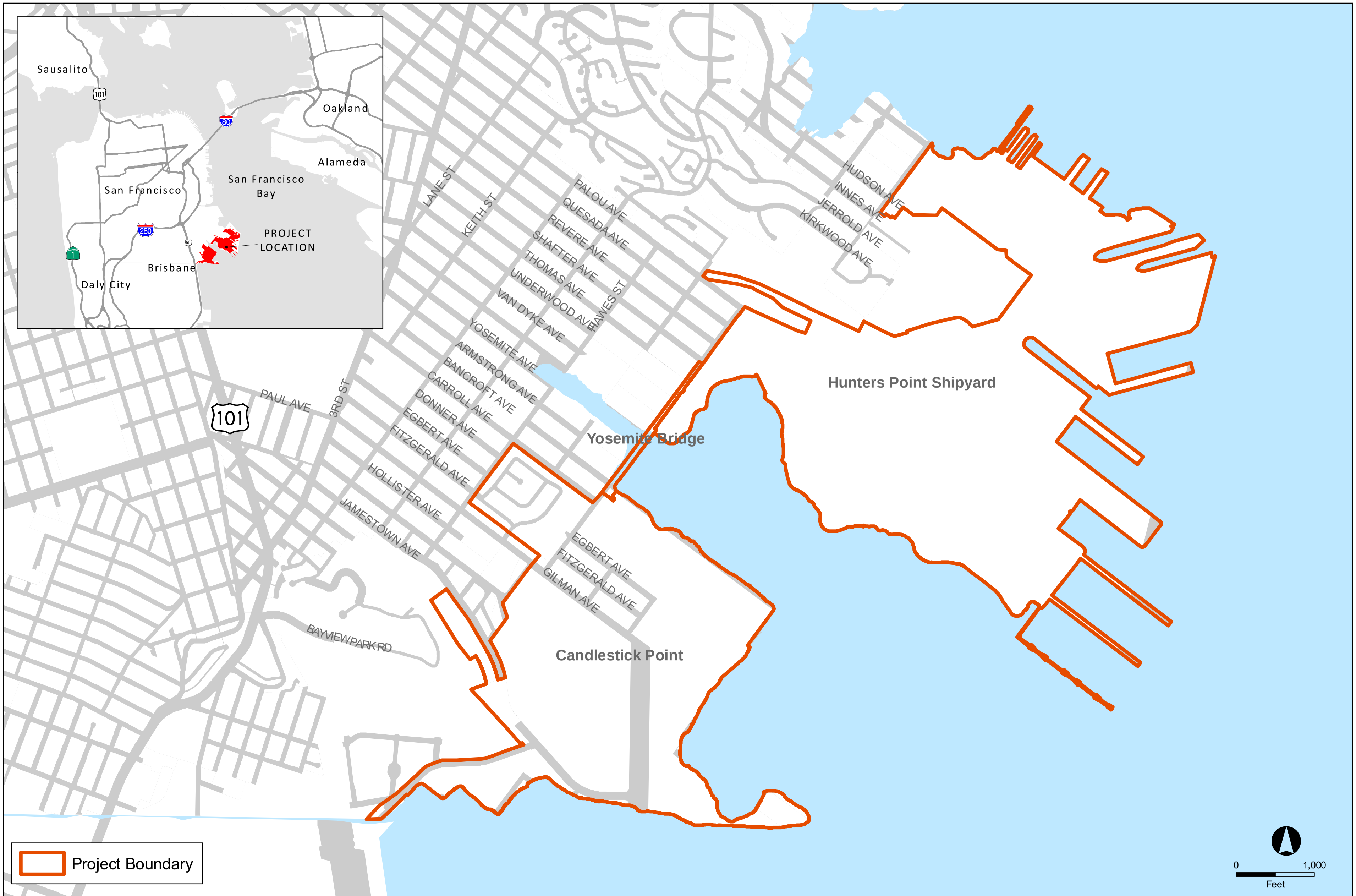

FIGURE **1-1**

Regional and Project Location

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Bayview WSA

1.1.2.1. Hunters Point Shipyard Phase II

The Hunters Point Shipyard area is to the southeast of the Hunters Point neighborhood. The Hunters Point Shipyard site is generally bounded by San Francisco Bay to the north, east, and south. The south end of the western boundary extends from Yosemite Slough along Arelious Walker Drive north to approximately Crisp Road, excluding the University of California San Francisco (UCSF) property. The inland northern boundary generally extends along Crisp Road and Spear Avenue. The northernmost end of the HPS Phase II area is contiguous with Earl Street.

1.1.3. Proposed Project Land Use Information

The proposed project would consist of nine districts: five in Candlestick Point and four in Hunters Point Shipyard Phase II. Table 1-1 presents the overall land use distribution.

Table 1-1: Project Proposed Land Uses

Land Use	Candlestick Point	Hunters Point Shipyard Phase II	Total
Residential (DU)			
Residential Density Range I (15 to 75 units per acre)	1,325	680	2,005
Residential Density Range II (50 to 125 units per acre)	2,865	1,415	4,280
Residential Density Range III (100 to 175 units per acre)	2,000	265	2,265
Residential Density Range IV (175 to 285 units per acre)	1,660	290	1,950
Total	**7,850**	**2,650**	**10,500**
Commercial Uses			
Retail			
Regional Retail (gsf)	635,000	~	635,000
Neighborhood Retail (gsf)	125,000	125,000	250,000
Total	**760,000**	**125,000**	**885,000**
Hotel (150,000 gsf)	220 rooms		220 rooms
Office (gsf)	150,000	~	150,000
Community Uses/Services (gsf)	50,000	50,000	100,000
Research & Development (gsf)			
Office	~	835,000	835,000
Laboratory	~	835,000	835,000
Light Industrial	~	835,000	835,000
Total		**2,500,000**	**2,500,000**
Artist Center and Studios			
Artist's Studios		225,000	225,000
Artist Education Center		30,000	30,000
Total	**~**	**255,000**	**255,000**
Parks & Open Space (acres)			
New Parks	8.1	140.0	148.1
New Sports Fields and Waterfront Recreation	~	91.6	91.6
New and Improved State Parkland at CP	96.7 acres	~	96.7
Total	**104.8**	**231.6**	**336.4**
Ferry Terminal	~	1	1
Marina (slips)	~	300	300
Stadium (seats)		69,000	69,000
Performance Venue (75,000 gsf)	10,000 seats		10,000 seats

Notes:
gsf = gross square feet; DU = dwelling units
Source: Lennar Urban, 2009.

Figure 1-2 illustrates the land use plan.

- **Residential:** The proposed project would consist of 10,500 for-sale and rental residential units, including approximately 6,899 market-rate units and approximately 3,345 below market rate and 256 public housing replacement units. The units would range in size from studios to four bedrooms. Units include 2- and 3-story townhomes over parking, 3- to 5-story low-rise flats over podium parking, 8- to 14-story mid-rise flats, and 22- to 42-story high-rise towers. Depending on their location, lower floors of all residential building types (other than townhomes) could include commercial uses.
  - Residential Density Range I (15 to 75 units per net acre): Housing types would typically include townhomes, flats, and lofts
  - Residential Density Range II (50 to 125 units per net acre): Housing types would typically include low-rise flats and lofts
  - Residential Density Range III (100 to 175 units per net acre) Housing types would typically include low and mid-rise flats or low-rise flats and high-rise buildings
  - Residential Density Range IV (175 to 285 units per net acre): Housing types would typically include low-rise flats and high-rise buildings
- **Regional Retail.** A regional retail center of up to 635,000 gross square feet (gsf) is proposed on Candlestick Point. Retailers could include a variety of general merchandise, apparel, furniture and home furnishings, food service and restaurants, and entertainment related businesses to serve the regional market.
- **Neighborhood Retail.** Neighborhood retail sites are designated at both Candlestick Point and Hunters Point Shipyard, and in addition, small-scale neighborhood retail uses could be established throughout the project site depending on demand. Up to 250,000 gsf of neighborhood retail could include convenience goods (e.g. food, drugs and groceries) and personal services (e.g. laundry, dry cleaning, barbering, and shoe repair) for daily needs of the immediate neighborhood.
- **Community Services.** Up to 100,000 gsf of fire, police, healthcare, day-care, places of worship, senior centers, library, recreation center, community center, and performance center uses at sites designated for community serving use on both Candlestick Point and Hunters Point Shipyard.
- **Research and Development.** Hunters Point Shipyard Phase II would be the site of up to 2,500,000 gsf of a possible wide range of businesses including, but not limited to, emerging industries and technologies such as green technology and biotechnology.
- **Hotel.** A 220-room hotel is proposed at Candlestick Point Center.
- **Office.** Up to 150,000 gsf of office uses on Candlestick Point could include but not be limited to professional offices, real estate offices, and financial services.
- **Performance Venue/Arena.** A 10,000-seat venue for theatre productions, concerts, speaking engagements, educational events, or sporting events is proposed on Candlestick Point.
- **Artist's Studios/Artist Education Center.** Up to 255,000 gsf of artist's studios and an artist education center is proposed on Hunters Point Shipyard.
- **Parks and Open Space.** The Project would include an estimated 336 acres of new public parks and open space, sports fields, and improvements to the Candlestick Point Recreation Area.

Source: Lennar Urban, 2009.

PBSJ

FIGURE **1-2**
Candlestick Point - Hunters Point Shipyard Phase II Land Use Plan

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Bayview WSA

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- **Parking.** Parking would be provided as structured parking for residential uses, (as structured and on-street parking for commercial uses) for dedicated stadium use, and as general parking.
- **Marina.** A 300-slip marina is proposed at Hunters Point Shipyard. A marina could include utilities at each slip. Landside amenities could include a classroom facility for restrooms, showers and to sailing instruction.
- **Ferry Terminal.** A ferry terminal and dock to accommodate Water Emergency Transportation Authority (WETA) vessels is proposed at Hunters Point Shipyard. The terminal building could include ticketing kiosks, real-time transit information, and public restrooms.

1.1.4. Proposed Research and Development Variant Information

The Research and Development (R&D) Variant assumes that the Stadium would not be constructed at the HPS Phase II site; instead, additional R&D uses emphasizing emerging technologies would be developed. With the R&D Variant, the 69,000-seat Stadium proposed under the proposed project would not be constructed. Instead, the R&D Variant would result in construction of an additional 2,500,000 gross square feet of R&D uses above what is currently proposed in the HPS South neighborhood district. Table 1-2 lists the additional R&D space that would be constructed at the HPS South neighborhood district under the R&D Variant; all other proposed project land uses remain unchanged.

Table 1-2: Proposed R&D Variant

Land Use	Candlestick Point	Hunters Point Shipyard Phase II	Total
Research & Development (gsf)			
Office	~	1,665,000	1,665,000
Laboratory	~	1,665,000	1,665,000
Light Industrial	~	1,665,000	1,665,000
TOTAL		**5,000,000**	**5,000,000**

All other proposed project land uses remain unchanged.
Source: Lennar Urban, October 2009

1.2. Water Supply Planning

Senate Bill 610 was passed into law on January 1, 2002. This law reflects the need to incorporate water supply and demand analysis at the earliest possible stage in the planning process. SB 610 amended portions of the Water Code, including Section 10631, which contains the Urban Water Management Planning Act, as well as adding Sections 10910, 10911, 10912, 10913, and 10915, which describe the required elements of a WSA. Upon signing this bill and a related bill not applicable to the proposed project, Governor Gray Davis stated, “Most notably, these bills will coordinate local water supply and land use decisions to help provide California’s cities, farms, and rural communities with adequate water supplies. Additionally, these bills increase requirements and incentives for urban water suppliers to prepare and adopt comprehensive management plans on a timely basis.”[1]

Senate Bill 610 is designed to build on the information that is typically contained in an Urban Water Management Plan (UWMP). The amendments to Water Code Section 10631 were designed to make WSAs and UWMPs consistent. A key difference between the WSAs and UWMPs is that UWMPs are required to be revised every five years, in years ending with either zero or five, while WSAs are required as part of the environmental review process for each

1 Department of Water Resources. 2003. Guidebook for Implementation of SB 610 and SB 221 of 2001.

individually qualifying project. As a result, the 20-year planning horizons for each type of document may cover slightly different planning periods than other WSAs or the current UWMP. Additionally, not all water providers who must prepare a WSA are required to prepare an UWMP.

1.2.1. SB 610 Water Supply Assessment

The SB 610 water supply assessment process involves answering the following questions:

- Is the project subject to CEQA?
- Is it a project under SB 610?
- Is there a public water system?
- Is there a current UWMP that accounts for the project demand?
- Is groundwater a component of the supplies for the project?
- Are there sufficient supplies available to serve the project over the next 20 years?

1.2.1.1. "Is the Project Subject to CEQA?"

The first step in the SB 610 process is determining whether the project is subject to CEQA. SB 610 amended Public Resources Code Section 21151.9 to read: "Whenever a City or county determines that a project, as defined in Section 10912 of the Water Code, is subject to this division [i.e., CEQA], it shall comply with part 2.10 (commencing with Section 10910) of Division 6 of the Water Code." The City of San Francisco and the San Francisco Redevelopment Agency have determined that the proposed project is a project subject to CEQA. The information contained in this assessment will be used to inform and support the Environmental Impact Report (EIR) for the proposed project, and will be appended thereto.

1.2.1.2. "Is It a Project Under SB 610?"

The second step in the SB 610 process is to determine if a project meets the definition of a "Project" under Water Code Section 10912 (a). Under this section, a "Project" is defined as meeting any of the following criteria:

1. A proposed residential development of more than 500 dwelling units;
2. A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet (ft^2) of floor space;
3. A commercial building employing more than 1,000 persons or having more than 250,000 ft^2 of floor space;
4. A hotel or motel with more than 500 rooms;
5. A proposed industrial, manufacturing, or processing plant, or industrial park, planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 ft^2 of floor area;
6. A mixed-use project that includes one or more of these elements; or
7. A project creating the equivalent demand of 500 residential units.

Alternately, if a public water system has less than 5,000 service connections, the definition of a "Project" also includes any proposed residential, business, commercial, hotel or motel, or industrial development that would account for an increase of 10 percent or more in the number of service connections for the public water system. The proposed project is a mixed-use project that would include one or more of these elements listed above, specifically, "the proposed project exceeds residential development of more than 500 dwelling units" and for that reason, it meets the requirements as a "Project" under the Water Code.

1.2.1.3. "Is There a Public Water System?"

The third step in the SB 610 process is determining if there is a "public water system" to serve the project. Section 10912 (c) of the California Water Code states: "[A] public water system means a system for the provision of piped water to the public for human consumption that has 3,000 or more service connections." The San Francisco Public Utilities Commission (SFPUC) is a public water system that serves the City and County of San Francisco, including the proposed project area. The SFPUC's Retail service area is shown in Figure 1-3. The SFPUC provides water to both retail and wholesale water customers. A population of over 2.5 million people within the counties of San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne rely entirely or in part on the water supplied by the SFPUC.

Retail Customers: The SFPUC's retail water customers include the residents, business, and industries located within the corporate boundaries of the City and County of San Francisco (City). In addition to these customers, retail water service is also provided to other customers located outside of the City, such as Treasure Island, the Town of Sunol, San Francisco International Airport, Lawrence Livermore Laboratory, Castlewood, and Groveland Community Services District.

Wholesale Customers: The SFPUC sells water to wholesale customers under terms of the recently renegotiated Water Supply Agreement together with individual water sales contracts. Since 1970, the SFPUC has supplied approximately 65 percent of the total wholesale customer water demand. Some of the wholesale water customers are entirely reliant on the SFPUC for their water supply.

1.2.1.4. "Is There a Current UWMP That Accounts for the Project Demand?"

Step four in the SB 610 process involves determining if there is a current UWMP that considers the projected water demand for the project area. The Water Code requires that all public water systems providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet annually must prepare an UWMP, and the plan must be updated at least every five years on or before December 31 in years ending in five and zero.

Water Code Section 10910 (c)(2) states: "If the projected water demand associated with the proposed project was accounted for in the most recently adopted urban water management plan, the public water system may incorporate the requested information from the urban water management plan in preparing the elements of the assessment required to comply with subdivisions (d),(e),(f), and (g) [i.e., the WSA]." The SFPUC 2005 UWMP is currently available online.[2]

2 SFPUC 2005 Urban Water Management Plan, http://sfwater.org/detail.cfm/MC_ID/13/MSC_ID/165/C_ID/2776.

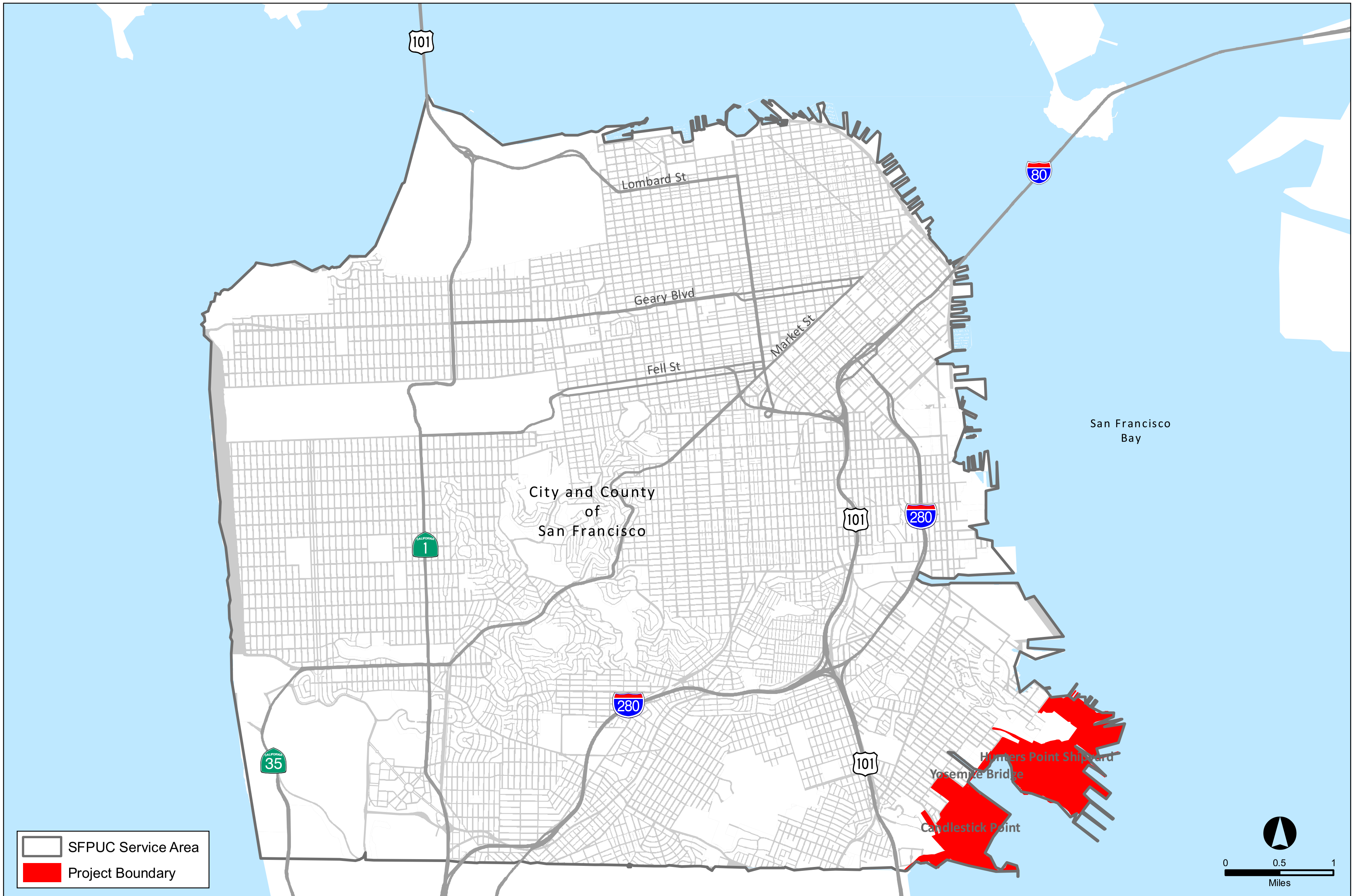

FIGURE **1-3**

SFPUC Service Area within City and County of San Francisco

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Bayview WSA

As of late 2008, the SFPUC concluded that its 2005 UWMP no longer accounted for every qualifying project within San Francisco including the land use changes at the proposed project area. Therefore, any qualifying projects not accounted in the 2005 UWMP will require preparation of a WSA that documents the SFPUC's current and projected supplies when compared to projected demands associated with new growth not covered in the 2005 UWMP including agriculture and industrial uses. When the 2005 UWMP was prepared, the redevelopment plan at Candlestick Point and Hunters Point Shipyard did not encompass the entire development of the proposed project; therefore, this WSA analyzes the change in demand at the project site under the proposed project.

1.2.1.1. "Is Groundwater a Component of the Supplies for the Project?"

This section addresses the requirements of Water Code Section 10910 (f), paragraphs 1 through 5, which apply if groundwater is a source of supply for a proposed project. As required by Water Code Section 10910 (f) a description and status of the local groundwater basin is discussed below. Groundwater is a minor component of water supply for the SFPUC and for the proposed project. A discussion of the SFPUC's groundwater supply programs is included in Sections 2.6.2.1 and 3.4 of this WSA.

In April 2005, the SFPUC completed the Final Draft North Westside Basin Groundwater Management Plan (GWMP), which identified opportunities for increasing groundwater production in San Francisco. The GWMP included a Plan Element to regularly report on groundwater conditions in the North Westside Groundwater Basin. Since completion of the GWMP, the SFPUC prepared two annual reports on the condition, status and water supply programs involving the North Westside Groundwater Basin.

Groundwater Basin Descriptions

The City and County of San Francisco are located over seven groundwater basins: Westside, Lobos, Marina, Downtown, Islais Valley, South San Francisco, and Visitation Valley. The Lobos, Marina, Downtown, and South San Francisco Basins are located completely within City limits; the remaining basins extend into San Mateo County. The basins are part of the larger San Francisco Bay Hydrologic Region, as defined by the Department of Water Resources (DWR) in its Bulletin 118. DWR Bulletin 118 describes the groundwater resources of the state and provides individual basin descriptions. DWR has not identified any of the basins listed above as being in overdraft or as being adjudicated.[3]

The following information is from the SFPUC's *2008 Annual Groundwater Monitoring Report Westside Basin.* See Appendix A for the entire report.

> The Westside Basin is about 40 square miles in area and includes four major geologic units. These units are the Jurassic - Cretaceous Franciscan Complex, Pliocene Merced Formation, Pleistocene Colma Formation, and Pleistocene to recent Dune Sands. There are also minor, yet widespread, units of recent alluvium along stream channels. Groundwater development has primarily occurred in the Colma and Merced Formations. The Merced Formation is the primary water-producing aquifer in the basin; however, the Colma Formation is also of interest since Lake Merced is incised within this formation. As a result of the difficulty of differentiating the contacts between the Dune Sands, the Colma Formation, and the Merced Formation, the precise thickness of the Colma Formation and Dune Sands overlying the Merced Formation has not been determined. Groundwater in the vicinity of Lake Merced, and north to Stern Grove and Golden Gate Park, is encountered at relatively shallow depths (ranging from approximately 5 to

3 Department of Water Resources. Groundwater Management Technical Assistance – Adjudicated Basins. http://www.groundwater.water.ca.gov/technical_assistance/gw_management/#adbasins

60 feet). South of Lake Merced, the depth to groundwater can exceed 300 feet below ground surface (bgs).

Phillips, et al. (1993) defined each of the groundwater basins in San Francisco as a continuous body of unconsolidated sediments and the surrounding surface drainage area. All seven major groundwater basins identified in San Francisco are open to the Pacific Ocean or San Francisco Bay. The landward parts of the groundwater basins generally are bounded horizontally and vertically by bedrock, which is assumed to be relatively impermeable compared with unconsolidated marine and alluvial deposits. Groundwater flow may occur between basins where the bedrock ridge that constitutes the boundary is subterranean. The north-south topography and bedrock height defined by the Coast Ranges generally forms an east-west hydrologic boundary through San Francisco.

The western part of San Francisco is divided into the Westside and Lobos Basins on the basis of a northwest-trending bedrock ridge through the northeastern part of Golden Gate Park. The bedrock ridge has several small surface expressions, and bedrock altitude data indicate that the ridge is continuous, though subterranean. Some degree of hydraulic connection is possible between the two basins where the ridge is not exposed at the land surface, but the degree of connection probably is minimal. The Westside Basin extends south to Burlingame and Hillsborough. Well drillers' logs for the San Bruno area indicate a deep sandy unit overlain by about 200 feet of predominantly fine-grained clays. Correlation of the deeper sand deposits is unclear; however, surficial mapping may indicate a relationship to exposures of sand/gravel deposits in the Burlingame area, which are mapped as non-marine Santa Clara Formation (Brabb and Pampeyan, 1983). A southward-extending ridge of Franciscan bedrock appears to separate San Bruno from the San Francisco Bay to the east. The upper fine grained beds appear to be Holocene to Late Pleistocene estuarine deposits of the San Francisco Bay (LSCE, 2004).

The subsurface configuration of the various geologic units in the Westside Basin has been delineated in a series of geologic cross-sections based on a combination of lithologic logs; water well drillers' reports, and geophysical logs (LSCE, 2004 and 2006). Lithologic units and other significant features in the basin are illustrated in geological cross-section form. In the northern Westside Basin, in San Francisco, there are up to three aquifer units separated by two distinctive fine-grained units, the –100-foot clay and the W-Clay (LSCE, 2004). The aquifer units are generally designated as: 1) The "Shallow aquifer", which is present to an elevation of approximately –100 feet mean sea level (msl) (located above the –100-foot clay), in the vicinity of Lake Merced and the southern portion of the Sunset District of San Francisco; 2) The "Primary Production aquifer", which overlies the W-Clay; and 3) The "Deep aquifer" which underlies the W-Clay. In the Daly City area, the –100-foot clay is absent, and the aquifer system is primarily composed of the Primary Production aquifer and the Deep aquifer. Further to the south, in the South San Francisco area, the W-Clay is absent and the Primary Production aquifer is split into shallow and deep units, separated by a fine-grained unit at an elevation of approximately 300 feet below msl. The primary production aquifer in the San Bruno area is located at an elevation less than 200 feet below msl, and it underlies a thick, surficial fine-grained unit comprised of clay, sandy clay, and sand beds.

1.2.1.2. "Are There Sufficient Supplies to Serve the Project Over the Next 20 Years?"

Water Code Section 10910 (c)(4) states: "If the City or county is required to comply with this part pursuant to subdivision (b), the water assessment for the project shall include a discussion with regard to whether the total projected water supplies, determined to be available by the City or county for the project during normal, single dry and multiple dry water years during a 20-year projection, will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses, including agricultural and manufacturing uses."

The SFPUC, based on the analysis in this WSA, concludes that are adequate supplies to serve the proposed project, including existing demand and planned future uses in the SFPUC's Retail service area through 2030. However, after 2030 in multiple dry-year events, the SFPUC would have to implement its demand management programs to reduce demand to meet projected supply curtailments.

As required, the next step in the SB 610 process is to prepare the assessment of the available water supplies, including the availability of these supplies in all water-year conditions over a 20-year planning horizon, and an assessment of how these supplies relate to project-specific and cumulative demands over that same 20-year period. In this case, the period is 20 years and covers the years 2010 to 2030.

There are three primary areas addressed in a water supply assessment:

- relevant water supply entitlements, water rights, and water contracts;
- a description of the available water supplies; and,
- an analysis of the demand placed on those supplies, both by the project and on a cumulative basis.

Water entitlements and contracts are addressed in Section 2 and demand analysis is discussed in Section 4. Section 6 contains conclusions and findings.

2.0 WATER SUPPLY

This section presents the local climate conditions and reviews the SFPUC's water supply sources, entitlements, water rights and contracts.

2.1. Climate

San Francisco has a Mediterranean climate. Summers are cool and winters are mild with infrequent rainfall. Temperatures in the San Francisco area average 58 degrees Fahrenheit annually ranging from the mid-40s in winter to the mid-70s in late summer. Strong onshore winds in summer keeps the air cool, generating fog through September. The warmest temperatures generally occur in September and October. Rainfall in the San Francisco area averages about 20 inches[4] per year and is generally confined to the "wet" season, from late October to early May. Except for occasional light drizzles from thick marine stratus clouds, summers are nearly completely dry. Coastal fog helps reduce summer irrigation requirements. A summary of temperature and rainfall data for the City of San Francisco is included in Table 2-1.

Table 2-1: City of San Francisco Climate Summary

	Maximum Average Temperature (°F)[a]	Minimum Average Temperature (°F)[a]	Average Monthly Rainfall (inches)[1]
January	55.8	42.5	4.38
February	59.1	44.9	3.63
March	61.2	46.1	2.81
April	63.9	47.6	1.37
May	66.8	50.2	0.39
June	70.0	52.7	0.11
July	71.5	54.1	0.02
August	72.1	55.0	0.05
September	73.4	54.8	0.18
October	70.2	51.9	0.96
November	62.9	47.4	2.36
December	56.4	43.2	3.76
Annual Average	**65.3**	**49.2**	**20.00**

Note:
1. Source: Western Regional Climate Center – San Francisco. Data from 1/1/1937 to 12/31/2008.

According to the Department of Water Resources, eleven droughts have occurred in California since 1850.[5] The year 1977 is recognized as the driest single year of California's measured hydrologic record. The most recent multi-year statewide drought took place between 1987 and 1992. Droughts exceeding three years are relatively rare in Northern California; however, even localized droughts in Northern California have extensive repercussions for water agencies dependent upon Sierra Nevada snowpack and spring runoff.

4 Hydrologic data from 1971 -2000: Western Regional Climate Center; Mission Delores/SF 047772 and Richmond/SF 047767.

5 Department of Water Resources. Background: Droughts in California. http://watersupplyconditions.water.ca.gov/background.cfm, accessed September 2007.

2.2. Water Supply Entitlements, Water Rights and Contracts

Water Code Section 10910 (d)(1) states: "The assessment required by this section shall include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the public water system, or the City or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights or water service contracts."

2.3. Introduction to the SFPUC Water Supply Sources

The Regional Water System (RWS) currently delivers an annual average of approximately 265 million gallons of water per day (mgd), with approximately 85 percent of that water supply provided by the Hetch Hetchy system, which diverts water from the Tuolumne River. The balance (of approximately 15 percent) comes from runoff in the Alameda Creek watershed, which is stored in the Calaveras and San Antonio reservoirs, and runoff from the San Francisco Peninsula, which is stored in the Crystal Springs, San Andreas, and Pilarcitos reservoirs (which also provide storage for water delivered from the Hetch Hetchy Project). A small portion of retail demand is met through locally produced groundwater, used primarily for irrigation at local parks and on highway medians, and recycled water, which is used for wastewater treatment process water, sewer box flushing, and similar wash down operations. The SFPUC also retails groundwater (pumped from the Pleasanton well field) to the Castlewood development in Alameda County.

2.3.1. Surface Water Rights

The City and County hold pre-1914 appropriative water rights to store and deliver water from the Tuolumne River in the Sierra Nevada and locally from the Alameda and Peninsula watersheds. The City and County also divert and store water in the San Antonio Reservoir under an appropriative water right license granted by the State Water Resources Control Board (SWRCB) in 1959.

Appropriative water rights allow the holder to divert water from a source to a place of use not connected to the water source. These rights are based on seniority and use of water must be reasonable, beneficial, and not wasteful. In 1914, California established a formal water rights permit system, which is administered by the SWRCB. The SWRCB has sole authority to issue new appropriative water rights but cannot define property rights created under a pre-1914 appropriative water right.

The 1912 Freeman Report identified the ultimate diversion rate from the Tuolumne River to the Bay Area as 400 mgd and the City used this as the basis for designing the export capacity of the Hetch Hetchy project. The City has sufficient water rights for current diversions and the ultimate planned diversion rate of the Hetch Hetchy Project.

The federal Raker Act, enacted on December 19, 1913, grants to the City rights-of-way and public land use on federal property in the Sierra Nevada Mountains to construct, operate, and maintain reservoirs, dams, conduits, and other structures necessary or incidental to developing and using water and power. It also imposes restrictions on the City's use of the Hetch Hetchy Reservoir, including (among others) the requirement that the City recognize the senior water rights of the Turlock and Modesto Irrigation Districts (TID and MID) to divert water from the Tuolumne River. Specifically, the Raker Act requires the City to bypass certain flows through its Tuolumne River reservoirs to TID and MID for beneficial use. By agreement, the City, TID, and MID have supplemented these Raker Act obligations to increase the TID and MID entitlements to account for other senior Tuolumne River water rights and to allow the City to "pre-pay" TID and

MID their entitlement by storing water in the Don Pedro water bank. The City is required to bypass inflow to TID and MID sufficient to allow these districts to divert 2,416 cfs or natural daily flow, whichever is less, at all times (as measured at La Grange), except for April 15 to June 13, when the requirement is 4,066 cfs or natural daily flow as measured at La Grange, whichever is less.

2.4. Water Supply Considerations

The SFPUC prepared a Program Environmental Impact Report (PEIR) under CEQA for the Water System Improvement Program (WSIP). (A discussion of the WSIP follows in Section 2.7.1). At the request of the SFPUC, the San Francisco Planning Department studied the Phased WSIP Variant as part of the environmental analysis. The SFPUC identified this variant in order to consider a program scenario that involved full implementation of all proposed WSIP facility improvement projects to insure that the public health, seismic safety, and delivery reliability goals were achieved as soon possible, but phased implementation of a water supply program to meet projected water purchases through 2030. Deferring the 2030 water supply element of the WSIP until 2018 would allow the SFPUC and its wholesale customers to focus first on implementing additional local recycled water, groundwater, and demand management actions while minimizing additional diversions from the Tuolumne River.

The Phased WSIP Variant establishes a mid-term planning milestone in 2018 when the SFPUC would reevaluate water demands through 2030 in the context of then-current information, analysis, and available water resources. The SFPUC currently delivers on an annual average approximately 265 million gallons per day (mgd) from local watersheds (Peninsula and Alameda Creek) and the Tuolumne River Watershed. By 2030, demand on the SFPUC system is expected to increase to annual average of 300 mgd. The Phased WSIP Variant would meet the projected 2018 purchase requests of 285 mgd from the RWS by capping purchases at 265 mgd; the remaining 20 mgd would be met through water conservation, recycling, and groundwater use—10 mgd by Wholesale Customers and 10 mgd in the City. Before 2018, the SFPUC and the Wholesale Customers will engage in a new planning process to re-evaluate water system demands and supply options, including conducting additional studies and environmental reviews necessary to address water supply needs after 2018. Therefore, this WSA assumes the SFPUC will limit purchases to an annual average of 265 mgd from the RWS watersheds.

2.5. SFPUC Regional Water System

In 1934, San Francisco combined the Hetch Hetchy system and Spring Valley system to create the SFPUC RWS. The rights to local diversions were originally held by the Spring Valley Water Company, which was formed in 1862. The RWS is owned and operated by the City and County.

On average, the Hetch Hetchy Project provides over 85 percent of the water delivered and the balance approximately 15 percent is met through the Bay Area reservoirs. The RWS delivers an annual average of approximately 265 mgd – 81 mgd serves the Retail customers within the City and County of San Francisco and the other 184 mgd is delivered to the Wholesale customers. The RWS currently delivers water to 2.5 million users in Tuolumne, Alameda, Santa Clara, San Mateo, and San Francisco counties.

The RWS is a complex system, shown in Figure 2-1, and supplies water from two primary sources:

- Tuolumne River through the Hetch Hetchy Reservoir, and
- Local runoff into reservoirs in Bay Area reservoirs in the Alameda and Peninsula watersheds.

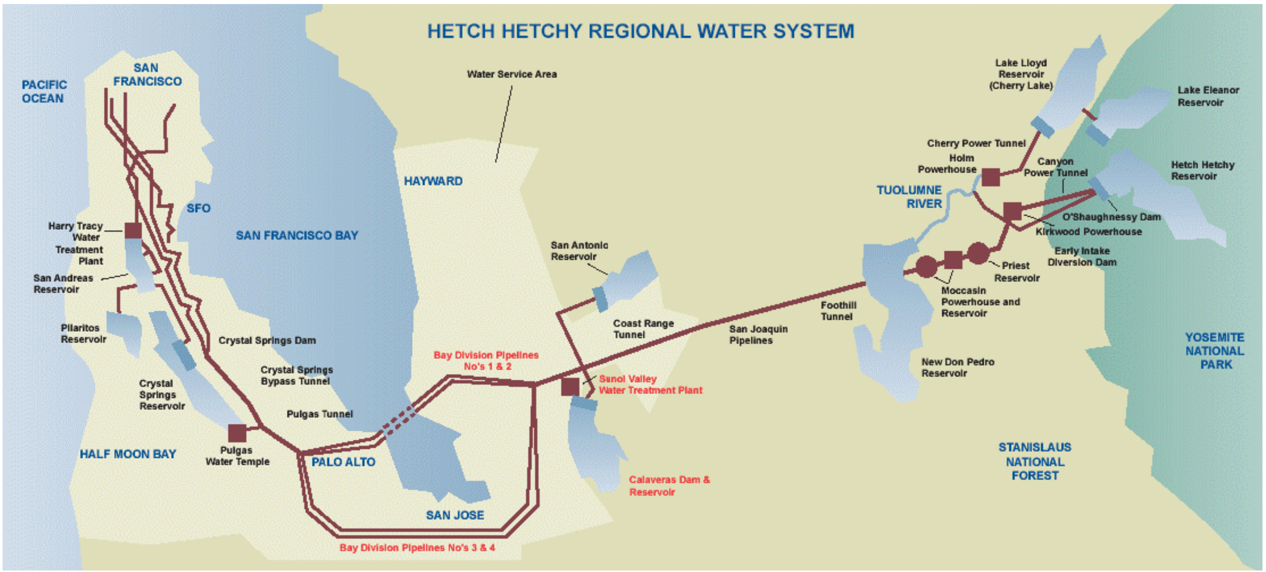

Figure 2-1: Regional Water Supply System

Water from Hetch Hetchy Reservoir, through the Hetch Hetchy facilities represents the majority of the water supply available to the SFPUC. On average, the Hetch Hetchy Project provides over 85 percent of the water delivered to the Bay Area. During droughts the water received from the Hetch Hetchy system can amount to over 93 percent of the total water delivered.

Bay Area reservoirs provide on average approximately 15 percent of the water delivered by the SFPUC RWS. The local watershed facilities are operated to conserve local runoff for delivery. On the San Francisco Peninsula, the SFPUC utilizes Crystal Springs Reservoir, San Andreas Reservoir, and Pilarcitos Reservoir to capture local watershed runoff. In the Alameda Creek watershed, the SFPUC constructed the Calaveras Reservoir and San Antonio Reservoir. In addition to capturing runoff, San Antonio, Crystal Springs, and San Andreas reservoirs also provide storage for Hetch Hetchy diversions. The local watershed facilities also serve as an emergency water supply in the event of an interruption to Hetch Hetchy diversions.

2.5.1. Local Groundwater

San Francisco overlies all or part of seven groundwater basins. These groundwater basins include the Westside, Lobos, Marina, Downtown, Islais Valley, South, and Visitation Valley basins. The Lobos, Marina, Downtown, and South basins are located wholly within the City limits, while the remaining three extend south into San Mateo County. The portion of the Westside Basin aquifer located within San Francisco is commonly referred to as the North Westside Basin. With the exception of the Westside and Lobos basins, all of the basins are generally inadequate to supply a significant amount of groundwater for municipal supply because of low yield.

Early in its history, San Francisco made significant use of local groundwater, springs, and spring-fed surface water. However, after the development of surface water supplies in the Peninsula and Alameda watersheds by Spring Valley Water Company and the subsequent completion of the Hetch Hetchy Reservoir and aqueduct in the 1930's, the municipal water supply system has relied almost exclusively on surface water from local runoff, the Alameda and Peninsula watersheds, and the Tuolumne River watershed. Local groundwater use, however, has continued in the City primarily for irrigation purposes. The San Francisco Zoo and Golden

Gate Park use groundwater for non-potable purposes. Current use accounts for annual average of approximately 2.5 mgd.

About one (1) mgd of groundwater is delivered to Castlewood Country Club from well fields operated by the SFPUC in Pleasanton and drawn from the Central Groundwater Sub Basin in the Livermore/Amador Valley. These wells are metered and have been in operation for several decades. For purposes of water accounting and billing, these deliveries to Castlewood are accounted for as part of San Francisco's Retail Customer base. Castlewood groundwater supplies are used entirely within Castlewood and not available for use in the City and County of San Francisco.

2.5.2. Local Recycled Water

From 1932 to 1981, the City's McQueen Treatment Plant provided recycled water to Golden Gate Park for irrigation purposes. Because of changes in regulations the City closed the McQueen plant and discontinued use of recycled water in Golden Gate Park. Currently, recycled water from the SFPUC's Southeast Water Pollution Control Plant is used on a limited basis for wash-down operations and is provided to construction contractors for dust control and other nonessential construction purposes. Current use of recycled water for these purposes in the City is less than one mgd.

2.5.3. Local Water Conservation

The SFPUC is committed to demand-side management programs and the City's per capita water use has dropped by about one-third since 1977 due, in part, to these programs. The first substantial decrease came following the 1976-77 drought in which gross per capita water use dropped from 160 to 130 gallons per capita per day (gpcd). Despite continuous growth in the City since then, water demands have remained lower than pre-drought levels.

A second substantial decrease in water use within the City occurred as a result of the 1987-92 drought when a new level of conservation activities resulted in further water use savings. It is anticipated that through the continuation and expansion of these programs, per capita water use will continue to decrease into the future. Current gross per capita water use within the City is 91.5 gpcd with residential water use calculated to be approximately 57 gpcd, the lowest use of any major urban area in the State.

The SFPUC's demand management programs range from financial incentives for plumbing devices to improvements in the distribution efficiency of the system. The conservation programs implemented by the SFPUC are based on the California Urban Water Conservation Council's list of fourteen Best Management Practices identified by signatories of the Memorandum of Understanding Regarding Urban Water Conservation in California executed in 1991.

2.6. Water Supply Reliability and Improvements

To improve dry-year supplies and ensure that the future water needs of its retail and wholesale customers will be met in a more reliable and sustainable manner, the SFPUC has undertaken water supply projects in the WSIP. In addition, the SFPUC is looking to diversify and enhance the City's water supply portfolio through the development of local water supplies, such as recycled water, groundwater, and water conservation.

2.6.1. Water System Improvement Program and the Phased WSIP Variant

The WSIP is a multi-billion dollar, multi-year, capital program to upgrade the RWS. The program will deliver improvements that enhance the SFPUC's ability to provide reliable, affordable, high quality drinking water to its 27 wholesale customers and regional Retail customers in Alameda, Santa Clara, and San Mateo counties, and to 800,000 Retail customers in San Francisco, in an environmentally sustainable manner.

As required under CEQA, the San Francisco Planning Department prepared a PEIR for the WSIP. The PEIR evaluated the potential environmental impacts of the proposed WSIP and identified potential mitigations to those impacts. The PEIR also evaluated several alternatives to meet the SFPUC service area's projected increase in water demand between now and 2030. The water supply improvement options investigated included 10 alternatives using various water supply combinations from the local watersheds; the Tuolumne and Lower Tuolumne; ocean desalination; and additional recycled water, groundwater, and conservation.

The PEIR was certified by the San Francisco Planning Commission on October 30, 2008. On the same day the SFPUC adopted the Phased WSIP Variant option. (Appendix B contains the SFPUC Commission Agenda Item for approval of the PEIR)

2.6.1.1. Phased WSIP Variant

At the request of the SFPUC, the San Francisco Planning Department studied the Phased WSIP Variant as part of the environmental analysis. The SFPUC identified this variant in order to consider a program scenario that involved full implementation of all proposed WSIP facility improvement projects to insure that the public health, seismic safety, and delivery reliability goals were achieved as soon possible, but phased implementation of a water supply program to meet projected water purchases through 2030. Deferring the 2030 water supply element of the WSIP until 2018 would allow the SFPUC and its wholesale customers to focus first on implementing additional local recycled water, groundwater, and demand management actions while minimizing additional diversions from the Tuolumne River.

The Phased WSIP Variant establishes a mid-term planning milestone in 2018 when the SFPUC would reevaluate water demands through 2030 in the context of then-current information, analysis and available water resources. The SFPUC currently delivers on an annual average approximately 265 million gallons of water per day from local watersheds (Peninsula and Alameda Creek) and the Tuolumne River Watershed. By 2030, demand on the SFPUC system is expected to increase to an annual average of 300 million gallons of water per day. The Phased WSIP Variant would meet the projected 2018 purchase requests of 285 mgd from the RWS by capping purchases from the watersheds at 265 mgd; the remaining 20 mgd would be met through water efficiencies and conservation, water recycling and local groundwater use—10 mgd by Wholesale Customers and 10 mgd in the City and County. Before 2018, the SFPUC and the Wholesale Customers will engage in a new planning process to reevaluate water system demands and supply options, including conducting additional studies and environmental reviews necessary to address water supply needs after 2018.

The Phased WSIP Variant includes the following key program elements:

- Full implementation of all WSIP facility improvement projects.
- Water supply delivery to RWS customers through 2018 only of 265 mgd average annual target delivery originating from the watersheds. This includes 184 mgd for the Wholesale Customers and 81 mgd for the Retail Customers.
- Water supply sources include: 265 mgd average annual from the Tuolumne River and local watersheds and 20 mgd of water conservation, recycled water and local groundwater developed within the SFPUC's service area (10 mgd Retail; 10 mgd wholesale).

- Dry-year water transfers of 2 mgd coupled with the Westside Groundwater Basin Conjunctive Use Project.
- Re-evaluation of 2030 demand projections, potential RWS purchase requests and water supply options by December 31, 2018 and a separate SFPUC decision in 2018 regarding RWS water deliveries after 2018.
- The ability to impose financial penalties is included in the new Water Supply Agreement to limit water sales to an average annual of 265 mgd from the watersheds.

The additional 10 mgd of supplies produced in San Francisco by implementation of the local WSIP programs have been included in this WSA. This WSA assumes WSIP local water supplies will be in place in the timeframes stated in the SFPUC WSIP, with this assumption total Retail supplies increase to 94.50 mgd in 2015 and remain constant over the 20-year planning horizon. Projects related to these efforts are detailed below. WSIP programs, financials and progress-to-date is presented in Appendix C.

2.6.2. Local Groundwater Projects

2.6.2.1. San Francisco Groundwater Supply Project

The San Francisco Groundwater Supply Project would provide up to 4 mgd of local groundwater water to improve reliability during drought or maintenance conditions, as well as ensure that a reliable, high-quality source of water is available in the case of an earthquake or other emergency. The project proposes the construction of up to six wells and associated facilities in the western part of San Francisco to extract up to 4 mgd of groundwater water from the Westside Groundwater Basin for distribution in the City. The extracted groundwater, which would be used both for regular and emergency water supply purposes, would be disinfected and blended in small quantities with imported surface water before entering the municipal drinking water system. The environmental review for this project begins in November 2009.

2.6.2.2. Lake Merced Water Level Restoration Project

The goal of the Lake Merced Water Level Restoration Project is to protect and balance the beneficial uses of Lake Merced by providing a more stable water level regime using groundwater and stormwater, rather than supplies provided through the RWS.

2.6.2.3. Local Recycled Water Projects

In March 2006, the SFPUC updated the Recycled Water Master Plan (RWMP) for the City. The 2006 RWMP identified where and how San Francisco could most feasibly develop recycled water in the City and provided strategies for implementing the recycled water projects that were identified.

The proposed Westside, Harding Park and Eastside Recycled Water Projects would provide up to 4 mgd of recycled water to a variety of users in San Francisco. Recycled water will primarily be used for landscape irrigation, toilet flushing and industrial purposes. The Harding Park Project has completed environmental review, and the Westside Project will begin environmental review in late 2009 or early 2010.

The proposed Westside Project would bring recycled water from the proposed recycled water treatment facility in Golden Gate Park to the San Francisco Zoo, Golden Gate Park, and Lincoln Park Golf Course. Recycled water would be used for irrigation at all three sites; additionally, it would be used for non-potable uses in Golden Gate Park at the California Academy of Sciences. The proposed Harding Park Recycled Water Project would use available recycled water from the North San Mateo County Sanitation District (NSMCSD) located in Daly City, to irrigate Harding Park and Fleming Park golf courses in San Francisco. The SFPUC has partnered with the NSMCSD for this proposed project.

Currently, the SFPUC is conducting a recycled water demand assessment on the Eastside of San Francisco. The assessment examines the potential uses of recycled water for irrigation, toilet flushing, and commercial applications. The WSIP contains funding for planning, design, and environmental review for the San Francisco Eastside Recycled Water Project.

2.6.3. Local Water Conservation

The SFPUC has also increased its water conservation programs in an effort to achieve new water savings by 2018. The SFPUC's conservation program is based on the Demand Study that identified water savings and implementation costs associated with a number of water conservation and efficiency measures. The Demand Study evaluated the costs and benefits of implementing 48 different conservation measures using an end-use model. The results indicated that local conservation programs implemented through 2030 could cumulatively reduce Retail purchases from the SFPUC RWS by 4.5 mgd in year 2030. These new conservation programs include high-efficiency toilet replacement in low-income communities, plumbing retrofits in compliance with the 1992 California plumbing code and water efficient irrigation systems in municipal parks. Through its expanded conservation program, the SFPUC anticipates reducing gross per capita consumption from 91.5 gpcd to 87.4 gpcd by 2018 for an average daily savings of approximately 4.0 mgd.

2.6.4. Summary of New Local Water Supply Programs

As previously stated, the SFPUC anticipates that the expanded groundwater and recycled water production, and increased conservation programs will provide the City with an additional 10 mgd of local WSIP water supplies. As quantified in Table 2-2 with implementation of the WSIP, the SFPUC expects to have in these local WSIP supplies in place by 2015. These programs and projects are reliable in all hydrologic conditions and are not subject to RWSAP reductions or curtailments. (Appendix C contains the Summary of the WSIP Projects, a Quarterly Progress Report [April – June 2009] and other progress-to-date information)

Table 2-2: WSIP Water Supply Sources (mgd)

WSIP Water Supplies	2010	2015	2020	2025	2030
Groundwater	0.0	2.0	2.0	2.0	2.0
Recycled Water	0.0	4.0	4.0	4.0	4.0
Conservation	0.0	4.0	4.0	4.0	4.0
Total New Supplies	**0.0**	**10.0**	**10.0**	**10.0**	**10.0**

Source: SFPUC Water System Improvement Program, October 2008.

2.7. Total SFPUC Retail Water Supplies

Table 2-2 summarizes the SFPUC's total water supplies now and over the 20-year planning period. In 2010, prior to the development of the 10 mgd of local supplies, the SFPUC can access an annual average 84.50 mgd from all sources discussed above. Beginning in 2015, when the WSIP water supply sources are readily available, the SFPUC's Retail water supplies increase to 94.5 mgd. These supplies are assumed to be available in the quantities listed in Table 2-2. The SFPUC intends to use these supplies to meet its Retail customer demands.

Figure 2-1 is a graphical representation of the SFPUC's current supply sources and the WSIP local supply sources. As shown in Figure 2-2, the supplies grow from 84.5 mgd in 2010 to 94.5 mgd as the WSIP local supplies are brought into the SFPUC Retail supply system. The figure shows the total supplies increasing in 2015 and holding constant over the 20-year planning horizon.

Table 2-2: SFPUC Water Supplies 2010 – 2030 (mgd)

Water Supply Sources	2010	2015	2020	2025	2030
Current Water Supply Sources					
SFPUC RWS (Surface water: Tuolumne River, Alameda & Peninsula)(1)	81.0	81.0	81.0	81.0	81.0
Groundwater Sources					
Groundwater (In-City Irrigation Purposes)	2.5(2)	0.5(3)	0.5(3)	0.5(3)	0.5(3)
Groundwater at Castlewood(4)	1.0(4)	1.0(4)	1.0(4)	1.0(4)	1.0(4)
Groundwater: Treated for Potable – Previously used for In-City Irrigation purposes(5)	0.0	2.0	2.0	2.0	2.0
Groundwater Subtotal	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**
Current Water Supply Subtotal	**84.5**	**84.5**	**84.5**	**84.5**	**84.5**
WSIP Water Supply Sources					
Groundwater Development: Potable from SF GWSP (Westside Groundwater Basin)(6)	0.0	2.0	2.0	2.0	2.0
Recycled Water Expansion Irrigation(7)	0.0	4.0	4.0	4.0	4.0
Supply Conservation Program	0.0	4.0	4.0	4.0	4.0
WSIP Supply Subtotal	**0.0**	**10.0**	**10.0**	**10.0**	**10.0**
Total Retail Supply (Current and WSIP Supplies)	**84.5**	**94.5**	**94.5**	**94.5**	**94.5**

Notes:
1. RWS surface water supplies are subject to reductions due to below-normal precipitation. This may affect dry year supplies - model shows supply reduction occurs in year 2 of multiple dry year event. (Source: SFPUC 2008 WSIP Phase Variant Supply limitation)
2. Groundwater serves irrigation to Golden Gate Park, SF Zoo, and Great Highway Median. (Source: 2005 SFPUC UWMP Table 8B page 43)
3. A Groundwater reserve of 0.5 mgd for irrigation purposes will remain as part of SFPUC's non-potable groundwater supply. (Source: SFPUC 2008 WSIP Phase Variant)
4. Castlewood current and projected use remains unchanged over 20 year planning horizon. (Source: 2005 SFPUC UWMP Table 8B page 43)
5. 2.0 mgd of groundwater treated and blended for Potable water supply purposes. (Source: 2005 SFPUC UWMP Table 8B page 43)
6. 2.0 mgd of new groundwater developed as part of the new local supply target. (Source: SFPUC 2008 WSIP Phase Variant Supply Target)
7. 2.0 mgd of Recycled used for irrigation at Golden Gate Park, SF Zoo, Great Highway Median, and 2.0 mgd for other non-potable purposes. (Source: SFPUC 2008 WSIP Phase Variant Supply Target)

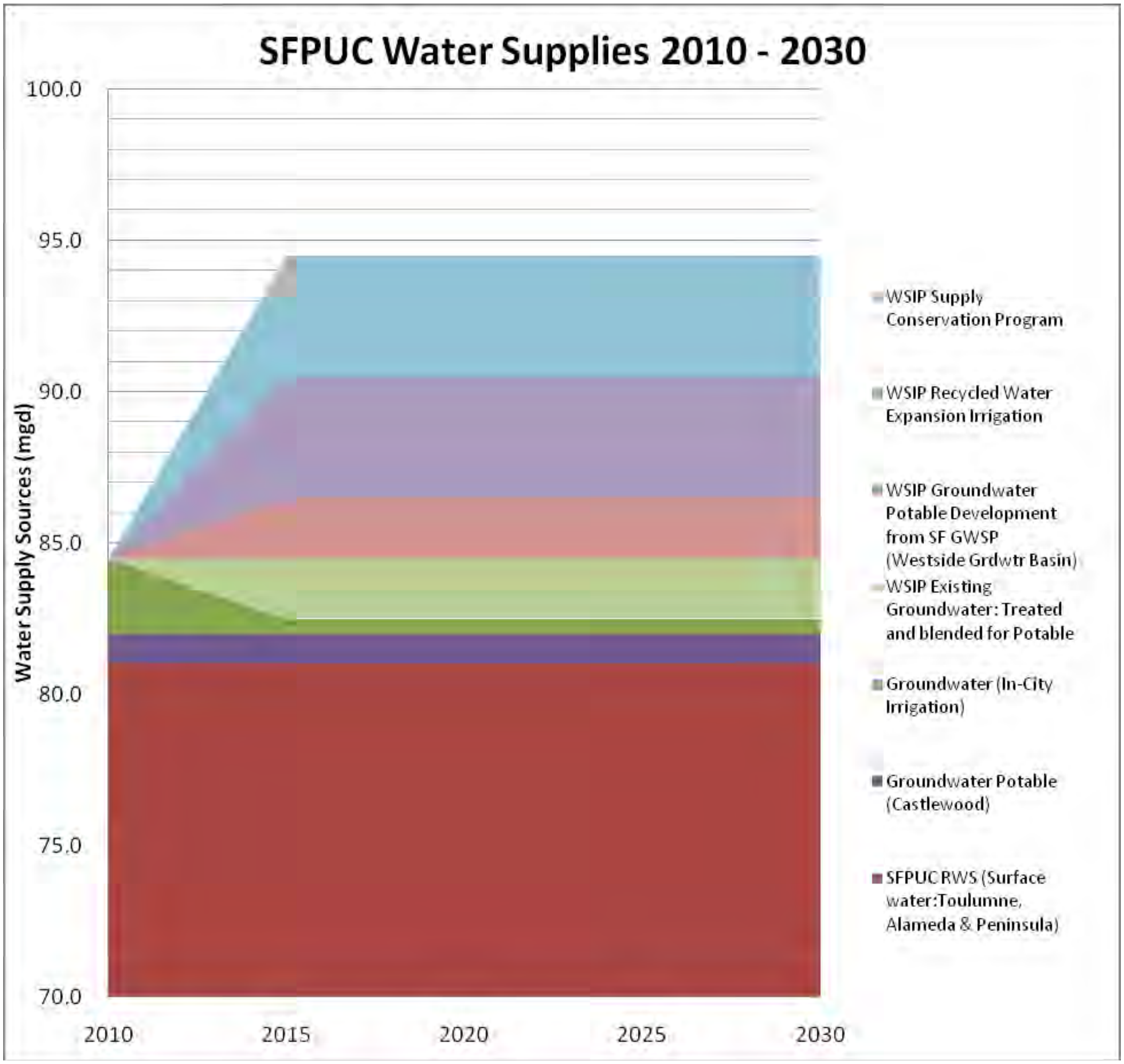

Figure 2-2: SFPUC Water Supplies

2.7.1. New Drought Supplies

As outlined above, the WSIP includes development of dry-year supplies for the RWS – these supplies would be readily available during dry years when the watershed supplies are cutback due to below-normal precipitation. The PEIR also included an analysis of dry-year water supply transfers from the senior water rights holders (MID and TID) on the Tuolumne River in 2018; a groundwater conjunctive use project; and, a regional desalination project. The latter two projects are described in greater detail in Section 3.4. The SFPUC is currently investigating the possibility of a dry-year water transfer with MID and TID in 2018.

3.0 DROUGHT SUPPLY PLANNING AND WATER SUPPLY RELIABILITY

3.1. Overview

The SFPUC water supply system reliability is expressed in terms of its ability to deliver water during droughts. Reliability is defined by the amount and frequency of water delivery reductions required to balance customer demands with available supplies in droughts. The SFPUC has a reliability goal of meeting dry-year delivery needs while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts.

The total amount of water the SFPUC has available to deliver to its retail and wholesale customers during a defined period of time is dependent on several factors. These include the amount of water that is available to the SFPUC from natural runoff, the amount of water in reservoir storage, and the amount of water that must be released from the SFPUC's system for commitments to purposes other than customer deliveries, such as releases below Hetch Hetchy reservoir to meet the Raker Act and fishery purposes.

The SFPUC operates its system to optimize the reliability and quality of its water deliveries. Hetch Hetchy Reservoir operations are guided by two principal objectives: collection of Tuolumne River water runoff for diversion to the Bay Area; and fulfillment of the SFPUC's downstream release obligations. To conserve runoff, Hetch Hetchy Project reservoirs are drawn down beginning in early winter, relying on the recurrence and forecast of snow melt to guide drawdown releases. Similarly, the RWS Bay Area reservoirs are operated to conserve watershed runoff. As such, reservoirs are drawn down during the winter period to capture storms and reduce the potential for spilling water out of the reservoirs. In the spring, excess Hetch Hetchy water supply (snowmelt) is transferred to three of the Bay Area reservoirs, capable of receiving the water, to fill any unused reservoir storage.

Prior to the late 1970's, droughts did not seriously affect the ability of the SFPUC to sustain full deliveries to its customers. However, as the 1987-1992 drought progressed and reservoir storage continued to decline, it became apparent that continued full deliveries could not be sustained without the risk of running out of water before the drought ended.

To provide some level of assurance that water could be delivered continuously throughout a drought (although at reduced levels), the SFPUC adopted a drought planning sequence and associated operating procedures that trigger different levels of water delivery reduction rationing relative to the volume of water actually stored in SFPUC's reservoirs. Each year, during the snowmelt period, the SFPUC evaluates the amount of total water storage expected to occur throughout the RWS. If this evaluation finds the projected total water storage to be less than an identified level sufficient to provide sustained deliveries during drought, the SFPUC may impose delivery reductions or rationing.

SFPUC's UWMP assumes "firm" delivery "as the amount the system can be expected to deliver during historically experienced drought periods."[6] The 1987 to 1992 drought is the basis for this plan, plus an additional period of limited water availability.[7] The SFPUC plans its water deliveries assuming that the worst drought experience is likely to recur and then adds an additional period of limited water availability. An 8.5-year drought scenario is referred to as the "design drought" and is ultimately the basis for SFPUC's water resource planning and modeling.

6 San Francisco Public Utilities Commission. December 2005. *Urban Water Management Plan*. p. 21.
7 San Francisco Public Utilities Commission. December 2005. *Urban Water Management Plan*. p. 21.

The "design drought" is based on the 1986-1992 drought plus 2.5 years of "prospective drought", which includes 6 months of recovery period.[8]

3.1.1. Water Shortage Allocation Plan

During a drought, it is expected that the retail and wholesale customers would experience a reduction in the amount of water received from the RWS. The amount of this reduction has been dictated by existing contractual agreements between the SFPUC and the Wholesale Customers, as detailed in the existing Water Shortage Allocation Plan (WSAP). The WSAP provides specific allocations of available water between the retail and wholesale customers collectively associated with different levels of system-wide shortages, as shown in Table 3-1.

Table 3-1: WSAP Allocation

Level of System-Wide Reduction in Water Use Required	Share of Available Water	
	SFPUC Share	Wholesale Customers Share (collectively)
5% or less	35.5%	64.5%
6% through 10%	36.0%	64.0%
11% through 15%	37.0%	63.0%
16% through 20%	37.5%	62.5%

In addition to providing an allocation method, the plan also includes provisions for transfers, banking and excess use charges.

Under the WSAP, SFPUC retail customers would experience no reduction in deliveries at a 10 percent shortage. However, during a 20 percent system-wide shortage, the retail customers would experience a 1.9 percent reduction in retail deliveries. This assumes the development of the additional 10 mgd of local supplies in the retail service area. These additional supplies are not subject to a reduction under the WSAP as the WSAP only allocates water from the RWS. Table 3-2 compares SFPUC RWS retail supplies during normal, single dry year, and multiple dry year periods.

Table 3-2: 2005 – 2030 SFPUC Retail Allocations in Normal, Dry and Multiple Dry Years

	Normal Year		Single Dry Year		Multiple Dry Year Event					
					Year 1		Year 2		Year 3	
	mgd	%	mgd	%	mgd	%	mgd	%	mgd	%
2010	81.0	100%	81.0	100.0%	81.0	100.0%	79.5	98.1%	79.5	98.1%
2015	81.0	100%	81.0	100.0%	81.0	100.0%	79.5	98.1%	79.5	98.1%
2020	81.0	100%	81.0	100.0%	81.0	100.0%	79.5	98.1%	79.5	98.1%
2025	81.0	100%	81.0	100.0%	81.0	100.0%	79.5	98.1%	79.5	98.1%
2030	81.0	100%	81.0	100.0%	81.0	100.0%	79.5	98.1%	79.5	98.1%

Notes:
1. In 2010 the retail allocation of RWS supply is reduced to 81 mgd to reflect the retail allocation under the 2018 Phased WSIP Variant. 10 mgd of recycled water, groundwater, and conservation will be implemented by 2015 to make up for the loss in RWS supply. The 10 mgd of local supply is not subject to reduction under the WSAP.
2. Under the WSAP, the SFUPC retail allocations at a 10 percent shortage are 85.86 mgd. However, due to the Phased WSIP Variant, only 81 mgd of RWS supply is shown. The remaining supply can be transferred to the Wholesale Customers under the terms of the Water Supply Agreement.

Source: San Francisco Public Utilities Commission. 2005. Urban Water Management Plan for the City and County of San Francisco. p. 54-57 and discussions with SFPUC staff.

8 San Francisco Public Utilities Commission. April 2000. *Water Supply Master Plan*. p. 22.

The WSAP has been carried forward in the new Water Supply Agreement for system-wide shortages of up to 20 percent. For shortages in excess of this amount, the Water Sales Agreement provides that the SFPUC may allocate water in its discretion.

3.2. Retail Water Shortage Allocation Plan

San Francisco has established criteria that relate water deliveries to water supply and the SFPUC's objectives to manage water deliveries during extended drought. These criteria provide guidance to the SFPUC for the determination of the annual availability of water. The structure of the criteria was developed during the course of the 1987-92 drought period and incorporates procedures which were implemented during actual operations.

The established water delivery criteria incorporate a three-level staging of delivery reductions: the first stage is associated with voluntary actions by customers and the second and third stages are associated with mandatory rationing programs enforced by the SFPUC. Depending on the level of water demand and the desired maximum delivery reduction, one, two or all three of the stages are required. These criteria have been found to be viable through computer simulation of historical drought events and resultant SFPUC operations.

Based on past drought experience and the established criteria, San Francisco's Retail Water Shortage Allocation Plan (RWSAP) was adopted to formalize the three-stage program of action to be taken in San Francisco to reduce water use during a drought.

In accordance with the RWSAP, prior to the initiation of any water delivery reductions in San Francisco, whether it be initial implementation of reduction delivery or increasing the severity of water shortage, the SFPUC would outline a drought response plan that would address the following: the water supply situation; proposed water use reduction objectives; alternatives to water use reductions; methods to calculate water use allocations and adjustments; compliance methodology and enforcement measures; and, budget considerations. This drought response will be presented at a regularly scheduled SFPUC Commission meeting for public input. The meeting will be advertised in accordance with the requirements of Water Code Section 6066 of the Government Code, and the public will be invited to comment on the SFPUC's intent to reduce deliveries.

Depending on the level of water demand and the desired objective for water use reduction, one, two, or all three stages of the RWSAP may be required.

Stage 1 (Voluntary)

- System-wide demand reductions of 5-10 percent experienced
- Voluntary rationing request of customers
- Customers are alerted to water supply conditions
- Remind customers of existing water use prohibitions
- Education on, and possible acceleration of, incentive programs

Stage 2 (Mandatory)

- System-wide demand reductions of 11-20 percent experienced
- All Stage 1 actions implemented
- All customers receive an "allotment" of water based on the Inside/Outside allocation method (based on base year water usages for each account)

- Water use above the "allocation" level will be subject to excess use flow restrictor devices and shut-off of water

Stage 3 (Mandatory)

- System-wide demand reductions of 20 percent or greater experienced
- Same actions as in Stage 2 with further reduced allocations

3.3. Urban Water Management Planning Act (Water Code Section 10632)

Pursuant to the Urban Water Management Planning Act (Water Code Section 10632), water suppliers with an existing dry year shortage contingency plan can implement subsequent stages of demand reduction measures listed in its UWMP as a strategy to balance supply and demand. The WSAP and the RWSAP, contained in Section 9 of the SFPUC's 2005 UWMP is the SFPUC's dry year shortage contingency plan that allows the SFPUC to reduce water deliveries to customers and implement demand reductions during periods of water shortage. Therefore, when a supply deficit occurs, the SFPUC would follow its adopted water shortage contingency plans (WSAP and RWSAP) to implement drought-planning sequences and associated operating procedures that trigger different levels of water delivery reduction rationing relative to the volume of water actually stored in the SFPUC reservoirs. These delivery reductions allow the SFPUC to maintain water in storage over an extended period. In addition, under the RWSAP, the SFPUC would balance Retail supply curtailments by reducing demand.

3.4. Dry Year Water Supply Projects

As discussed in Section 2.7, the SFPUC, as part of the WSIP, has currently engaged the following projects or programs as methods to improve RWS dry-year supplies. Within the WSIP, the SFPUC addressed the development of supplies to be utilized during dry year events. These plans include the use of recycled water as component of a conjunctive use program and participation in the development of Bay Area desalination plant. Each of these plans is discussed below.

3.5. Development of Dry Year Supplies

3.5.1. Groundwater Storage and Recovery Project

The proposed Regional Groundwater Storage and Recovery Project would balance the use of both groundwater and surface water to increase water supply reliability during dry years or in emergencies. The proposed project is located in San Mateo County and is sponsored by the SFPUC in coordination with its partner agencies, the California Water Service Company, City of Daly City and City of San Bruno. The partner agencies currently purchase wholesale surface water from the SFPUC and also independently operate groundwater production wells for drinking water and irrigation.

The proposed Regional Groundwater Storage and Recovery Project would extract groundwater from the South Westside Basin groundwater aquifer in San Mateo County. The project would consist of installing up to 16 new recovery well facilities in northern San Mateo County to pump stored groundwater during a drought. During years of normal or heavy precipitation, the proposed project would provide surface water to the partner agencies in order to reduce the amount of groundwater pumped. Over time, the reduced pumping would result in the storage of approximately 61,000 acre-feet of water (more than the supply contained in the Crystal Springs Reservoir on the SFPUC Peninsula Watershed). This would allow recovery of this stored water at a rate of up to 7.2 mgd for a 7.5-year dry period. The water would be in compliance with the California Department of Public Health requirements for drinking water supplies. This project would include construction of well pump stations, disinfection units, and piping. This project is currently undergoing environmental review.

3.5.2. Desalination

The SFPUC's investigations of desalination as a water supply source have focused primarily on the potential for regional facilities. The proposed Bay Area Regional Desalination Project is a joint venture between the SFPUC, Contra Costa Water District, East Bay Municipal Utility District, and the Santa Clara Valley Water District. The regional desalination project would: provide an additional source of water during emergencies; provide a supplemental water supply source during extended droughts; allow other major water facilities to be taken out of service for maintenance or repairs; and increase supply reliability by providing water supply from a regional facility. The Bay Area Regional Desalination Project would have an ultimate total capacity of up to 65 mgd.[9]

9 EBMUD, "Desalination Project", www.ebmud.com/water_&_environment/water_supply/current_projects/desalination_project/default.htm, accessed July 30, 2009.

4.0 WATER DEMAND OVERVIEW

The SFPUC provides wholesale water service to 27 Bay Area water agencies located in Alameda, San Mateo and Santa Clara Counties (Wholesale Customers), and also serves as the retail water supplier for the City. This section shows the calculated water demand for the proposed project as well the calculated water demand projections for San Francisco based on recent housing and population forecasts within the entire system.

4.1. Overview

Over 2.5 million people in Bay Area counties currently rely on water supplied by the SFPUC RWS. The water supplied by the RWS comes from sources in the Bay Area (reservoirs with local runoff) and water from the Tuolumne River watershed. The water is of excellent quality and reasonable cost, and is a positive factor in attracting businesses, new residents, and industry to the Bay Area.

In addition to providing wholesale water supply, the SFPUC provides retail water service to residents, businesses, and institutions within the City limits, as well as to a number of residential and commercial accounts in the Bay Area and the Sierra Nevada foothills.

Wholesale Customers: The SFPUC provides wholesale water service to 27 Bay Area water agencies in Alameda, San Mateo, and Santa Clara Counties under the terms of a recently renegotiated Water Supply Agreement. The SFPUC supplies approximately 65 percent of the total wholesale customer water demand. Some of the wholesale water customers rely entirely on the SFPUC for their water supplies.

Retail Customers: The SFPUC's retail water customers include the residents, businesses, and industries within the municipal boundaries of the City and County. In addition to these customers, retail water service is also provided to other customers in the Bay Area and Sierra Nevada foothills. These accounts include the San Francisco International Airport and the San Francisco County Jail in San Mateo County, the unincorporated Town of Sunol and Lawrence Livermore Laboratory in Alameda County, and the Groveland Community Services District in Tuolumne County. In addition, the SFPUC retails groundwater (pumped from the Pleasanton well field) to the Castlewood development in Alameda County.

Historically, approximately 96 percent of the SFPUC's retail water demands have been met through deliveries from the SFPUC RWS. A small portion of San Francisco's demand is met through locally produced groundwater and secondary treated recycled water. The groundwater is used primarily for irrigation at local parks and on highway medians. The recycled water is used mostly at municipal facilities for wastewater treatment process water, sewer box flushing, and similar wash down operations.

4.2. Historical System Demand

Table 4-1 presents the historical water demands in the SFPUC Retail service area in fiscal years 2000-2008 and shows the changes in demands over this same year period. As shown in Table 4-1, over the last eight years, total demand in the Retail service area has decreased by 7.9 mgd.

Table 4-1: SFPUC Water Demands (mgd)

Fiscal Years[1]	2000	2001	2002	2003	2004	2005	2006	2007	2008
In City Retail Total	83.3	84.2	84.2	81.3	78.4	78.4	78.1	75.5	75.3
Outside Retail Customers[2]	8.4	8.4	8.6	8.2	9.1	9.1	7.7	8.4	8.5
Total Demand[3]	**91.7**	**92.6**	**92.8**	**89.5**	**87.5**	**87.1**	**85.8**	**83.9**	**83.8**

Notes:
1. Fiscal Years June to July
2. Other Retail Customers include: Groveland CSD, Lawrence Livermore Laboratory, City Irrigation, Castlewood.
3. Includes Unaccounted for water
Source: SFPUC 2005 UWMP and data from SFPUC staff August 2009.

4.3. Proposed Project Water Demand

The project sponsor's water resource consultants provided the expected water use of the proposed project under different development scenarios. An independent analysis was performed as a part of the Water Supply Availability Study (Appendix D) by analyzing similar land uses and assigning a demand factor for each use. The results of the independent analysis conclude that the demand estimates provided by the project sponsors are reliable. Proposed project implementation is expected by 2015 and build-out is expected by 2030.

Table 4-2 and Table 4-3 estimate the projected water demand at the project site with compliance to the California plumbing code and San Francisco's Green Building Ordinance. Each of the demand scenarios is described below.

Table 4-2: Water Demands for Proposed R&D Variant (mgd)(1)

Land and Facility Uses	Units/Area	Candlestick Point (mgd)	Hunters Point & Shipyard (mgd)	Total (mgd)
Residential	10,500 DU	0.61	0.22	0.83
Community Uses	100,000 gsf	0.01	0.01	0.02
Residential Uses Subtotal		**0.62**	**0.23**	**0.85**
Parks and Open Space Irrigation	336.4 acres	0.05	0.14	0.19
Residential and Irrigation Subtotal		**0.67**	**0.38**	**1.05**
Hotel	150,000 gsf	0.05	0.00	0.05
Office	150,000 gsf	0.04	0.02	0.06
R & D	5,000,000 gsf	0.00	0.71	0.71
Neighborhood Retail	250,000 gsf	0.02	0.02	0.03
Regional Retail	635,000 gsf	0.08	0.00	0.08
Football Stadium	~	0.00	0.00	0.00
Performance Venue	10,000 seats	0.01	0.00	0.01
Non-Residential Subtotal	~	**0.20**	**0.75**	**0.95**
Total Demand(1)		**0.88**	**1.13**	**1.99**
Existing Demand				0.30
Net Change in Demand				**1.69**

Note:
DU = dwelling unit; gsf = gross square footage
1. Average annual demands. Water demand for the proposed project were provided to the City by project developer. They were developed using an end use model on a per-unit or per-employee basis. The developer demands were independently reviewed by PBS&J and the SFPUC as part of this Study, and appear consistent with the SFPUC demand estimates. (Appendix D SFPUC Water Supply Availability Study [Appendix B]) Source: Lennar Urban, Water Demand Memorandum for Candlestick Point-Hunters Point Development, ARUP with Winzler & Kelly, September 25, 2009.
2. Includes local system losses, process water and miscellaneous uses of approximately 0.02 to 0.03 mgd.
Source: PBS&J October 2009.

Table 4-3: Water Demands with Proposed Stadium (mgd)(1)

Land and Facility Uses	Units/Area	Candlestick Point (mgd)	Hunters Point & Shipyard (mgd)	Total (mgd)
Residential	10,500 DU	0.61	0.22	0.83
Community Uses	100,000 gsf	0.01	0.01	0.02
Residential Uses Subtotal		**0.62**	**0.23**	0.85
Parks and Open Space Irrigation	336.4	0.06	0.15	0.21
Irrigation Subtotal		**0.67**	**0.38**	1.06
Hotel	150,000 gsf	0.05	0.00	0.05
Office	150,000 gsf	0.04	0.02	0.06
R & D	2,500,000 gsf	0.00	0.36	0.36
Neighborhood Retail	250,000 gsf	0.02	0.02	0.04
Regional Retail	635,000 gsf	0.08	0.00	0.08
Football Stadium	69,000 seats	0.00	0.02	0.02
Performance Venue	10,000 seats	0.01	0.00	0.01
Non-Residential Subtotal		**0.20**	**0.42**	**0.62**
Total Demand[a]		**0.88**	**0.79**	**1.67**
Existing Demand				0.30
Net Change in Demand				**1.37**

Note:
DU = dwelling unit; gsf = gross square footage
1. Average annual demands. Water demand for the proposed project were provided to the City by project developer. They were developed using an end use model on a per-unit or per-employee basis. The developer demands were independently reviewed by PBS&J and the SFPUC as part of this Study, and appear consistent with the SFPUC demand estimates. (Appendix D SFPUC Water Supply Availability Study [Appendix B]) Source: Lennar Urban, Water Demand Memorandum for Candlestick Point-Hunters Point Development, ARUP with Winzler & Kelly, September 25, 2009.
2. Includes local system losses, process water and miscellaneous uses of approximately 0.02 to 0.03 mgd.
Source: PBS&J October 2009.

Table 4-2 presents the proposed project demand under the R&D Variant, which estimates a conservative demand based on higher end-use of Research & Development (R&D) at the project site. Total demand at the project site is estimated at 1.99 mgd. Annual potable demand is estimated at 2,230.0 acre-feet per year.

Existing demand at the project site is reported at 0.3 mgd.[10] Therefore, the net change in daily demand at the project site under the R&D Variant is estimated at 1.69 mgd or an annual potable demand is 1,893.7 acre-feet per year.

Table 4-3 presents the proposed project demand with development of a new NFL stadium (Stadium) in place of an additional 2.5 million square feet of R&D space. Total demand at the project site is estimated at 1.67 mgd. Annual potable demand is estimated at 1,871.3 acre-feet per year.

Existing demand at the project site is reported at 0.3 mgd.[11] Therefore, the net change in daily demand at the project site under the Stadium development is estimated at 1.67 mgd or an annual potable demand is 1,893.7 acre-feet per year. The net change in demand is estimated at 1.37 mgd or 1,535.2 acre-feet per year.

4.4. Potential Recycled Water of Proposed Project

As described in the WSAS, on-site recycled water facilities developed at the project site could be used to offset the potable water demand. It is estimated that recycled water demand could be at least 0.89 mgd; however, this is contingent upon the level of development at the project site. At this time, on-site recycled water facilities are in the planning stages and have not been

10 SFPUC billing information from staff. July 2009.
11 SFPUC billing information from staff. July 2009.

fully evaluated; therefore, this WSA provides a conservative water supply analysis without on-site recycled water at the project site. It should be noted, that recycled water, generated on-site is considered additional water supply sources beyond the SFPUC's WSIP recycled water supplies.

4.5. City of San Francisco Retail Water Demand Analysis

To update the water supply and demand estimates provided in the 2005 UWMP, the SFPUC developed a Water Supply Availability Study (Appendix D) The WSAS incorporates new water supply information (per the Phased Variant WSIP) and generates new estimates of future water demand, which were based on new population and employment estimates, including several major development proposals not anticipated in the 2005 UWMP, including the proposed project (abbreviated as CP-HPS II), Treasure Island-Yerba Buena Island (TI-YBI) and Parkmerced.

To update future water demand, the WSAS compared the estimates of residential households and employees used in the 2005 UWMP with new population and employment forecasts provided by the San Francisco Planning Department,[12] which were designed to closely match the recently adopted Association of Bay Area Governments (ABAG) Projections 2009 target, but taken into account local knowledge of projects currently in various stages of the entitlement process. Updated water demand estimates were then generated, which included the incremental future growth that was not previously included in the 2005 UWMP estimates.

The new demand estimates also incorporate the results of the 2004 Demand Report, which analyzed water demands associated with each retail customer sector and included development of a water use model. The water use model accounts for demand at the end use level (such as individual toilets and showers), and established water use rates for specific units, including multiple family residential households and employees, the latter of which is used to estimate non-residential water demands. The WSAS used an average of these water use rates over the next 20 years (2010-2030) to establish a water use rate for multi-family residential households of 98.7 gpd, and a water use rate for employees of 42.42 gpd. With these unit rates, future water demand can be estimated from changes in the number of residential households and/or employees in San Francisco.

4.5.1. Water Demand of Major Development Projects and Incremental Growth

Upon buildout in 2030, the development at the CP-HPS II project site and two other large development projects represent the majority of new growth in San Francisco above the 2030 growth projected in the 2005 UWMP. Table 4-4 shows the total water demand of the proposed project, the R&D Variant and other proposed developments currently in the SF Planning development pipeline. The CP-HPS II project includes a number of different development scenarios, the estimated water demands of the two main proposed development scenarios are also shown in Table 4-4.

As stated previously, the Demand Report analyzed water demand associated with each Retail customer sector and established per unit-use rates. As such, between 2010 and 2030, the SFPUC used a per-unit use rate average of 98.7 gpd per household for multi-family residential demands. As shown in Table 4-4, the 98.7 gpd per household rate was applied to the incremental growth of 2,387 new dwelling units throughout the City resulting in a demand of 0.24 mgd in 2030.

12 San Francisco Planning Department, Projections of Growth by 2030, July 9, 2009 (included as Appendix A to the Water Supply Availability Study).

Table 4-4: 2030 Water Demand Increase within San Francisco (Proposed Project, R&D Variant, Other Development Projects and Incremental Growth) (mgd)

Development	Water Demand (mgd)(1)			
	Stadium		R&D Variant	
	Projected Demand	Demand with Non-Residential Adjustment (1.18)(7)	Projected Demand	Demand with Non-Residential Adjustment (1.40)(7)
CP-HPS II(2)	1.67	1.04	1.99	1.04
Treasure Island – Yerba Buena Island(3)	1.70	1.17	1.70	1.17
Parkmerced(4)	0.98	0.94	0.98	0.94
Development Subtotal	**4.38**	**3.16**	**4.67**	**3.16**
Existing Demand at Development Sites(5)	-1.51	-1.51	-1.51	-1.51
Net Development Subtotal	**2.87**	1.64	**3.17**	1.66
Incremental Growth in SF (City and County)(6)	0.24	0.24	0.24	0.24
Net Change in Water Demand with Non-Residential Adjustment(7)	~	**1.88**(7)	~	**1.89**(7)

Notes:
1. Average annual demands. Residential water demands for the proposed projects were provided to the City by project developer. They were also developed using an end use model on a per unit or per employee basis. The developer demands were independently reviewed by PBS&J and the SFPUC as part of this Study, and appear consistent with the SFPUC demand estimates. (Appendix D [WSAS Appendix B])
2. CP-HPS Phase II Arup – Winzler & Kelly Water Demand Memo September 25, 2009 (Appendix D [WSAS Appendix B])
3. Treasure Island Technical Memo Section 7 August 2009. (Appendix D [WSAS Appendix B])
4. Parkmerced Water Demand Spreadsheet from August 2009 (Appendix D [WSAS Appendix B])
5. Existing demand provided by SFPUC from current billing records (CP-HPS = 0.3 mgd) (TI-YPI = 0.25 mgd) (Parkmerced = 0.71 mgd) (Appendix D [WSAS Appendix B])
6. Derived by SFPUC staff based on approximately 2,387 dwelling units at 98.7 gpd. (Appendix D [WSAS Appendix B])
7. To avoid double-counting the water demand associated with the 2009 SF Planning Non-Residential Employment Projections and the non-residential demand calculated in the developer estimates at each of the Project sites, the total water demand at each of the developments was adjusted to remove the non-residential demands. This study assumes all non-residential demand is accounted for in the 2009 SF Planning Non-Residential Employment Projections.

At the CP-HPS II project site in 2030, total potable demand is calculated at 1.67 mgd for the Stadium development and 1.99 mgd for the R&D Variant development. In that same year, under either development scenario, residential demand at the CP-HPS II project site is estimated to be 1.04 mgd. As shown in Table 4-4, in 2030 the total net change in demand of 1.89 mgd accounts for demand related to new development less existing demand, and includes a non-residential demand adjustment to avoid double-counting the SF Planning employment in 2030.[13]

4.5.2. Water Demand of Residential Projections

[In an effort to represent development implementation over the 20-year planning horizon (2010–2030), this WSA assumes that residential growth and demand would occur at a linear rate over the same 20-year period without accounting for market force influences or changes in local economics.

Table 4-5 presents the residential growth projections included the 2005 UWMP and the 2009 growth projections developed by the SF Planning department. As shown in Column A, residential growth in 2010 is estimated at 344,306 units, builds to 351,608 units in 2015 and then grows continually to 373,513 units by 2030. As shown in Column C, under the linear growth assumption, by 2015 new residential units are estimated to increase by 7,447 units, and

13 To avoid double-counting the water demand associated with the 2009 SF Planning Non-Residential Employment Projections and the non-residential demand calculated in the developer estimates at each of the proposed development sites, the total water demand at each of the developments was adjusted to remove the non-residential demands. This WSA assumes all non-residential demand is accounted for in the 2009 SF Planning Non-Residential Employment Projections.

continue to increase proportionally over the next 15 years to 29,787 units in 2030. Of these 29,787 units, 27,400 are proposed in the large development projects and account for the majority of new residential growth in 2030. The balance of 2,387 is projected as Incremental Growth throughout the San Francisco. As presented in Column A+C, San Francisco can expect 359,055 units in 2015, and based on the 2009 SF Planning Projections estimate, total residential units would be 403,330 by 2030.

Table 4-5: Projections for Residential Growth and Residential Demand

Year	2005 UWMP Projections (DU)[1]	2005 UWMP Demand (mgd)[2]	2009 SF Planning Projections (DU)[3]	2009 SF Planning Demand (mgd)[4]	Total Residential (DU)[5]	Total Demand (mgd)[6]
	A	B	C	D	A+C	B+D
2010	344,306	44.7	0	0	344,306	44.70
2015	351,608	43.8	7,447	0.47	359,055	44.27
2020	358,910	43.2	14,894	0.95	373,804	44.15
2025	366,211	42.9	22,340	1.42	388,551	44.32
2030	373,513	42.9	29,787	1.89	403,300	44.79

Notes:
DU = Dwelling Units
1. Single and Multiple Family Residential Unit Projections from SFPUC 2005 UWMP(Table 2, page 7)
2. Estimated Demand generated by Residential Unit Projections from SFPUC 2005 UWMP (Table 8B, page 43)
3. Residential Units Projections from 2009 SF Planning (In 2030 - Projects (CP-HPS II (10,500 DU); TI-YBI (8,000 DU) and Parkmerced (total 8,900 DU) including Incremental Growth (2,387 DU) linear distribution over 20-year (2010-2030) planning period (Appendix D [WSAS Table 5-2])
4. Estimated Demand generated by Projects (from developer estimates) and Incremental Growth (98.7 gpd per household) linear distribution over 20-year (2010-2030) planning period (Appendix D [WSAS Tables 5-4 and 5-6])
5. Total Residential Unit Projections (2005 UWMP + 2006 SF Planning) residential units over the 20-year planning horizon. (Appendix D [WSAS Table 5-2])
6. Total Projected Water Demand generated by all new residential units over the 20-year planning horizon. (Appendix D [WSAS Table 5-6])
Source: Developed by PBS&J and SFPUC, October 2009.

Column B shows the residential water demand projected in the 2005 UWMP; demand deceases from 44.7 mgd in 2010 to 42.9 in 2030 because of plumbing fixture retrofits in existing residences and higher water efficiency fixtures at new developments, including the development at the project site. As shown in Column D, water demand Table 4-5, new residential water demand commences in 2015 at 0.47 mgd and progresses to 1.89 mgd in 2030. Column B+D shows the total residential demand, accounting for demand from the 2005 UWMP and 2009 SF Planning Projections over the 20 year planning period.]

[In 2030, total residential demand is estimated to be 44.79 mgd. In that same year, the proposed project's estimated residential demand of 1.04 mgd would increase average daily demand by 2.3 percent (1.04/44.79).]

4.5.3. Water Demand of Non-Residential Employment Projections

Between 2010 and 2030, SFPUC used an average of 42.42 gallons per day (gpd) per employee for non-residential water demands (Appendix D). As shown in Table 4-6, the 42.42 gpd per employee water demand rate was applied to the growth in jobs over the 20-year planning horizon. In 2015, demand is expected to be 30.52 mgd and by 2030, water demand generated through employment is expected to reach 31.73 mgd. To avoid double-counting the non-residential demand calculated in the developer estimates at each of the development sites, this WSA assumes all non-residential demand is accounted for in the 2009 SF Planning Non-Residential Employment Projections.

[In 2030, total non-residential demand is estimated to be 31.73 mgd. In that same year, at buildout, the proposed project's estimated non-residential demand of 0.95 mgd would increase average daily demand by 2.9 percent (0.95/31.73).]

Table 4-6: Water Demand for Non-Residential Employment Projections

Employment Projections and Non-Residential Demand	2010	2015	2020	2025	2030
SF Planning Employment Total[(1)] (jobs)	712,145	719,447	726,749	734,050	748,100
Non-Residential - Business/Industrial Demand[(2)] (mgd)	30.21	30.52	30.83	31.14	31.73

Notes:
1. Table 5-1 2009 SF Planning Projections (Appendix D)
2. Average of 42.42 gallons per day (gpd) per employee for non-residential water demands. (Appendix D])

4.5.4. SFPUC Total Retail System Demand

The SFPUC incorporated the 2009 SF Planning projections for residential and non-residential growth in San Francisco into the WSAS to assess the results of the SF Planning projections and its effects on the City's water demand. The totals of the previous tables (Table 4-4 and Table 4-6) along with demand data from the 2005 UWMP is incorporated in the City's total Retail demand shown in Table 4-7. The table represents the anticipated growth in demand commencing in 2010 and extending over the 20-year planning horizon to 2030.

Table 4-7: SFPUC Retail Demand (mgd)

Users, Facilities and Entities	Projected Water Demand (mgd)				
	2010	2015	2020	2025	2030
Residential Demand (Single & Multiple Family)[(1)]	44.70	43.80	43.20	42.90	42.90
New Residential Demand generated by Projects and Incremental Growth[(2)(4)]	-	0.47	0.95	1.42	1.89
Subtotal	44.70	44.27	44.15	44.32	44.79
Non-Residential - Business/Industrial Demands[(3,4)]	30.21	30.52	30.83	31.14	31.73
Subtotal	**74.91**	**74.79**	**74.97**	**75.46**	**76.52**
Unaccounted-for System Losses	7.30	7.30	7.30	7.30	7.30
Subtotal	**82.21**	**82.09**	**82.27**	**82.76**	**83.82**
Other Retail Demands[(5)]	4.90	4.90	4.90	4.90	4.90
Lawrence Livermore Laboratory; Groveland CSD[(6)]	1.20	1.20	1.20	1.20	1.20
City Irrigation Demand[(7)]	2.5	2.5	2.5	2.5	2.5
Castlewood Community Demand[(8)]	1.0	1.0	1.0	1.0	1.0
Total Retail Demand	**91.81**	**91.69**	**91.87**	**92.36**	**93.42**

Notes:
1. Residential Demands (Source: 2005 SFPUC UWMP Table 8B, page 43.)
2. See Table 4-4. Multiple Family – [In 2030 Incremental Growth of 0.24 mgd + (CP-HPS II 10,500 DU) 1.04 mgd + (TI-YBI 8,000 DU) 1.17 mgd + (Parkmerced 8,900 total DU) 0.94 mgd = 3.40 mgd] Existing Demand is 1.51 mgd at all sites. [3.40 mgd – 1.51 = 1.89 mgd] as shown in Table 4-2 (Sources: ARUP Water Demand Memo for CP-HPS Phase II September 25, 2009; Parkmerced Water Demand Spreadsheet June 30, 2009; Treasure Island Water Technical Report December 2008 Updated August 2009.)
3. See Table 4-6. Agriculture, Mining, Construction, Manufacturing, Transportation, Wholesale & Retail Trade, F.I.R.E., Services, Gov't including Builders – Contractors and Docks – Shipping. (Source: Adapted from 2009 ABAG Employment Projections in conjunction with SF Planning, July 2009) As developed in the Demand Study, SFPUC derived the employment water demands by taking the ABAG employment projections and multiplying by 42.42 gallons per employee per day and is consistent with SFPUC's demand projection methodology.
4. See Table 4-6. Non-residential (jobs/employment) demands at major project sites were assumed to be contained in the 2009 ABAG Employment projections. Growth in demand is incrementally increased to reflect the growth in jobs over the 20-year planning horizon. To avoid double-counting the water demand associated with the 2009 SF Planning Non-Residential Employment Projections and the non-residential demand calculated in the developer estimates at each of the Project sites, the total water demand at each of the developments was adjusted to remove the non-residential demands. This study assumes all non-residential demand is accounted for in the 2009 SF Planning Non-Residential Employment Projections. Table 4-4 shows the net change in water demand at the Project sites and the adjusted change in water demand without non-residential demand. Adapted by PBS&J and SFPUC September 2009 from ARUP Water Demand Memo for CP-HPS Phase II September 25, 2009; Parkmerced Water Demand Spreadsheet June 30, 2009; Treasure Island Water Technical Report December 2008 Updated August 2009.
5. US Navy, SF International Airport, and other suburban/municipal accounts. (Source: 2005 SFPUC UWMP Table 8B, page 43.)
6. Lawrence Livermore Laboratories (0.8 mgd); Groveland CSD (0.4 mgd). (Source: 2005 SFPUC UWMP Table 8B, page 43.)
7. City Irrigation at Golden Gate Park, Great Highway Median and SF Zoo. (Source: 2005 SFPUC UWMP Table 8B, page 43.)
8. Castlewood Community demand served by wells in the Pleasanton well field.

Source: 2005 SFPUC UWMP Table 8B, page 43.

As shown in Table 4-7, incremental residential growth demand and demand at each of large development sites commences in 2015 at 0.47 mgd and progresses to 1.89 mgd in 2030. In

2015, demand drops slightly due to a reduction in total residential demand. The non-residential demand commences in 2010 at 30.21 mgd, increases to 30.83 mgd and culminates at 31.73 in 2030.

Table 4-7 shows total Retail demands for the SFPUC beginning in 2010 at 91.81, and then drops slightly in 2015 because of a drop in residential demand and then increases to 91.87 mgd in 2020. In 2030, total Retail demand is expected to be 93.42 mgd. In that same year, the proposed project's total demand of 1.67 mgd would increase average daily demand by 1.8 percent (1.67 mgd/ 93.42 mgd); alternatively, the R&D Variant's demand of 1.99 mgd would increase the average daily demand by 2.1 percent (1.99/94.42 mgd).

5.0 COMPARISON OF AVAILABLE WATER SUPPLIES VERSUS DEMAND

Section 10910 (c)(3) of the Water Code states, "the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available for normal, dry and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses."

5.1. Supply and Demand Comparison

Table 5-1 compares the SFPUC Retail supplies and demand during normal, single dry year, and multiple dry year periods, as required by Water Code Section 10910 (c)(3). Section 2.7 discusses the SFPUC's total water supplies now and over the 20-year planning period. In 2010, prior to the development of the 10 mgd of local WSIP supplies, the SFPUC has access to annual average of 84.5 mgd from all water supply sources. Beginning in 2015, when the WSIP water supply sources are readily available, the SFPUC's Retail water supplies increase to 94.5 mgd. These supplies are assumed to be available in the quantities listed in Table 5-1. The SFPUC intends to use these supplies to meet its Retail customer demands.

The demand estimates in this Study show that the 2009 SF Planning projections result in an increase in City Retail demand. As stated previously, by 2030 Retail demand is estimated at 93.42 mgd. This increase, however, does not change the findings in the 2005 UWMP, which estimated demand at 93.4 mgd in 2030.[14] As shown in Table 5-1, the SFPUC can meet the current and future demands of its Retail customers in normal years, single dry-years and nearly all multiple dry-year events with the exception of years 2 and 3 after 2030. A discussion of an anomaly that occurs in 2010 follows Table 5-1 below.

As modeled in Table 5-1, the deficit shown in 2010 is the result of reducing the RWS supply to 81 mgd as per the Phased WSIP Variant, without full development of the additional 10 mgd of new WSIP supplies. It is expected that 10 mgd of local WSIP supply sources will be developed and available for use in San Francisco by 2015. However, Retail demand is currently lower than the 2010 projected demand (Fiscal Year 2007-2008 use was 83.9 mgd). If Retail demand exceeds the available RWS supply of 81.0 mgd between 2010 and 2015, and total RWS deliveries exceed 265 mgd between 2010 and 2015, the Water Supply Agreement allows the SFPUC to purchase additional water with the payment of an Environmental Surcharge. Notably, total RWS deliveries in Fiscal Year 2007-2008 were 256.7 mgd, which is 8.3 mgd below the 265 mgd watershed delivery goal.

As discussed in Section 3, in time of system-wide shortages due to drought conditions, the WSAP provides a fair and reasonable method for allocating water between the SFPUC's Retail service area and its wholesale customers (collectively). As shown in Table 5-1, after 2030, pursuant to the SFPUC's WSAP, Retail customers would experience no reduction in deliveries at a 10 percent RWS Retail supply curtailment. However, during a 20 percent RWS shortage when Retail RWS supplies are reduced by 1.9 percent to 79.5 mgd, the Retail customers would experience a 1.5 mgd reduction in RWS Retail deliveries. The SFPUC, as part of the WSIP, adopted a water reliability objective of no greater than 20-percent rationing in any one year of a drought. The RWS rationing reduction of 1.9 percent is well within the SFPUC's 20-percent reliability objective.

14 SFPUC 2005 Urban Water Management Plan Table 8B, p. 43.

Table 5-1: Projected Supply and Demand Comparison - Normal, Dry, and Multiple Dry Years (mgd)

	Retail Supply and Demand	Normal Year	Single Dry Year	Multiple Dry Year Event		
				Year 1	Year 2	Year 3
2010	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater Supply(2)	3.50	3.50	3.50	3.50	3.50
	Total Retail Supply(3)	84.50	84.50	84.50	83.00	83.00
	Total Retail Demand(4)	91.81	91.81	91.81	91.81	91.81
	Surplus/(Deficit)(5)	**-7.31**	**-7.31**	**-7.31**	**-8.81**	**-8.81**
2015	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater(6)	3.50	3.50	3.50	3.50	3.50
	WSIP Supply Sources(7)	10.00	10.00	10.00	10.00	10.00
	Total City Supply(3)	94.50	94.50	94.50	93.00	93.00
	Total Retail Demand(4)	91.69	91.69	91.69	91.69	91.69
	Surplus/(Deficit)	**2.81**	**2.81**	**2.81**	**1.31**	**1.31**
2020	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater(6)	3.50	3.50	3.50	3.50	3.50
	WSIP Supply Sources(7)	10.00	10.00	10.00	10.00	10.00
	Total City Supply(3)	94.50	94.50	94.50	93.00	93.00
	Total Retail Demand(4)	91.87	91.87	91.87	91.87	91.87
	Surplus/(Deficit)	**2.63**	**2.63**	**2.63**	**1.13**	**1.13**
2025	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater(6)	3.50	3.50	3.50	3.50	3.50
	WSIP Supply Sources(7)	10.00	10.00	10.00	10.00	10.00
	Total City Supply(3)	94.50	94.50	94.50	93.00	93.00
	Total Retail Demand(4)	92.36	92.36	92.36	92.36	92.36
	Surplus/(Deficit)	**2.14**	**2.14**	**2.14**	**0.64**	**0.64**
2030	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater(6)	3.50	3.50	3.50	3.50	3.50
	WSIP Supply Sources(7)	10.00	10.00	10.00	10.00	10.00
	Total City Supply(3)	94.50	94.50	94.50	93.00	93.00
	Total Retail Demand(4)	93.42	93.42	93.42	93.42	93.42
	Surplus/(Deficit)	**1.08**	**1.08**	**1.08**	**-0.42(8)**	**-0.42(8)**

Notes:
1. RWS Supply SFPUC (Table 2-2)
2. Groundwater Uses for In-City Irrigation and Castlewood (Table 2-2).
3. Total Retail Supply from SFPUC Water Supplies Table 2-2.
4. SFPUC Retail Demand from Table 4-7.
5. The deficit shown in 2010 is the result of reducing the RWS supply to 81 mgd per the Phased WSIP Variant, without full development of the additional 10 mgd of new WSIP supplies. 10 mgd of new sources will be developed and available for use in San Francisco by 2015. However, Retail demand is currently lower than the 2010 projected demand (FY 07/08 use was 83.9 mgd). If Retail demand exceeds the available supply of 84.5 mgd between 2010 and 2015, the Water Supply Agreement allows the SFPUC to purchase additional water from the RWS. If combined Retail and Wholesale RWS deliveries exceed 265 mgd, the SFPUC Retail customers would be required to pay an Environmental Surcharge for RWS deliveries over 81 mgd (Total RWS deliveries in FY07/08 were 256.7 mgd).
6. Groundwater Supplies at Castlewood and In-City Irrigation (Table 2-2).
7. WSIP Supply Sources (Recycled Water (4.0 mgd; Groundwater (2.0 mgd Existing and 2.0 from NWGWP, and WSIP Water Efficiency and Conservation (4.0 mgd) (Table 2-2).
8. Deficit occurs in year 2 and 3 of multiple dry year event, SFPUC implements its Drought Year Water Shortage Contingency Plans - RWSAP and WSAP to balance supply and demand under this projected shortfall as described in Section 3.0.

As shown in Table 5-1, under this multiple dry-year event scenario,[15] it is possible that the SFPUC will not be able to meet 100 percent of its Retail demand. After 2030, as modeled in this WSA, a supply shortfall of 0.42 mgd is anticipated to occur in the second and third year of a multiple dry-year event due to RWS supply curtailments.

15 Multiple dry-year events are defined as a three-year event per UWMP requirements. SFPUC determined that a multiple dry-year event is years 2-4 of SFPUC's 8.5 year design drought. SFPUC can meet 100 percent of deliveries in the first year of such an event.

Pursuant to the Urban Water Management Planning Act (Water Code Section 10632), water suppliers with an existing dry year shortage contingency plan can implement subsequent stages of demand reduction measures listed in its UWMP as a strategy to balance supply and demand. The WSAP and the RWSAP, contained in Section 9 of the SFPUC's 2005 UWMP is SFPUC's dry year shortage contingency plan that allows the SFPUC to reduce water deliveries to customers and implement demand reductions during periods of water shortage. Therefore, to overcome the potential 0.42 mgd supply deficit expected after 2030, the SFPUC would follow its adopted water shortage contingency plans (WSAP and RWSAP) to implement drought-planning sequences and associated operating procedures that trigger different levels of water delivery reduction rationing relative to the volume of water actually stored in the SFPUC reservoirs. These delivery reductions allow the SFPUC to maintain water in storage over an extended period. In addition, under the RWSAP, the SFPUC would balance Retail supply curtailments by reducing demand.

Table 5-2 was extracted from Table 5-1 to demonstrate the additional conservation necessary to balance supply and demand under the RWSAP in 2030. When the SFPUC implements its RWSAP, as shown in Table 5-2, Retail customers would be required to reduce daily demand by approximately 0.44 percent to balance demand against the supply shortfall. Stage 1 of the RWSAP in Section 3.2 requests voluntary conservation of at least 5 percent up to 10 percent. The 0.44 percent needed falls within Stage 1 and as modeled no further conservation would be required.

Table 5-2: 2030 Supply and Demand with Implementation of WSAP and RWSAP (mgd)

Retail Supply and Demand[1]	Normal Year	Single Dry Year	Multiple Dry Year Event		
			Year 1	Year 2	Year 3
RWS Supply	81.00	81.00	81.00	79.50	79.50
Groundwater	3.50	3.50	3.50	3.50	3.50
WSIP Supply Sources	10.00	10.00	10.00	10.00	10.00
Total City Supply	94.50	94.50	94.50	93.00	93.00
Total Retail Demand	93.42	93.42	93.42	93.42	93.42
Surplus/(Deficit)	**1.08**	**1.08**	**1.08**	**-0.42**	**-0.42**
RWSAP Demand Reduction (Conservation Needed)					
Total City Supply	94.50	94.50	94.50	93.00	93.00
Total Retail Demand	93.42	93.42	93.42	93.42	93.42
Surplus/(Deficit)	None	None	None	-0.42	-0.42
Stage 1 Conservation Savings (0.44%)	*None*	*None*	*None*	*0.42*	*0.42*
Retail Demand Reduction with RWSAP	*Surplus*	*Surplus*	*Surplus*	*93.00*	*93.00*
Surplus/(Deficit)	**None**	**None**	**None**	**0.00**	**0.00**

Note:
1. Table 5-1 Projected Supply and Demand Comparison - Normal, Dry, and Multiple Dry Years.
Adapted by PBS&J October 2009.

6.0 CONCLUSION OF ANALYSIS AND FINDINGS

There is an anticipated increase in the SFPUC supply reliability over the next 20 years as a result of the SFPUC implementing the water supply improvements in the WSIP and local water supply projects. Over this same period, demand in SFPUC's Retail service area will continue to increase as well. This is the result of growth in housing developments, population increases and employment opportunities throughout San Francisco.

In 2030, the proposed project's demand of 1.67 mgd would increase average daily demand by 1.8 percent; alternatively, the R&D Variant's demand of 1.99 mgd would increase the average daily demand by 2.1 percent. This increase, however, does not affect the ability of the SFPUC to meet the demand of its Retail customers. Beginning in 2015, when the WSIP water supply sources are readily available, the SFPUC's Retail water supplies increase to 94.5 mgd. The SFPUC intends to use these supplies to meet its Retail customer demands. As shown in Table 5-1, the SFPUC has sufficient supplies to meet current and planned future uses in normal year, single dry and all multiple dry-year events with the exception of years 2 and 3 after 2030.

After 2030, as shown in Figure 6-1, under a multiple dry-year event the SFPUC will experience a 0.42 mgd supply deficit (demand exceeds supply) and would not be able to meet 100 percent of its Retail demand including the proposed project. The water supply deficit is related to increasing demand throughout the SFPUC's Retail service area and the policy decision to limit RWS deliveries from the watersheds until 2018. This WSA used a conservative assumption and extended the decision to limit deliveries to 2030 (Annual average RWS limit is 265 mgd [81 mgd in SFPUC's Retail service area and 184 mgd in the Wholesale service area]).

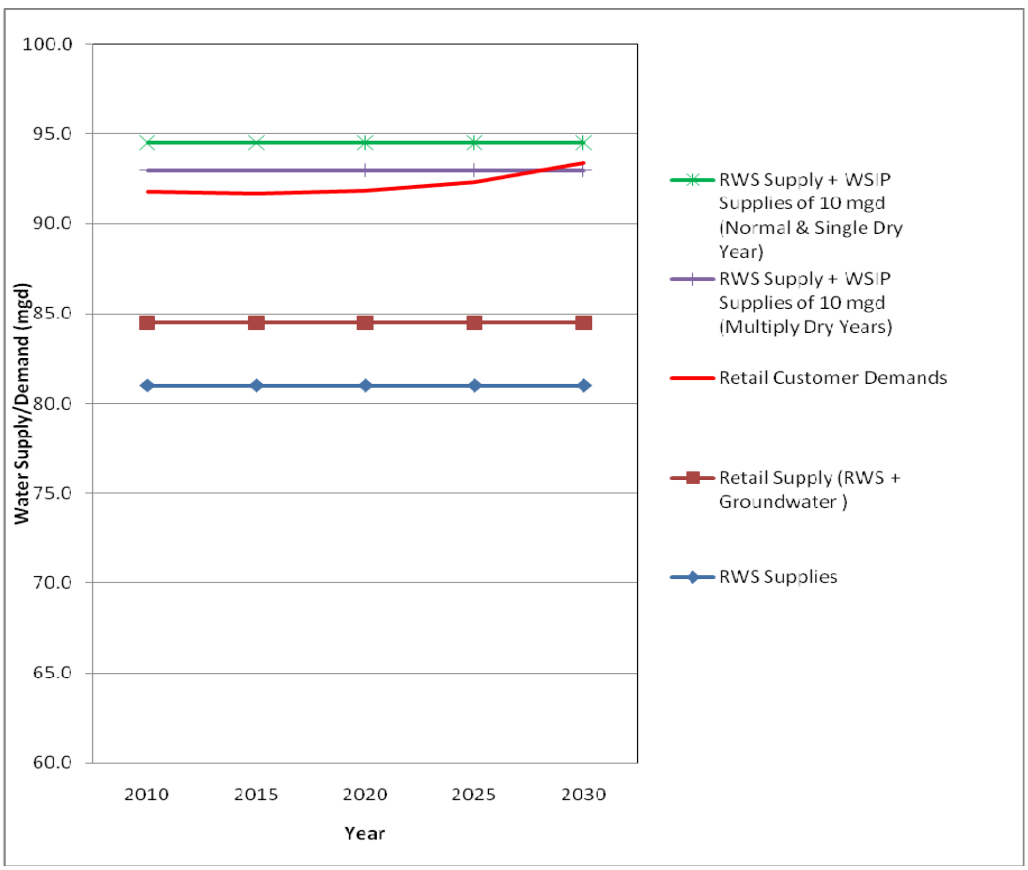

Figure 6-1: Comparison of Supply and Demand over 20 years

Pursuant to the Urban Water Management Planning Act (Water Code Section 10632), water suppliers with an existing dry year shortage contingency plan can implement subsequent stages of demand reduction measures listed in its UWMP as a strategy to balance supply and demand. The WSAP and the RWSAP, contained in Section 9 of the SFPUC's 2005 UWMP is the SFPUC's dry year shortage contingency plan that allows the SFPUC to reduce water deliveries to customers and implement demand reductions during periods of water shortage. Therefore, to overcome the potential 0.42 mgd supply deficit expected after 2030, the SFPUC would follow its adopted water shortage contingency plans (WSAP and RWSAP) to implement drought-planning sequences and associated operating procedures that trigger different levels of water delivery reduction rationing relative to the volume of water actually stored in the SFPUC reservoirs. These delivery reductions allow the SFPUC to maintain water in storage over an extended period. In addition, under the RWSAP, the SFPUC would balance Retail supply curtailments by reducing demand.

As discussed previously, the SFPUC has water rights and entitlements that are more than adequate to meet existing and projected future demand throughout the SFPUC's Retail service area. With completion of the WSIP projects, the SFPUC will have the capacity to reliably deliver potable water to meet customer purchases up to an annual average of 300 mgd. However, due to conditions of approval in the WSIP PEIR, the SFPUC is limiting deliveries from the watersheds until at least 2018. Prior to 2018, the SFPUC will engage in a new planning process to re-evaluate water system demand and water supply options. As a part of this process, San Francisco will conduct additional environmental studies and CEQA review as appropriate to address the SFPUC's recommendation regarding water supply and proposed water system deliveries after 2018.

This WSA concludes that the SFPUC has adequate supplies based on water rights and entitlements and adopted plans for local water supply projects to meet Retail demand in all years with the exception of a potential shortfall occurring after 2030 under a multiple dry-year event. In the event of a supply shortfall, the SFPUC, through its WSAP and RWSAP can impose supply curtailments and subsequent stages of demand reductions to balance demand against curtailed supplies.

6.1. WSA Findings

Regarding the availability of water supplies to serve the proposed project, beginning in 2015 the SFPUC finds as follows:

- In years of average and above-average precipitation, and including development of the SFPUC's local WSIP water supply sources, the SFPUC has adequate supplies to serve 100 percent of normal, single dry and multiple dry year demand up to 2030.[16]
- In multiple-dry-year events after 2030, when the SFPUC imposes reductions in its supply, the SFPUC has in place the WSAP and RWSAP to balance supply and demand.
- With the WSAP and RWSAP in place, and the addition of local WSIP supplies, the SFPUC finds it has sufficient water supplies available to serve its Retail customers including the demand of the proposed project, and existing and planned future uses.

16 The deficit shown in 2010 is the result of reducing the RWS supply to 81 mgd per the Phased WSIP Variant, without full development of the additional 10 mgd of new WSIP supplies. 10 mgd of new sources will be developed and available for use in San Francisco by 2015. However, Retail demand is currently lower than the 2010 projected demand (FY 07/08 use was 83.9 mgd). If Retail demand exceeds the available supply of 84.5 mgd between 2010 and 2015, the Water Supply Agreement allows the SFPUC to purchase additional water from the RWS. If combined Retail and Wholesale RWS deliveries exceed 265 mgd, the SFPUC Retail customers would be required to pay an Environmental Surcharge for RWS deliveries over 81 mgd (Total RWS deliveries in FY07/08 were 256.7 mgd).

7.0 REFERENCES

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APPENDICES

APPENDIX A SFPUC 2008 ANNUAL GROUNDWATER MONITORING REPORT WESTSIDE BASIN

2008 ANNUAL GROUNDWATER MONITORING REPORT WESTSIDE BASIN SAN FRANCISCO AND SAN MATEO COUNTIES, CALIFORNIA

Prepared By:
San Francisco Public Utilities Commission

In Coordination with the City of Daly City, the City of San Bruno and the California Water Service Company (South San Francisco District)

April 2009

April 28, 2009

ACKNOWLEDGEMENTS

The Westside Basin Annual Groundwater Report for 2008 was prepared by the San Francisco Public Utilities Commission (SFPUC) in cooperation with the City of Daly City, California Water Services Company (South San Francisco District) and the City of San Bruno. This report summarizes the results of water level elevation monitoring, water quality sampling and analysis, and additional field activities conducted within the basin for 2008.

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1.0 INTRODUCTION

This report presents the results of the 2008 Annual Groundwater Monitoring for the Westside Basin. The Westside Groundwater Basin extends from Golden Gate Park in San Francisco to the City of Burlingame in San Mateo County, and is an important municipal and irrigation water supply for the respective communities and businesses that overlie the Basin (Figure 1).

As part of continuing agency coordination and public education, it is intended that the preparation of this annual report, along with future annual reporting and supplemental technical reports, will provide regular summaries of overall basin conditions. The annual report is intended to provide information summarizing basin-wide groundwater pumping in the basin, describe groundwater levels and quality in the different aquifer systems that are present in the basin, and describe surface water conditions, most notably in Lake Merced. In addition to reporting of hydrogeologic conditions, the data-gathering network will be modified as necessary to provide a comprehensive review of basin conditions. Additionally, monitoring activities will be coordinated with ongoing and future project-specific monitoring activities to ensure an efficient, comprehensive monitoring program.

1.1 Background

Over the last several years, there has been a significant increase in data collection efforts and cooperative management of groundwater and interrelated surface water resources in the Westside Basin among the San Francisco Public Utilities Commission (SFPUC), the City of Daly City (Daly City), California Water Service Company (Cal Water, municipal water purveyor to South San Francisco, the Town of Colma and a portion of unincorporated San Mateo County), and the City of San Bruno (San Bruno). The initial data collection efforts included increased monitoring of groundwater and lake level elevations in the northern Westside Basin and the initiation of a basin-wide, semi-annual monitoring program that has involved the cooperative efforts of the SFPUC, Daly City, Cal Water, and San Bruno beginning in spring 2000. Part of the increased management effort was the preparation of the 2005 Final Draft North Westside Groundwater Basin Management Plan, which included a Plan Element to regularly report on groundwater conditions in the Westside Basin (SFPUC, 2005).

In 2006, the SFPUC, in cooperation with Daly City, Cal Water, and San Bruno, prepared a report entitled “Hydrogeologic Conditions in the Westside Basin, 2005” (LSCE, 2006). That report provided an overview of historical, current and planned activities related to groundwater use within the Basin, and described the hydrogeologic conditions of the Westside Basin as of 2005. Since 2007, the SFPUC Water Resources Division has prepared the annual groundwater monitoring reports in cooperation with Daly City, San Bruno, and Cal Water.

The monitoring program has expanded to monitor changes in groundwater levels and quality resulting from the recycled water program and the pilot conjunctive use program and to assist the SFPUC in quantifying the change in groundwater storage resulting from the above projects.

The physical barriers to seawater intrusion that are evident west of Daly City (as a result of faulting and steeply dipping beds of the Merced Formation) are not as evident in the North Westside portion of the basin, where the beds do not exhibit pronounced dips, and faults are further offshore. In that light, the expansion of the monitoring program included the construction of monitoring wells along the coast from Daly City to Golden Gate Park to monitor for the potential occurrence of seawater intrusion resulting from ongoing groundwater use and planned groundwater development within the North Westside Basin. Monitoring for the potential occurrence of seawater intrusion on the San Francisco Bay-side (Bay Side) of the basin was implemented by the City of San Bruno in 2006. In the fall of 2006, two new well clusters were installed by San Bruno at locations in the San Francisco Airport and within Burlingame. These wells are monitored semi-annually by San Bruno.

For convenience, the portion of the Westside Groundwater Basin north of the San Francisco/ San Mateo County line is referred to as the North Westside Groundwater Basin. The portion of the Westside Basin located south of the County line is referred to as the South Westside Groundwater Basin.

1.1.1 Planned and Ongoing Projects

The purpose and scope of the monitoring program has evolved to monitor changes in the groundwater system resulting from the following planned and ongoing projects:

Proposed Westside Basin Recycled Water Project

The proposed Westside Recycled Water Project is part of the SFPUC's Water System Improvement Program. It would deliver highly treated recycled water to a variety of customers through a system of pipelines, pump stations, storage tanks, and reservoirs. The system would bring recycled water from the proposed water treatment facility in Golden Gate Park to the San Francisco Zoo, Golden Gate Park, and Lincoln Park and Golf Course. The recycled water would be used for irrigation at all three sites, as well as non-portable uses at the Zoo and at the California Academy of Sciences.

In 2004, the North San Mateo County Sanitation District (NSMCSD), a subsidiary of Daly City, constructed facilities at its wastewater treatment plant to produce recycled water. The plant currently provides recycled water that is used for irrigation purposes at the Lake Merced Golf Club, the Olympic Club Golf Course, and the San Francisco Golf Club, as well as other landscaped areas in Daly City. These recycled water customers use less than 1 million gallons of recycled water per day on average. The plant has the capacity to produce up to 2.8 million gallons of recycled water per day. As a result, the NSMCSD has recycled water available to irrigate the Harding Park and Fleming Golf Courses, while still meeting the needs for its current recycled water customers.

Daly City and the SFPUC are proposing to expand the NSMCSD's recycled water distribution system in order to provide recycled water for irrigation purposes to the Harding Park and Fleming Golf Courses. Recycled water would replace potable water from the SFPUC's Regional Water System currently being used for irrigation at these locations. The proposed project facilities would include:

- Distribution Facilities: The project would require a new pump station at the Harding Park Maintenance Yard, and approximately 4,800 feet of 18-inch distribution pipeline along Lake Merced Boulevard.
- Storage Reservoir: The project would require construction of a new 700,000 gallon underground recycled water storage tank at Harding Park Maintenance Yard.
- Back-up Connection: The project would require construction of a back-up connection to SFPUC potable water distribution system.

San Francisco Groundwater Supply Project

As part of the San Francisco Groundwater Supply Project, the SFPUC proposes the construction of up to six wells and associated facilities in the western part of San Francisco. The wells would extract up to 4 million gallons per day (mgd) of water from the Westside Basin. The extracted groundwater, which would be used both for regular and emergency water supply purposes, would be blended with imported surface water before entering the municipal drinking water system. The project would provide a new source of water and improve reliability during system maintenance and drought conditions.

South Westside Basin Conjunctive Use Project

The purpose of the project is to develop a groundwater supply in the South Westside Basin for use during drought conditions. In normal and wet years, the SFPUC will supply supplemental surface water to Daly City, Colma, San Bruno, and the California Water Service Company (South San Francisco District) to be used in place of groundwater pumping. The reduced pumping during the normal and wet years would thereby increase the volume of groundwater in storage that can be pumped in dry years.

The proposed project includes construction of 16 groundwater wells with a total capacity of 7.2 mgd. Five of the wells would be connected to the Daly City water system, six (or three each) will be connected to the water systems of Cal Water and San Bruno, and five would be connected to the SFPUC transmission system. Treatment may be required at some of the wells for the removal of manganese. Additionally, the project would include nearly 9,800 feet of water distribution piping to make the necessary connections.

In October 2008, five new monitoring well clusters were installed at the following locations as part of this project:

- CUP-10A located within SFPUC Right of Way in Daly City
- CUP-18 located within SFPUC Right of Way at Colma Blvd. in Colma;
- CUP-19 located within SFPUC Right of Way at Serramonte Blvd. in Colma;
- CUP-22A located within SFPUC Right of Way at Hickey Blvd. at Camaritas Road, in South San Francisco; and.
- CUP-36-1 located within SFPUC Right of Way at Southwood Drive in South San Francisco.

The well construction permits, as-built construction details, lithologic and geophysical logs, and summaries of groundwater quality are presented in Appendix D. Subsequent monitoring events will incorporate these wells into the monitoring network to enhance characterization of groundwater conditions in the southern portion of the basin.

1.2 Municipal Water Agencies

The SFPUC is responsible for providing a reliable, high quality water supply for the City and County of San Francisco (San Francisco). The SFPUC also provides water to a large network of wholesale customers that extend from Daly City, adjacent to San Francisco, south through the Peninsula to Santa Clara County, and up the southeast side of San Francisco Bay through Alameda County to Hayward. The SFPUC water supply system supplies all of the San Francisco municipal demand and about two-thirds of the total water demands of its wholesale customers (SFPUC, 2005). Total water demand of retail customers in San Francisco is nearly 94 million gallons per day (mgd), or about 105,000 acre-feet per year (afy), which represents a significant decrease in water demand from recent drought periods (SFPUC, 2005). The total water requirements of the Bay Area wholesale customers in 2005 were estimated to be about 282 mgd, or about 316,000 afy (SFPUC, 2005).

Since the 1990's the SFPUC, Daly City, Cal Water and San Bruno have worked cooperatively on Westside Basin investigations, monitoring and coordinated projects. Daly City, Cal Water, and San Bruno have typically included groundwater from the Westside Basin for municipal water supply in combination with SFPUC-imported surface water. The City of Daly City's Department of Water and Wastewater Resources is responsible for the management and operation of Daly City's drinking water supply system. The City of San Bruno's Water Division of the Public Works Department is responsible for the management and operation of San Bruno's drinking water supply system. Cal Water is an investor-owned utility that serves South San Francisco, Colma and a very small part of Daly City.

2.0 SITE DESCRIPTION AND HYDROGEOLOGICAL SETTING

2.1 Hydrogeologic Setting

The Westside Basin is about 40 square miles in area (Figure 1) and includes four major geologic units. These units are the Jurassic - Cretaceous Franciscan Complex, Pliocene Merced Formation, Pleistocene Colma Formation, and Pleistocene to recent Dune Sands. There are also minor, yet widespread, units of recent alluvium along stream channels. Groundwater development has primarily occurred in the Colma and Merced Formations. The Merced Formation is the primary water-producing aquifer in the basin; however, the Colma Formation is also of interest since Lake Merced is incised within this formation.

As a result of the difficulty of differentiating the contacts between the Dune Sands, the Colma Formation, and the Merced Formation, the precise thickness of the Colma Formation and Dune Sands overlying the Merced Formation has not been determined. Groundwater in the vicinity of Lake Merced, and north to Stern Grove and Golden Gate Park, is encountered at relatively shallow depths (ranging from approximately 5 to 60 feet). South of Lake Merced, the depth to groundwater can exceed 300 feet below ground surface (bgs).

Phillips, et al. (1993) defined each of the groundwater basins in San Francisco as a continuous body of unconsolidated sediments and the surrounding surface drainage area. All seven major groundwater basins identified in San Francisco are open to the Pacific Ocean or San Francisco Bay. The landward parts of the groundwater basins generally are bounded horizontally and vertically by bedrock, which is assumed to be relatively impermeable compared with unconsolidated marine and alluvial deposits. Groundwater flow may occur between basins where the bedrock ridge that constitutes the boundary is subterranean. The north-south topography and bedrock height defined by the Coast Ranges generally forms an east-west hydrologic boundary through San Francisco.

The western part of San Francisco is divided into the Westside and Lobos Basins on the basis of a northwest-trending bedrock ridge through the northeastern part of Golden Gate Park. The bedrock ridge has several small surface expressions, and bedrock altitude data indicate that the ridge is continuous, though subterranean. Some degree of hydraulic connection is possible between the two basins where the ridge is not exposed at the land surface, but the degree of connection probably is minimal. The Westside Basin extends south to Burlingame and Hillsborough. Well drillers' logs for the San Bruno area indicate a deep sandy unit overlain by about 200 feet of predominantly fine-grained clays. Correlation of the deeper sand deposits is unclear; however, surficial mapping may indicate a relationship to exposures of sand/gravel deposits in the Burlingame area, which are mapped as non-marine Santa Clara Formation (Brabb and Pampeyan, 1983). A southward-extending ridge of Franciscan bedrock appears to separate San Bruno from the San Francisco Bay to the east. The upper fine grained beds appear to be Holocene to Late Pleistocene estuarine deposits of the San Francisco Bay (LSCE, 2004).

The subsurface configuration of the various geologic units in the Westside Basin has been delineated in a series of geologic cross-sections based on a combination of lithologic logs, water well drillers' reports, and geophysical logs (LSCE, 2004 and 2006). Lithologic units and other significant features in the basin are illustrated in geological cross-section form in Figure 2.

In the northern Westside Basin, in San Francisco, there are up to three aquifer units separated by two distinctive fine-grained units, the –100-foot clay and the W-Clay (LSCE, 2004). The aquifer units are generally designated as:

1) The "Shallow aquifer", which is present to an elevation of approximately –100 feet mean sea level (msl) (located above the –100-foot clay), in the vicinity of Lake Merced and the southern portion of the Sunset District of San Francisco;

2) The "Primary Production aquifer", which overlies the W-Clay; and

3) The "Deep aquifer" which underlies the W-Clay.

In the Daly City area, the –100-foot clay is absent, and the aquifer system is primarily composed of the Primary Production aquifer and the Deep aquifer.

Further to the south, in the South San Francisco area, the W-Clay is absent and the Primary Production aquifer is split into shallow and deep units, separated by a fine-grained unit at an elevation of approximately 300 feet below msl. The primary production aquifer in the San Bruno area is located at an elevation less than 200 feet below msl, and it underlies a thick, surficial fine-grained unit comprised of clay, sandy clay, and sand beds.

2.2 Lake Merced

Lake Merced is incised in the Shallow aquifer and is composed of four lakes: North Lake, East Lake, South Lake, and Impound Lake. A narrow channel connects the North and East Lakes, thereby creating equal water elevations in both lakes. A conduit between North Lake and South Lake allows water to flow between the lakes when the elevation in either lake is approximately 3.35 feet, San Francisco City datum[1]. When lake levels are below that elevation, these two lakes are separated and typically exhibit different elevations. South Lake and Impound Lake are separated below an elevation of approximately 4.26 feet, San Francisco City datum, by a levee that contains the Ingleside combined sewer pipeline and the foundation of a pedestrian walkway. Soil has accumulated on the foundation to an elevation of approximately 5 feet, San

[1] City Datum = NAVD88-11.37ft.

Francisco City datum. When either lake level is above that 5-foot elevation, water flows freely underneath the pedestrian walkway to connect both lakes.

Until the early 1900's, Lake Merced was one continuous body of water fed by local runoff and springs, with an outflow to the ocean in the form of a stream located at the northwestern end of North Lake. The stream flowed westward toward the ocean through the present-day location of the San Francisco Zoo and Sloat Boulevard. The springs that fed the lake were primarily located on the eastern side and in the southern portion of Lake Merced, causing a primary flow direction through the lake from the south to the north. In contrast, the current flow direction through the lakes is reversed, largely as a result of urban growth in the vicinity of Lake Merced, which has resulted in reduced recharge from springs and increased pumpage in the Primary Production aquifer south of Lake Merced. The urbanization of the watershed has also resulted in the emplacement of large amounts of fill that now impede spring discharge in the lake, and the diversion of an increasing amount of storm water away from Lake Merced and into the ocean or wastewater treatment plant. These diversions began with the construction of the Vista Grande Canal and Tunnel by the Spring Valley Water Works in 1897, and have continued with successive urban development in San Francisco and northern San Mateo County. The development of the watershed has also affected groundwater recharge from precipitation, which previously infiltrated and recharged the Shallow aquifer to a greater extent. As a result of all the preceding, the amount of subsurface inflow into Lake Merced, which in the early 1900's was manifested as spring inflow, has been reduced. The reduction in subsurface recharge to Lake Merced results in short-term lake levels being more sensitive to fluctuations in precipitation, since direct precipitation, along with shallow groundwater inflow, are the primary lake recharge mechanisms.

2.3 Pine Lake

Pine Lake is located north/northeast of Lake Merced in the westernmost portion of the Stern Grove and Pine Lake Park. Pine Lake (also known as Laguna Puerca) is one of San Francisco's few natural lakes. It is a small, shallow lake approximately three (3) acres in size. The lake has historically been overgrown with aquatic plants, which have periodically been removed. The San Francisco Recreation and Park Department has recently implemented a park improvement program for the Stern Grove and Pine Lake Park area. In November 2004, the Recreation and Park Department augmented lake levels over a 15-day period using groundwater pumped from a nearby well located east of Pine Lake. The lake addition was part of a study to evaluate the rate of lake level decline following a water addition. Approximately 25 acre-feet were discharged to the lake, which would theoretically raise the lake by about 8 feet. Nearby groundwater monitoring showed a corresponding increase in groundwater levels of about 5 feet in the Shallow aquifer.

We understand that the San Francisco Recreation and Park Department intends to resume groundwater pumping at the newly rehabilitated Pine Lake well in the near future, to once again augment the water level in Pine Lake.

SFPUC will cooperate with the Recreation and Park Department to measure future groundwater pumping from the Pine Lake well.

3.0 HISTORICAL GROUNDWATER DEVELOPMENT

By the early 1900's, wells had been constructed north, east, and south of Lake Merced for farming and drinking water supply. During that time, Spring Valley Water Company had two wells located near the Lake Merced outlet. Spring Valley pumpage was only about 100 afy (Bartell, 1913). The total of Lake Merced, Sunset District, and Golden Gate Park pumpage averaged 400 to 500 afy. In the early 1930s, the San Francisco Board of Public Works installed production wells in the Sunset District with a pumping capacity of about 6 mgd (6,700 afy). Groundwater withdrawals for emergency (drought) purposes averaged about 5 mgd (5,600 afy) from October 1930 through October 1935, but were discontinued after the availability of Hetch Hetchy water in the mid-1930s.

Beginning in the early 1950's, post-World War II development of Daly City and farther south onto the Peninsula was met with an increase in groundwater pumping and imported water deliveries from the SFPUC. Groundwater pumping increased from about 1,000 afy to nearly 5,000 afy between 1950 and 1970 (Kirker, Chapman & Associates, 1972). Since then, Daly City's groundwater pumping has ranged between approximately 3,000 and 5,000 afy, where it remained until October 2002, when an increase in SFPUC system water replaced the majority of Daly City's groundwater supply in normal and wet years as part of a demonstration conjunctive use pilot program among San Francisco, Daly City, Cal Water in South San Francisco, and the City of San Bruno. The conjunctive use pilot program ended in 2004. However, a subsequent agreement extended the project with Daly City, which received supplemental surface water until May 2007 when deliveries were suspended due to dry year water conditions. SFPUC plans to continue this demonstration program in Daly City. Daly City groundwater pumping totaled about 3,600 acre-feet (af) for 2008.

Groundwater pumping by Cal Water in South San Francisco has progressively declined from about 2,200 afy in 1947, to about 1,600 afy in 1969, to about 1,200 afy in 2002, to zero in 2003 (Figure 3). The decreases in groundwater pumping have been offset by increases in SFPUC system water deliveries. In early 2003, groundwater pumping in South San Francisco was discontinued as part of the same conjunctive use pilot program described above, with local surface water supplies replacing pumped groundwater. Groundwater pumping for municipal supply in South San Francisco resumed once again in March 2008 and totaled 206 af during 2008.

Pumping in San Bruno ranged from approximately 1,700 to 3,100 afy from 1997 through 2001 (Figure 3). In 2002, San Bruno decreased groundwater pumping to approximately 1,240 acre feet (af) and further decreased groundwater production to about 550 af in 2003 and 2004 as part of the pilot conjunctive use program. San Bruno resumed pumping after cessation of the demonstration conjunctive use program in that part of the basin in early 2005. In 2008 San Bruno pumped approximately 2,100 af of groundwater.

Total municipal pumping in the Westside Basin, as shown in Figure 3, was about 7,500 afy from the mid-1970s to the mid-1980s, and then ranged generally between about 6,000 and 8,000 afy until 2001. From 2002 to 2007, municipal pumping was reduced as part of the conjunctive use pilot program. In spring 2007, due to the dry 2006/2007 winter conditions, the SFPUC discontinued supplemental water delivery to Daly City, and Daly City resumed pumping from its municipal wells. Major groundwater production areas and historical groundwater pumping in the Westside Basin are presented on Figure 1 and Figure 3, respectively. Recent municipal groundwater usage is shown on Figure 4.

In addition to municipal water supply pumping in the Westside Basin, groundwater has historically been developed for irrigation supply and other non-potable uses, most notably on golf courses around Lake Merced, on the cemeteries in Colma, in Golden Gate Park and at the San Francisco Zoo. All unmetered, groundwater pumping for irrigation supply has been estimated infrequently. Kirker Chapman (1972) estimated golf course and cemetery pumping to be about 5,000 afy in 1969, and Yates, et al. (1990) estimated Golden Gate Park pumping to be about 1,000 afy during the late 1970's and 1980's. Adding those estimates to metered municipal pumping, as illustrated in Figure 3, suggests that total pumping was almost 15,000 afy in the late 1960's [assuming that Golden Gate Park pumping was similar in the late 1960's to the late 1970's and 1980's, as reported by Yates, et al. (1990)]. Assuming irrigation pumping to not substantially have changed until 2005 as discussed below, total pumping could be considered to have been about 6,000 afy more than municipal pumping, or in the range of about 12,000 to 14,000 afy from the mid -1980's through 2001.

Between 2002 and 2004, municipal pumping significantly decreased as part of the conjunctive use pilot program, to around 2,000 afy. From 2005 to May 2007 supplemental SFPUC water continued to be delivered to Daly City. In 2005, initial deliveries of recycled water for golf course irrigation largely eliminated groundwater use at the courses around Lake Merced, leaving the cemeteries, the San Francisco Zoo, and Golden Gate Park as the notable pumpers for irrigation and other non-potable uses, using an estimated 3,000 afy. The combination of the conjunctive use demonstration project and recycled water deliveries for golf course irrigation resulted in the combination of metered and estimated pumping in the basin declining to about 6,000 af in 2005, and approximately 5,400 af in 2006. Following discontinuation of the conjunctive use pilot program with Daly City in May 2007, approximately 7,500 af of groundwater was pumped in 2007.

4.0 GROUNDWATER PUMPING, USAGE AND DEVELOPMENT - 2008

In 2008, groundwater pumping in the Westside Basin was primarily for municipal supply to Daly City, Cal Water (South San Francisco), and San Bruno, as well as for irrigation and other non-potable uses by the San Francisco Zoo, Golden Gate Park, golf courses, and cemeteries, as described below and summarized in Table 2.

The SFPUC is planning to develop 4 mgd of regular groundwater supply from the North Westside Basin. As part of this plan, a test well was constructed at the South Sunset Playground in June 2007 and a second test well was completed at the West Sunset Playground in 2008. The West Sunset Playground test well is 12-inches in diameter, with a total depth of about 370 feet bgs. The test well is screened from 160 to 200 feet bgs and from 210 to 360 feet bgs.. The well construction permit, as-built construction details, lithologic logs and geophysical logs, and a summary of groundwater quality are presented in Appendix D.

4.1 City of Daly City

From its highest historical pumping of around 5,000 afy through most of the 1960's, Daly City's pumping was near constant, around 4,500 afy, through the 1970's and 1980's. Slightly more variable in the 1990's, when it generally declined to around 4,000 afy, Daly City's pumping has been most notably reduced since 2001, when it initially decreased to about 2,700 afy in 2002, followed by further decreases to between 700 and 1,500 afy in 2003 through 2005. The decreases in 2003 through 2005 were associated with the conjunctive use pilot program, which continued in Daly City through May 2007. Groundwater pumping in Daly City during calendar year 2008 totaled about 3,600 af compared to about 2,600 af for 2007 (when Daly City only pumped for a portion of the year). The history of pumping in Daly City is illustrated in Figure 3 and Figure 4.

4.2 City of South San Francisco

Municipal groundwater pumping in South San Francisco is provided by Cal Water, which also serves Colma and small parts of Daly City. Historical pumping by Cal Water decreased from the late 1940's through 2002, from about 2,200 afy to about 1,200 afy. As part of the pilot conjunctive use project with the SFPUC, Cal Water discontinued groundwater pumping for water supply purposes in 2003 and 2004. The conjunctive use pilot program ended in South San Francisco in early 2005. Cal Water resumed groundwater pumping in March 2008. Groundwater pumping by Cal Water during calendar year 2008 totaled 206 af.

4.3 City of San Bruno

Over the long term, groundwater pumping in San Bruno has generally ranged between about 550 and 3,100 afy since the late 1940's. As part of the conjunctive use pilot program, San

Bruno reduced pumping to approximately 550 af in 2003 and 2004. After cessation of the conjunctive use pilot program in San Bruno in early 2005, groundwater pumping in San Bruno increased to about 1,700 af for that year. Groundwater pumping in San Bruno has amounted to approximately 1,950 af for 2006, 2,350 af for 2007, and 2,100 af for 2008.

4.4 San Francisco Zoo

The San Francisco Zoo uses groundwater for irrigation and Zoo operations. Landscape irrigation along part of the Great Highway is also supplied by groundwater. Since the mid-1990s, the water needs of the Zoo and the landscaping along the Great Highway have been met by Well No. 5, which is located at the Zoo and is operated and maintained by the San Francisco Recreation and Park Department. Groundwater meter data started being recorded in February 2005. In 2005 and 2006, annual groundwater pumping was reported at approximately 400 af and approximately 350 af, respectively. For 2008, metered groundwater pumping at the Zoo was approximately 260 af. This amount compares to about 620 af for 2007, and represents a decrease of about 42% compared to 2007 pumping (Table 2). The reason for the significant decrease in pumping at the SF Zoo is not readily apparent. SFPUC and Zoo staff are reviewing 2008 groundwater and surface water use in an attempt to understand these differences in 2008 groundwater use compared to 2007.

4.5 Golden Gate Park and Pine Lake

Groundwater is pumped in Golden Gate Park for irrigation and to maintain artificial lakes within the park. The Golden Gate Park wells are operated and maintained by the San Francisco Recreation and Park Department. Groundwater is pumped from three wells located at Elk Glen Lake, near North Lake, and near the South Windmill. Historically groundwater pumping data were not maintained for the Golden Gate Park wells. In 2005 meters were installed in all three production wells to quantify groundwater pumping in the park. Historical groundwater pumping in Golden Gate Park has previously been estimated to be approximately 1,100 afy (Yates, et al., 1990). For 2008, approximately 1,300 af of metered groundwater was pumped at the South Windmill Replacement well, the North Lake well, and the Elk Glen Lake well. This compares to about 830 af pumped from these wells in 2007 and represents an increase of about 57% over 2007 values. Total metered pumping in 2008 was calculated based on weekly flowmeter readings collected by the SFPUC from the three afore mentioned production wells. In accordance with recommendations made in the 2007 Annual Report, the SFPUC coordinated with Rec Park and retained Jensen Instruments (a licensed contractor) to service and calibrate the electronic flow totalizers at the North Lake and South Windmill Replacement wells. Service and calibration was conducted under the observation of SFPUC and Rec Park staff in November 2008.

In addition to Golden Gate Park, we understand that the Recreation and Park Department intends to resume groundwater pumping at the newly rehabilitated Pine Lake well sometime in the near future, to once again augment levels at the Pine Lake. SFPUC will cooperate with the Recreation and Park Department to measure future groundwater pumping from the Pine Lake well.

4.6 Golf Courses

There are six (6) golf courses in the Westside Basin that use groundwater for irrigation. These include the Lake Merced Golf Club, the Olympic Club Golf Course, the San Francisco Golf Club, the California Golf Club, the Golden Gate Park Golf Course and the Green Hills Country Club. In 2004, recycled water was made available to Lake Merced Golf Club, the Olympic Club Golf Course, and the San Francisco Golf Club by adding a tertiary level of treatment at the North San Mateo County Sanitation District (a subsidiary of the City of Daly City) Wastewater Treatment Plant and by installing a distribution system from the treatment plant to these respective golf courses.

In 2008, a total of 516 af of recycled water and 91 af of pumped groundwater were used by the Olympic Club Golf Course and the San Francisco Golf Club to meet irrigation needs. According to data provided by the City of Daly City, the Lake Merced Golf Club used about 78 af of recycled water in 2008. Annual pumping data for 2008 was not available from the Lake Merced Golf Club. A summary of golf course water use is presented in Table 1. Groundwater pumping data have not been requested from the California Golf Club for this report. However, based on the Recycled Water Feasibility Study (Carollo Engineers, September 2008), the pumping is estimated at 206 af per year. The Golden Gate Park Golf Course is irrigated with groundwater as part of the overall park irrigation. No pumping data have been requested from the Green Hills Country Club, located in Millbrae, within the southwestern portion of the basin.

4.7 Cemeteries

There are about 600 acres of cemeteries in Colma, most of which have historically been, and continue to be, irrigated with groundwater. Based on the Recycled Water Feasibility Study (Carollo Engineers, September 2008), the average annual groundwater pumping by cemeteries in Colma is estimated at 787 afy. Golden Gate National Cemetery has not been irrigated using groundwater for more than 20 years (personal communication on 9/7/07 between Greg Bartow (SFPUC) and Clifford Schem (US Dept. of Veterans Affairs, Nat'l Cemetery Administration)).

4.8 Summary

Total 2008 groundwater pumping in the Westside Basin is estimated at 8,500[2] af. Metered water use indicates that the cities of Daly City, South San Francisco, and San Bruno used approximately 5,900 af of groundwater in 2008, while the two metered golf courses in the Lake Merced area used approximately 91 af of groundwater and 516 af of recycled water during calendar year 2008.According to data provided by the City of Daly City, the Lake Merced Golf Course used approximately 78 af of recycled water in 2008. Annual pumping data for 2008 was not available from the Lake Merced Golf Club but is estimated at about 37 af based on 2007 metered groundwater use. A general comparison between the combinations of metered and estimated historical pumping, and more completely metered pumping in 2005, 2006, 2007 and 2008, is presented in Table 1 and 2.

Total 2008 reported metered pumping in the Westside Basin was approximately 8,550 af. This consists of metered pumping at the three wells in Golden Gate Park, the San Francisco Zoo well, Daly City, San Bruno, Olympic Club Golf Course, and San Francisco Golf Club, and estimated groundwater pumping at the Lake Merced Golf Club based on 2007 values. To date the SFPUC and cooperating municipal pumpers have not requested annual pumping information from the other irrigation pumpers in the Westside Basin. However, based on estimates compiled by Carollo Engineers (Carollo Engineers, September 2008), the other pumping in the South Westside Basin is estimated at about 1,000 afy. Pumping within the Westside Basin not described (e.g., private homeowner wells, groundwater remediation extraction wells, and construction dewatering wells) is assumed to be negligible compared to the municipal and large-scale irrigation uses.

5.0 GROUNDWATER MONITORING AND TESTING PROGRAM

Groundwater monitoring within the Westside Basin consists of groundwater elevation and water quality monitoring conducted on a semi-annual basis (conducted during the spring and fall each year). Monitoring of groundwater elevations and various water quality parameters is conducted throughout the Westside Basin to evaluate the potential for seawater intrusion, and define lake-aquifer interaction. The monitoring program is also conducted to assess general conditions in the basin resulting from ongoing pumping, the conjunctive use program pilot and the recycled water program. The groundwater elevation monitoring well network is listed in Table 3, and approximate well locations are shown on Figure 5. These include both dedicated monitoring wells and inactive production wells. Measurements are collected manually on a quarterly or semi-annual basis in some wells, and daily through the use of electronic pressure transducers in other wells. Groundwater elevation hydrographs of all the wells monitored in 2008 are presented in Appendix A. All groundwater elevations are presented relative to the North American Vertical Datum of 1988 (NAVD88).

In addition to monitoring groundwater elevation data, groundwater sampling and analysis were conducted from select wells to monitor concentrations of various analytes and physical parameters of groundwater within the Westside Basin. The groundwater quality testing network is shown on Figure 21. Results of these analyses are used to monitor and evaluate the potential for seawater intrusion and general groundwater quality. Groundwater samples collected by the SFPUC for the North Westside Basin were done so in accordance with the "Sampling and Testing Protocol" for the Westside Basin (Appendix C).

Select groundwater samples were tested for some or all of the following constituents:

- General Minerals including: total alkalinity, calcium, magnesium, sodium, potassium, bicarbonate as $CaCO_3$, chloride, and sulfate;
- Iron and manganese (total and dissolved fractions);
- Nitrate;
- General parameters including: specific conductance, pH, total dissolved solids (TDS), and hardness;
- Bromide;
- Orthophosphate, and
- Boron.

Select groundwater elevation data are summarized in hydrographs illustrated on Figures 6 to 15, and groundwater elevation contour maps are presented on Figures 16 to 19. Results of chemical analyses on select groundwater samples are summarized in Tables 6 to 9.

6.0 COASTAL AND BAY SIDE WATER LEVEL MONITORING

6.1 Coastal Water Level Monitoring

Groundwater level measurements are being collected from a coastal monitoring well network in the western part of the basin, along the Old Great Highway (near Kirkham, Ortega, and Taraval Streets), the north-western part of Golden Gate Park, at the Oceanside Wastewater Treatment Plant, at the San Francisco Zoo, at Fort Funston, and at Thornton Beach. Fieldwork was conducted in accordance with the "Sampling and Testing Protocol for the Westside Basin" presented in Appendix C.

Groundwater elevation hydrographs of the Kirkham, Ortega, Taraval, and Zoo monitoring wells are presented in Figures 6 through 9, respectively. These hydrographs also include chloride concentrations from the water quality monitoring conducted at these wells. The water quality data are further discussed in Section 7.1. Figures 6 through 9 show the history of groundwater levels in the coastal monitoring wells since installation of wells at those four sites.

Groundwater elevations within the Shallow aquifer at all four coastal wells increased slightly or remained virtually unchanged seasonally compared to observed 2007 levels, and continued to trend above sea level in all wells. Groundwater levels within the Primary Production aquifer and Deep aquifer at the following wells increased in 2008 from the observed seasonal low levels of 2007, as follows:

- Kirkham MW-255 (Figure 6b) increased from a seasonal low of 3.2 ft (September 2007) to 5.2 ft (July 22, 2008);

- Kirkham MW-385 (Figure 6c) increased from a seasonal low of 2.9 ft (September 2007) to 5.2 ft (September 22, 2008);

- Kirkham MW-435 (Figure 6d) increased from a seasonal low of -0.5 ft (September 2007) to 2.4 ft (June 2008);

- Groundwater levels in Ortega MW-475 (Figure 7d) increased from a seasonal low of -4.7 ft in September 2007 to 1.0 ft (May 2008).

- Taraval MW-530 (Figure 8d) increased from a seasonal low of -9.0 ft (September 2007) to -2.0 ft (May 2008); and

- Zoo Monitoring Well MW-565 (Figure 9c) increased from a seasonal low of -13.5 ft (September 2007) to -6.0 ft (May 2008);

At their lowest measured levels of 2008, groundwater elevations at Taraval MW-530 (-2.0 ft), and Zoo Monitoring Well MW-565 (-6.0 ft) were below sea level. In addition, observed groundwater levels at the South Windmill monitoring well MW-57 and MW-140 remained below sea level and were similar to the recorded 2007 levels (Appendix A). Groundwater levels in MW-57, located in close proximity to the South Windmill Replacement well, dropped below sea level for the first time in 2007 since water level measurement began in 1989.

The observed increase in water level elevations in the Primary Production and Deep aquifers at the Kirkham, Ortega, Taraval, and Zoo wells, are likely a result of the following factors:

- Decreased pumping of groundwater at the SF Zoo production well, from 616 af in 2007 to 260 af in 2008 (Table 2), resulting in reduced drawdown and impact on the nearby coastal monitoring wells screened in the Primary Production and Deep aquifer;

- Although total groundwater use at the Golden Gate Park increased from about 827 af in 2007 to 1,294 af in 2008 (Table 2), there was a slight shift in pumping patterns caused by the shutdown of the South Windmill Replacement production well to more inland locations at various times in 2008, and

- A corresponding increase in pumping at the North Lake production well in Golden Gate Park resulted in less observed drawdown of water levels in the coastal monitoring wells. Pumping at the North Lake production well increased from about 224 af in 2007 to 645 af in 2008, while pumping at the South Windmill Replacement production well decreased from 596 af in 2007 to 558 af in 2008. Pumping at the Elk Glenn production well located in the central portion of the Golden Gate Park, increased from 7 af in 2007 to 91 af in 2008.

With the exception of the South Windmill monitoring well MW-57 and MW-140, groundwater elevations measured at wells screened within the Shallow aquifer in 2008 were all above sea level. Groundwater elevation contours for the Shallow aquifer measured during the spring and fall 2008 monitoring events are presented on Figures 16 and 17, respectively.

Groundwater levels at coastal monitoring wells screened in the Primary Production aquifer increased in 2008 compared to observed 2007 levels. Groundwater elevation contours for the Primary Production aquifer measured during the spring and fall 2008 monitoring events are presented on Figures 18 and 19, respectively.

Groundwater levels at the two coastal wells screened in the Deep Aquifer (Taraval MW-530, and Zoo MW-565), increased compared to observed 2007 levels but remain below sea level.

In general, coastal groundwater levels in most of the wells on the Pacific Ocean side of the Westside Basin are sufficiently high (above sea level) to indicate a lack of potential for seawater intrusion. However groundwater levels in monitoring wells near the southwestern corner of Golden Gate Park were below sea level in the Shallow aquifer (South Windmill monitoring well MW-57 and MW-140). In the Shallow and Primary Production aquifers, the continued depression of groundwater levels appears to be the result of increased and concentrated pumping in the western part of Golden Gate Park. In addition, below-normal winter precipitation in 2006, 2007 and 2008 further reduced aquifer recharge, and increased the need for irrigation pumping. Continued concentrated pumping in Golden Gate Park and the resulting depression of groundwater levels below sea level indicates a potential for seawater intrusion.

Increased water level elevations observed in all monitoring wells screened in the Primary Production and Deep aquifer within the coastal monitoring system for 2008 reinforces the goal for more sustainable and decentralized pumping at the SF Zoo and Golden Gate Park. This would allow previously depressed water levels to continue to rise and reduce the potential for sea water intrusion, and create more sustainable groundwater conditions in the North Westside Basin.

The coastal monitoring wells located at Fort Funston and Thornton Beach have groundwater elevations above sea level. The aquifers at these locations appear to be hydraulically separated from the main portion of the Westside Basin by faults and resultant steeply dipping geologic units, which act as hydraulic barriers to flow (LSCE, 2004). Groundwater elevations in the Fort Funston monitoring wells (Fort Funston –S and Fort Funston –M) continue to exhibit a generally increasing trend in the Upper Merced Formation and a virtually constant water level elevation in the Middle Merced Formation. Groundwater elevation monitoring at the Thornton Beach well MW 225 (screened in the Primary Production aquifer) and MW 670 (screened in the Deep aquifer) indicates that groundwater levels in both aquifers continue to rise in this area and remain well above sea level. Groundwater hydrographs for all wells monitored in 2008 are presented in Appendix A.

6.2 Bay Side Water Level Monitoring

Additional monitoring on the Bay Side of the Westside Basin was implemented by the City of San Bruno in 2006. In the fall of 2006, two new well clusters were installed and monitored by the City of San Bruno at locations in the San Francisco Airport (SFO) and within Burlingame (Figure 5). These wells were positioned to enhance monitoring of groundwater levels and water quality parameters along the San Francisco Bay side of the basin. Details of field activities, well installation activities and resulting monitoring in November 2006 and April 2007, were presented in “San Bruno Groundwater Monitoring Wells: Installation and Monitoring, An AB 303 Project Report”, prepared for the City of San Bruno by WRIME, Inc. and dated April 2007.

In February 2008, groundwater elevations were measured in the two monitoring well clusters: SFO (S and D) and Burlingame (S, M, and D). Groundwater elevations measured during this event in wells SFO-S and SFO-D were 2.29 and -29.18 feet (NAVD88), respectively. Groundwater elevations measured during this event in wells Burlingame (S, M, and D) were 3.37, 1.52, and -3.95 ft (NAVD88), respectively. Groundwater elevations measured during the August 2008 monitoring event in wells SFO-S and SFO-D were 1.78 and -30.07 ft (NAVD88), respectively. Groundwater elevations measured at wells Burlingame –S, M, and D during the August event; were 1.64, -0.82, and -4.65 ft (NAVD88), respectively. Fieldwork was conducted by WRIME Inc in accordance with the “San Bruno Seawater Intrusion Monitoring Wells: Sampling Plan”, prepared for the City of San Bruno by WRIME, Inc. dated April, 2007.

6.3 Lake Merced and Lake-Aquifer Monitoring

The water level elevations in Lake Merced in 2009 ranged from about 16.27 feet to 18.30 feet (NAVD88 datum). Lake levels are presented on Figure 20. Observed 2008 lake levels are fairly similar to observed levels in 2007, and continue to show a generally upward trend from seasonal low levels in 2002. These lake level elevations are above the 14 to 16 foot (NAVD88) interim lake level range established by the SFPUC.

Lake-aquifer monitoring around Lake Merced is accomplished by a combination of continuous and periodic monitoring of water levels in each of the three lake bodies, and by a combination of continuous and intermittent monitoring of groundwater levels in a network of dedicated monitoring wells around the lake complex, as illustrated in Figure 5.

Measured groundwater elevations in wells screened in the Shallow aquifer around the Lake. during the spring 2008 event, ranged from 13.34 feet (LMMW-9SS) to 29.31 ft above sea level (LMMW-7SS). For the fall 2008 event groundwater elevations ranged from 12.76 feet (LMMW-9SS) to 28.75 feet (LMMW-7SS). In the underlying Primary Production aquifer, groundwater elevations in the vicinity of Lake Merced ranged from -5.75 feet (LMMW-3D) to 14.63 feet (LMMW-2D) during the spring 2008 event. For the fall 2008 event, measured groundwater elevations in the Primary Production aquifer in the vicinity of Lake Merced ranged from -9.01 feet (LMMW-3D) to 13.48 feet (LMMW-2D).

For 2008, Shallow aquifer groundwater elevations around the Lake ranged from about 1.2 ft below to 12.7 ft above the interim Lake levels. Groundwater levels in the Primary Production aquifer around the lake ranged from about 23 ft below to 0.5 ft below the interim Lake levels. Groundwater elevations in the Primary Production aquifer were also in general lower than levels measured in the Shallow aquifer and the lake, indicative of a potential for flow from the Shallow aquifer-Lake system toward the underlying aquifer in which nearby production wells are primarily completed.

Hydrographs of two wells screened in the Shallow and Primary Production aquifers (LMMW-1S and LMMW-1D, respectively) that monitor groundwater elevations in the vicinity of Lake Merced are presented on Figure 12. Groundwater elevations in both aquifers continue to exhibit a generally upward trend from their 2002 levels. However groundwater levels in wells screened in the Primary Production and Deep Aquifer located near the southern portion of Lake Merced (e.g. LMMW-3D) decreased compared to 2007 values (Appendix A). This appears to be a result of increased and continued groundwater pumping by the City of Daly City.

6.4 South Westside Basin Water Level Monitoring

As part of the Westside Basin Monitoring Program, water levels in 9 wells screened in the Primary Production aquifer are typically monitored in the South Westside Basin. These wells were initially monitored by the San Mateo County Department of Environmental Health, starting in 2000. Since 2002 these wells have been monitored as part of the SFPUC's groundwater monitoring program. These wells consist of: LMMW-6D, DC 1 (Westlake), DC 8, and Park Plaza (MW-460) located in Daly City; SS1-02 and SS1-20 located in South San Francisco; SB-12 in San Bruno, and UAL 13C and UAL 13D located at the San Francisco International Airport. In 2006, two new well clusters (SFO and Burlingame) were installed by the City of San Bruno to fill data gaps in their own monitoring program. In the summer of 2007 SFPUC installed a monitoring well cluster consisting of 4 wells, at the South San Francisco Linear Park in South San Francisco.

In October 2008, SFPUC installed five new monitoring well clusters at the following locations:

- CUP-10A located within SFPUC Right of Way in Daly City;
- CUP-18 located within SFPUC Right of Way at Colma Blvd in Colma;
- CUP-19 located within SFPUC Right of Way at Serramonte Blvd in Colma;
- CUP-22A located within SFPUC Right of Way at Hickey Blvd at Camaritas Road, in South San Francisco; and
- CUP-36-1 located within SFPUC Right of Way at Southwood Drive in South San Francisco.

The five monitoring well clusters were completed at depths ranging from 151 to 710 feet bgs. These well clusters were installed as part of the Water System Improvement Program, Groundwater Conjunctive Use Project well installation and will be incorporated in the SFPUC's Westside Basin monitoring program. Permits, well construction details, lithologic logs and geophysical logs from these monitoring wells are presented in Appendix D.

Water level measurements for the wells screened within the Primary Production aquifer and monitored during the spring 2008 event [LMMW-6D, DC 1 (Westlake), Park Plaza MW-460, DC 8, SB-12, SS 1-02, and SSFLP MW-220] indicate that groundwater elevations were below sea level. Groundwater elevations ranged from -15.54 feet (LMMW-6D) to -185.23 feet (SB-12 Elm

Avenue) relative to mean sea level during the spring event. Groundwater elevation contours in the Primary Production aquifer for the spring 2008 event are presented on Figure 18. Groundwater elevations during the fall 2008 monitoring event indicate that elevations in these wells ranged from -19.84 feet (LMMW-6D) to –194.94 feet (SB-12 Elm Avenue). Groundwater elevation contours in the Primary Production aquifer for the fall 2008 event are presented on Figure 19. Groundwater elevation hydrographs for all the wells monitored during the spring and fall 2008 events are presented in Appendix A.

7.0 GROUNDWATER QUALITY MONITORING

Groundwater quality data for the Westside Basin are primarily from a combination of historical water quality analyses, mostly from municipal supply wells, and from the semi-annual monitoring program that was initiated throughout the basin in May 2000. The program has expanded to include additional wells as they have been constructed. Program wells are illustrated in Figure 21 and listed in Table 5, and they reflect the location of both production and dedicated monitoring wells. Results of groundwater quality monitoring in 2008 are presented below.

7.1 Coastal Groundwater Quality

Monitoring of groundwater levels and groundwater quality at the coastal monitoring wells located along the Great Highway near Kirkham, Ortega, and Taraval streets, and at the San Francisco Zoo, as well as in the southwestern portion of Golden Gate Park, is conducted to detect the potential for seawater intrusion. Groundwater samples from these wells were tested for specific conductance, total dissolved solids (TDS) and chloride in the spring and fall 2008. Results of groundwater quality testing for the coastal monitoring wells are presented in Table 6. Chloride concentrations and groundwater elevations in 2008, as well as records since the inception of coastal monitoring (2004), are plotted on hydrographs presented in Figures 6 through 9.

Chloride concentrations for 2008 ranged from 19 mg/l (SF#32-Ortega MW400) to 178 mg/l (SF#57-USGS South Windmill MW-57). Detected chloride concentrations in the coastal monitoring wells generally ranged from 19 mg/l to 69 mg/l, with the exception of the SF#57-USGS South Windmill MW-57, which had concentrations of 150 mg/l (spring 2008) and 178 mg/l (fall 2008). For the shallow coastal wells (screened between 50 to 150 feet), chloride concentrations ranged from 30 mg/l (SF#30-Grt Hyw/Ortega MW-125) to 178 mg/l (SF#57-USGS South Windmill MW-57) (Table 6).

The chloride concentrations measured in 2008 are within historical ranges at all the wells sampled, except for the USGS South Windmill MW-57 well. All chloride concentrations are below the state of California secondary drinking water standard of 250 mg/l and are also well below 500 mg/l, a commonly referenced concentration indicative of seawater intrusion. Although groundwater levels continue to be depressed below sea level in the deeper part of the aquifer system and chloride concentrations at the Zoo, and the USGS South Windmill MW-140 well located in the southwestern portion of Golden Gate Park are slightly higher than the other monitoring locations along the coast, none appear to be suggestive of seawater intrusion at the present time. The total dissolved solids (TDS) concentrations and specific conductance values in these wells are all within historical ranges and below established secondary drinking water standards.

The chloride, TDS and specific conductance values in the USGS South Windmill MW-57 well show an increase in concentration that may be an early indication of seawater intrusion. Efforts are underway between the SFPUC and the SF Recreation and Park Department to develop a recycled water supply for Golden Gate Park, and to distribute groundwater pumping further away from the coast.

7.2 General Basin Conditions

Groundwater quality is monitored in a network of production and monitoring wells as described above and illustrated in Figure 21. Groundwater samples were collected from wells used to assess general basin conditions in the spring (April, May, and June) 2008. The analytical results are summarized in Tables 7 and 8. With the exception of nitrate (as $N0_3$) concentrations detected in DC#01 - A St (Daly City) and one of the South San Francisco wells SS#08 - SS 1-19, groundwater quality generally meets the maximum contaminant levels (MCLs) of primary drinking water standards set by California Department of Public Health.

The South San Francisco Linear Park (SSFLP) wells (MW-120, 220, 440, and 520) were sampled and analyzed for iron and manganese in the spring and fall 2008. Detected total iron concentrations ranged from 0.013 mg/l (SSFLP MW-520) to 0.161 mg/l (SSFLP MW-120), while detected total manganese concentrations ranged from 0.147 mg/l (SSFLP MW-220) to 0.825 mg/l (SSFLP MW-120). In addition groundwater samples from the well cluster at the South San Francisco Linear Park were tested for dissolved iron and manganese. Detected dissolved iron concentrations ranged from 0.005 (SSFLP MW-520) to 0.063 mg/l (SSFLP MW-120). Detected dissolved manganese concentrations at these wells ranged from 0.139 mg/l (SSFLP MW-220) to 0.805 mg/l (SSFLP MW-120). Detected concentrations of total and dissolved manganese in these wells exceed the secondary MCL of 0.05 mg/l. Detected iron and manganese concentrations are summarized on Table 8.

The 2008 water quality results for specific conductance, TDS, and chloride for Daly City well (DC#11 – Westlake DC2), South San Francisco well SS#08 - SS 1-19 , and San Bruno well SB#06 - SB-17 Corporation Yard are combined with available historical data and illustrated in Figures 22 through 24, respectively. South San Francisco well SS#05 – SS 1-14, which is typically sampled as part of the monitoring program, was offline. Production well SS#08 – SS 1-19 located within the same well field was sampled instead. Results from this well have been appended to the historical data available from SS 1-14 and are presented in Figure 23 and 25. The 2008 and historical nitrate data for the above wells and the Vale well (Daly City) are illustrated in Figure 25.

7.2.1 City of Daly City

In Daly City, the available data extend back to the mid 1970's (Table 7 and Figures 22 and 25), but are too sporadic to derive any substantive conclusions about trends or changes. During the spring 2008 monitoring event, detected nitrate concentrations ranged from 10 mg/l in DC#06 - Jefferson to 131 mg/l in DC#01 - A St. Nitrate concentrations in DC#01 - A St exceeded the primary MCL of 45 mg/l. With the exception of well DC#06- Jefferson, which remained essentially unchanged (from 9.4 to 10 mg/l), detected nitrate concentrations decreased slightly with respect to the 2007 sampling results in three of the four wells sampled during this event. Specific conductance increased slightly in three of the four wells sampled compared to 2007 levels. Chloride concentrations ranged from 56 mg/l (DC#06-Jefferson) to 122 mg/l (DC#11 Westlake DC 2). Except for DC#06- Jefferson, which showed a decrease from 80 to 56 mg/l, detected chloride concentrations increased slightly in all of the Daly City wells sampled during this event. Ongoing monitoring will delineate whether the recent data are indicative of changing, temporary, or anomalous conditions in that area. The monitoring program will continue to examine these trends in subsequent events.

7.2.2 City of South San Francisco

For the South San Francisco area, records from Cal Water date back to the late 1950's (Table 7 and Figures 23 and 25). Chloride concentrations for the spring 2008 monitoring event ranged from 63 mg/l (SSFLP 440) to 176 mg/l (SSFLP 120). Chloride concentrations in the South San Francisco area, have consistently been higher than elsewhere in the basin. Historically specific conductance and TDS concentrations in well SS#05 SS 1-14 have fluctuated more than chloride and appeared to exhibit a generally upward trend since the 2000 monitoring event. During the 2008 spring monitoring event, wells SS#05-SS1-14, and SS#10-SS1-21 were undergoing repair and consequently were not sampled. Two other production wells SS #08-SS 1-19 and SS #09-SS 1-20 located in the same well field, were sampled in their place. The specific conductance at the two production wells sampled in South San Francisco during the spring 2008 monitoring event was 993 µmhos/cm (SS#08 – SS 1-19) and 863 µmhos/cm (SS#09 – SS 1-20). Analysis detected 47 mg/l (SS#08 – SS 1-19) and 35 mg/l (SS#09 – SS 1-20) of nitrate respectively. The detected nitrate concentration at well SS#08 – SS 1-19 is slightly above the primary MCL of 45 mg/l (Table 7). Ongoing monitoring will delineate whether the recent data are indicative of changing, temporary, or anomalous conditions in that area.

7.2.3 City of San Bruno

In San Bruno, available groundwater quality data extend back to 2000 (Table 7, Figures 24 and 25). Interpretation of the records since 2000 (Figure 24) suggests fairly constant conditions. For 2008, chloride concentrations were 57 mg/l and 84 mg/l at SB 17 Corporation Yard and SB 20

Lions Field Park, respectively. Reported chloride concentrations increased slightly at the SB-17 well and decreased at the Lions Field Park well, but remained within historical ranges. The nitrate concentrations were 6 mg/l and 1 mg/l in SB-17 and SB 20, respectively. Detected nitrate concentrations in the two wells sampled during the spring 2008 event are well below the primary MCL of 45 mg/l (Table 7 and Figure 25). At present, we understand that the City of San Bruno is treating groundwater pumped from well SB#08 - SB 20 for manganese.

As part of the City of San Bruno's Bay side monitoring program, the two well clusters installed in 2006 were sampled by WRIME, Inc in August 2008. A summary of chemical testing results was provided by WRIME Inc on behalf of the City of San Bruno (Figure 7). Chloride concentrations and groundwater elevations beginning in 2006 for the Burlingame and SFO wells are plotted on hydrographs presented in Figures 10 and 11 respectively.

7.3 Recycled Water

The initiation of recycled water deliveries in 2004 for golf course irrigation around Lake Merced, which resulted in meeting about most of irrigation demand at the private courses in 2008, had raised a question regarding potential impact of recycled water application on the underlying groundwater. Initial evaluation of this question in 2005 consisted of a comparison between recycled water quality and background (current) groundwater quality in monitoring wells near the golf courses. Groundwater monitoring of these four wells continued in 2008. Available data on recycled water quality collected in 2005, and nearby dedicated monitoring wells sampled at least annually between 2004 and 2008, are presented in Table 9. Based on comparison of those data, the water quality of recycled water and groundwater is sufficiently similar that no substantial change in groundwater quality would appear to be expected as a result of recycled water application. For the available data, constituent concentrations in the recycled water are within, or slightly higher than, those in the underlying groundwater (Table 9). Ongoing monitoring of recycled water quality and underlying groundwater will permit interpretation of changes that may occur in the future.

8.0 SUMMARY AND PROPOSED ACTIVITIES FOR 2009

This report is the annual report on groundwater conditions in the Westside Basin, prepared by the SFPUC in cooperation with Daly City, San Bruno, and Cal Water (cooperating agencies).

8.1 Groundwater Monitoring

The groundwater monitoring and reporting program will continue to be implemented in accordance with the recommendations presented in the 2005 annual report (LSCE, 2006). Semi annual sampling and various water level measurements will be conducted in 2009 to assess general groundwater conditions in the Westside Basin, as well as to continue to evaluate the adequacy of the entire program. In 2009, the cooperating agencies will assess the need for expanding the monitoring program within the southern part of the Basin, and continue to incorporate water level elevation and water quality data from any future wells installed within these jurisdictions (e.g. the five new well clusters installed in October 2008 in the southern portion of the basin as part of the Conjunctive Use Project). The scope and frequency of the groundwater monitoring program are presented on Tables 10 and 11.

8.2 Coastal Monitoring

Continued semi-annual monitoring of coastal water quality (primarily TDS, specific conductance, and chloride) conducted during the spring and fall (Table 11) will be coupled with quarterly-to-daily water level measurements from the existing coastal monitoring well locations (Table 10).

8.3 Lake Merced

For 2009 the existing monitoring program at Lake Merced will be continued, with collection of lake level data from South Lake and Impound Lake in accordance with recommendations of the 2005 annual report. Groundwater measurements will be recorded daily and quarterly in accordance with the current program (Table 10). More frequent measurements may be appropriate as part of any artificial water additions to the lake or aquifer hydraulic testing. Such changes will be implemented as necessary.

8.4 General Basin Conditions and In-Lieu Conjunctive Use Program

The SFPUC will continue to monitor daily water levels of key wells in the Daly City, South San Francisco, and San Bruno areas (Table 10), along with annual water quality monitoring (Table 11). In the southern portion of the Westside Basin, there remains a need for quantification of pumping at the cemeteries in Colma and at the California Country Club, to complete the current understanding of significant pumping in the Westside Basin.

8.5 Recycled Water Program

SFPUC will continue monitoring recycled water quality and groundwater quality in the areas of recycled water use on an annual basis (Table 11). Although initial data show recycled water quality and groundwater quality to be fairly similar, continued monitoring will provide data to evaluate whether any trends develop as a result of the use of recycled water for irrigation purposes. For 2009, we will add testing for nitrate as $N0_3$ to the monitoring of groundwater quality in areas of planned recycled water use (e.g. LMMW -2S and LMMW-2D located at the Harding Park Golf Course in San Francisco).

8.6 Bay Side Monitoring

The City of San Bruno will continue to monitor the Bay Side wells in the southeastern portion of the Westside Basin on a semi-annual basis, in general accordance with the Westside Basin monitoring program and transmit this data to the SFPUC for inclusion in the annual groundwater monitoring reports.

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APPENDIX B SFPUC AGENDA ITEM FOR APPROVAL OF THE WATER SYSTEM IMPROVEMENT PROJECT OCTOBER 31, 2008

AGENDA ITEM
Public Utilities Commission
City and County of San Francisco

DEPARTMENT Water Enterprise AGENDA NO. __________

MEETING DATE October 30, 2008

SUMMARY OF PROPOSED COMMISSION ACTION

Approve the Phased Water System Improvement Program (Phased WSIP) Goals and Objectives and **Adopt** California Environmental Quality Act (CEQA) Findings, including a statement of overriding considerations and the Mitigation Monitoring and Reporting Program (MMRP).

DESCRIPTION OF ACTION

Program Approval

The Phased WSIP is a variant of the originally proposed WSIP and includes full implementation of the WSIP facility projects to ensure that the public health, water quality, seismic safety, and delivery reliability goals are achieved, with phased implementation of the water supply portion of the program. Under the Phased WSIP, the SFPUC will establish an interim, mid-term implementation horizon of 2018. The Phased WSIP includes water supply delivery to wholesale and retail customers through 2018.

The Phased WSIP goals and objectives are founded on two fundamental principles pertaining to the existing regional water system: (1) maintain a clean, unfiltered water source from the Hetch Hetchy system and (2) maintain a gravity-driven system.

The overall goals of the Phased WSIP for the regional water system are to:

- Maintain high-quality water and a gravity-driven system
- Reduce vulnerability to earthquakes
- Increase delivery reliability
- Meet customer water supply needs
- Enhance sustainability
- Achieve a cost-effective, fully operational system

APPROVAL:

PERFORMING ORGANISATION		FINANCE	Todd Rydstrom
COMMISSION SECRETARY	Michael Housh	GENERAL MANAGER	Ed Harrington

A table presenting the Phased WSIP goals and objectives as they relate to the program goals is included in the Resolution for this action. The system performance objectives describe and, in some cases, more specifically quantify, what the regional water system proposes to achieve under the Phased WSIP. The performance objectives guide the water supply actions, facility improvements, operations, and maintenance requirements included in the Phased WSIP.

To meet the program goals and objectives the Phased WSIP includes the following program elements:

- Full implementation of WSIP facility improvement projects.
- Water supply delivery to regional water system customers through 2018 with an average annual target delivery of 265 mgd originating from the watersheds. This includes 81 mgd for the retail customers and 184 mgd for the wholesale customers.
- Water supply sources include: 265 mgd average annual delivery from the Tuolumne River watershed and the local watersheds plus 20 mgd of conservation, recycled water, and groundwater developed in the service area (10 mgd retail; 10 mgd wholesale).
- Implementation of delivery and drought reliability elements of the WSIP, including dry-year water transfers coupled with the Westside Groundwater Basin Conjunctive Use project, will meet the drought-year goal of limiting rationing to no more than 20 percent on a systemwide basis.
- Reevaluation of 2030 demand projections, potential regional system demand (purchase requests), and water supply options by 2018, and SFPUC decision in 2018 regarding regional water system deliveries after 2018.
- Financial incentives to limit water sales to an average annual amount of 265 mgd from the SFPUC watersheds.

Adoption of CEQA Findings

The City Planning Department prepared and the Planning Commission will be asked to certify on October 30, 2008, a Program Environmental Impact Report (PEIR) for the WSIP as required under CEQA, the CEQA Guidelines and Chapter 31 of the San Francisco Administrative Code. In order to comply with CEQA requirements, as part of the approval of the WSIP, the Commission must adopt the CEQA Findings, including a statement of overriding considerations, and the MMRP, attached to the Resolution as Attachments A and B, respectively.

The Final PEIR (consisting of the Draft PEIR and the Comments and Responses document) identified potentially significant impacts resulting from water supply and system operations and construction of WSIP facility improvement projects. The potentially significant impacts that would result from implementation of the recommended Program, or the "Phased WSIP" are described in Chapter 13 of the Final PEIR and are included in the Findings. The Final PEIR identified mitigation measures to substantially reduce or eliminate many of the significant impacts identified in the PEIR. The CEQA Findings provide for adoption of the mitigation measures by the SFPUC and the MMRP provides information and allocates responsibility for implementing all of the mitigation measures proposed in the Final PEIR for the Phased WSIP.

Significant and unavoidable impacts are described in Section IV of the CEQA Findings attached to the Commission Resolution as Attachment A. Therefore, this Commission will need to adopt a Statement of Overriding Considerations, included in the CEQA Findings Section VI, explaining why the Commission has decided to approve the Phased WSIP notwithstanding these significant and unavoidable environmental impacts.

RECOMENDATION

SFPUC staff recommends that the Commission approve the Phased WSIP Goals and Objectives and adopt the CEQA Findings, including the statement of overriding considerations, and the MMRP.

CONTEXT OF THIS ACTION

The SFPUC began development of the Water System Improvement Program (WSIP) in the late 1990's through a series of studies, reports, and authorizations. In 1998, the SFPUC initiated a water supply planning effort, culminating in the Water Supply Master Plan (WSMP), issued in April 2000. The WSMP recommended a water resource strategy of demand management, facilities improvements, and development of additional supplies. Concurrent with the WSMP efforts, reliability studies of the water system facilities were performed to assess their vulnerability to earthquakes, landslides, fire, flood, and power outages.

These efforts led to the preparation of a Long-Term Strategic Plan for Capital Improvements, a Long-Range Financial Plan, and a Capital Improvement Program, approved and adopted by the San Francisco Public Utilities Commission on May 28, 2002 under Resolution No. 02-0101. The Capital Improvement Program identified 37 regional water system projects and 40 local (in-City) projects. The resolution authorized and directed the General Manager (GM) of the SFPUC to proceed with development and implementation of the strategic and financial plans, as well as the capital improvement program with such additions or changes as the GM and Commission deemed necessary or desirable.

Planning efforts for the Water System Improvement Program gained momentum in 2002 with the passage of Propositions A and E, San Francisco ballot measures that approved financing for water system improvements and long-term stewardship of the public utilities. Specifically, Proposition A was a revenue bond authorizing the City of San Francisco to borrow money to pay for improvements to its water system. The improvements cited in the bond measure included: upgrading and retrofitting the system's infrastructure against earthquake damage; upgrading the regional system's ability to store and convey water to the Bay Area; ensuring future water quality standards are met; and increasing water system capacity.

Proposition E was a charter amendment related to Proposition A that reinforced the SFPUC's charge to rehabilitate the aging water system in order to ensure reliable water delivery in the future and provided the agency the ability to finance the improvements. Proposition E's goals and objectives included clauses maintaining SFPUC's stewardship of the system as well as the requirements to provide reliable water, optimize the system's ability to withstand disasters, and improve drinking water quality. In addition, the charter amendment required the development of long-term capital, financial, and strategic plans to ensure accountability by the SFPUC, ensuring that the utility is being operated efficiently in accordance with best public utility practices. Prior to the ballot measures, the SFPUC prepared long-term capital, financial, and strategic plans, which were adopted on May 28, 2002. These initiatives provided the impetus to move the WSIP forward, founding the system performance objectives in the water system reliability requirements of Proposition E.

Also in 2002, the state legislature approved three bills reflecting wholesale customer concerns over risk of failure of the water system in a major earthquake. Governor Davis approved these bills in September of 2002, including Assembly Bill No. 1823, the Wholesale Regional Water System Security and Reliability Act.

Additional studies refined the scope and magnitude of the Water System Improvement Program since completion of the WSMP. A November 2004 technical report on wholesale customer water demand projections updated 2030 planning horizon demands. A 2004 analysis of system performance under various operating conditions also assessed the effectiveness of the proposed regional water projects to meet program objectives. Concurrently, development of a draft regional operational strategy/principles document delineated current and future system operating goals, constraints, and strategies.

From October 2004 to January 2005, the Commission held a series of public workshops to present these studies. At the final workshop the Commission provided direction on system performance objectives for the program. Based upon the system performance objectives the scope, schedule, and budget of the program were refined, allowing the San Francisco Public Utilities Commission (SFPUC) to provide a description of the Water System Improvement Program. On February 28, 2005, the SFPUC endorsed the WSIP.

Subsequently, the San Francisco Planning Department prepared the PEIR to evaluate the potential environmental effects of the WSIP pursuant to and in accordance with California Public Resources Code Sections 21000 et. Seq. (CEQA), Title 14 of the California Code of Regulations Sections 15000 et. seq. (CEQA Guidelines) and the provisions of Chapter 31 of the San Francisco Administrative Code. Attachment A to the Commission's Resolution approving the Program contains detailed information about the CEQA process and preparation of the PEIR.

During the environmental review process, the SFPUC and the Planning Department received many comments expressing strong concern about, and opposition to, a decision now to divert more water from the SFPUC watersheds. The SFPUC staff considered carefully those concerns and the long term needs of the water system, including the customers' needs as well as protection of natural resources. In order to accomplish urgently needed physical rehabilitation and maintenance of the system and to improve asset management and delivery reliability now, the SFPUC staff recommends immediate implementation of all of the WSIP facility improvement projects. In order to carefully consider the long term decision of whether to divert more water from the watersheds, the SFPUC staff believes that the water supply decision should now be a limited one for the next 10 years and then the SFPUC will reconsider the long term water supply decision by 2018. In the next 10 years, the SFPUC will explore and develop other water supply options, including conservation, recycling and groundwater programs.

The Phased WSIP Variant facility improvement projects remain the same irrespective of the water supply decision now and in 2018. To meet the system performance objectives for water quality, seismic reliability and delivery reliability, the SFPUC must implement the Phased WSIP Variant facility improvement projects that provide physical system capacities to meet the performance objectives. Design of WSIP project facilities is driven by all four of the program goals -- the need to improve system performance for seismic reliability and water delivery reliability as well as maintaining high water quality standards and meeting water supply goals. All four of these goals are factored in to the decision on how to size the WSIP's individual facilities. The SFPUC must move forward with the WSIP facilities as proposed, to meet average demand of up to 300 mgd, in order to improve seismic and water delivery reliability, meet current and future water quality regulations, provide for additional system conveyance for maintenance and meet water supply reliability goals for year 2030 and possibly beyond. The SFPUC must consider current needs as well as possible future changes and unplanned outages and design a system that achieves a balance among the numerous objectives, functions and risks a water supplier must face.

The Phased WSIP Variant also includes implementation of delivery and drought reliability elements of the WSIP, including dry-year water transfers coupled with the Westside Groundwater Basin Conjunctive Use project, to meet the drought-year goal of limiting rationing to no more than 20 percent on a systemwide basis. While average annual deliveries from the SFPUC watersheds would be limited to 265 mgd such that there would be no increase in diversions from the Tuolumne River to serve additional demand, there would be a small increase in average annual Tuolumne River diversions of about 2 mgd over existing conditions in order to meet the delivery and drought reliability elements through 2018.

ATTACHMENTS:

SFPUC Resolution
Attachment A – CEQA Findings
Attachment B – Mitigation and Monitoring Reporting Program

Contact: Michael Carlin, Assistant General Manager
Water Enterprise

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. ____________________

WHEREAS, the San Francisco Public Utilities Commission approved and adopted a Long-Term Strategic Plan for Capital Improvements, a Long-Range Financial Plan, and a Capital Improvement Program on May 28, 2002 under Resolution No. 02-0101; and

WHEREAS, the San Francisco Public Utilities Commission determined the need for the Water System Improvement Program (WSIP) to address water system deficiencies including aging infrastructure, exposure to seismic and other hazards, maintaining water quality, improving asset management and delivery reliability, and meeting customer demands; and

WHEREAS, Propositions A and E passed in November 2002 by San Francisco voters and Assembly Bill No. 1823 was also approved in 2002 requiring the City and County of San Francisco to adopt a capital improvement program designed to restore and improve the regional water system; and

WHEREAS, the San Francisco Public Utilities Commission staff developed a variant to the WSIP referred to as the Phased WSIP; and

WHEREAS, the two fundamental principles of the program are 1) maintaining a clean, unfiltered water source from the Hetch Hetchy system, and 2) maintaining a gravity-driven system; and

WHEREAS, the overall goals of the Phased WSIP for the regional water system include 1) Maintaining high-quality water and a gravity-driven system, 2) Reducing vulnerability to earthquakes, 3) Increasing delivery reliability, 4) Meeting customer water supply needs, 5) Enhancing sustainability, and 6) Achieving a cost-effective, fully operational system; and

WHEREAS, on October 30, 2008, the Planning Commission reviewed and considered the Final Program Environmental Impact Report (PEIR) in Planning Department File No. 2005.0159E, consisting of the Draft PEIR and the Comments and Responses document, and found that the contents of said report and the procedures through which the Final PEIR was prepared, publicized and reviewed complied with the provisions of the California Environmental Quality Act (CEQA), the CEQA Guidelines and Chapter 31 of the San Francisco Administrative Code ("Chapter 31") and found further that the Final PEIR reflects the independent judgment and analysis of the City and County of San Francisco, is adequate, accurate and objective, and that the Comments and Responses document contains no significant revisions to the Draft PEIR, and certified the completion of said Final PEIR in compliance with CEQA, the CEQA Guidelines and Chapter 31 in its Motion No. _____; and

WHEREAS, this Commission has reviewed and considered the information contained in the Final PEIR, all written and oral information provided by the Planning

Department, the public, relevant public agencies, SFPUC and other experts and the administrative files for the WSIP and the PEIR; and

WHEREAS, the WSIP and Final PEIR files have been made available for review by the San Francisco Public Utilities Commission and the public, and those files are part of the record before this Commission; and

WHEREAS, San Francisco Public Utilities Commission staff prepared proposed findings, as required by CEQA, (CEQA Findings) and a proposed Mitigation, Monitoring and Reporting Program (MMRP), which material was made available to the public and the Commission for the Commission's review, consideration and action; and

WHEREAS, the Phased WSIP includes the following program elements: 1) full implementation of all WSIP facility improvement projects; 2) water supply delivery to regional water system customers through 2018; 3) water supply sources (265 million gallons per day (mgd) average annual from SFPUC watersheds, 10 mgd conservation, recycled water, groundwater in San Francisco, and 10 mgd conservation, recycled water, groundwater in the wholesale service area); 4) dry-year water transfers coupled with the Westside Groundwater Basin Conjunctive Use project to ensure drought reliability; 5) re-evaluation of 2030 demand projections, regional water system purchase requests, and water supply options by 2018 and a separate SFPUC decision by 2018 regarding water deliveries after 2018; and, 6) provision of financial incentives to limit water sales to an average annual 265 mgd from the SFPUC watersheds through 2018; and

WHEREAS, the SFPUC staff has recommended that this Commission make a water supply decision only through 2018, limiting water sales from the SFPUC watersheds to an average annual of 265 mgd; and

WHEREAS, before 2018, the SFPUC would engage in a new planning process to re-evaluate water system demands and water supply options. As part of the process, the City would conduct additional environmental studies and CEQA review as appropriate to address the SFPUC's recommendation regarding water supply and proposed water system deliveries after 2018; and

WHEREAS, by 2018, this Commission will consider and evaluate a long-term water supply decision that contemplates deliveries beyond 2018 through a public process; and

WHEREAS, the SFPUC must consider current needs as well as possible future changes, and design a system that achieves a balance among the numerous objectives, functions and risks a water supplier must face, including possible increased demand in the future; now, therefore, be it

RESOLVED, this Commission hereby adopts the CEQA Findings, including the Statement of Overriding Considerations, attached to this Resolution as Attachment A and incorporated herein as part of this Resolution by this reference thereto, and adopts the Mitigation Monitoring and Reporting Program attached to this Resolution as Attachment B and incorporated herein as part of this Resolution by this reference thereto; and, be it

FURTHER RESOLVED, this Commission hereby approves a water system improvement program that would limit sales to an average annual of 265 mgd from the watersheds through 2018, and the SFPUC and the wholesale customers would collectively develop 20 mgd in conservation, recycled water, and groundwater to meet demand in 2018, which includes 10 mgd of conservation, recycled water, and groundwater to be developed by the SFPUC in San Francisco, and 10 mgd to be developed by the wholesale customers in the wholesale service area; and, be it

FURTHER RESOLVED, As part of the Phased WSIP, this Commission hereby approves implementation of delivery and drought reliability elements of the WSIP, including dry-year water transfers coupled with the Westside Groundwater Basin Conjunctive Use project, which meets the drought-year goal of limiting rationing to no more than 20 percent on a system-wide basis; and, be it

FURTHER RESOLVED, This Commission hereby approves the Phased Water System Improvement Program, which includes seismic and delivery reliability goals that apply to the design of system components to improve seismic and water delivery reliability, meet current and future water quality regulations, provide for additional system conveyance for maintenance and meet water supply reliability goals for year 2018 and possibly beyond; and, be it

FURTHER RESOLVED, This Commission hereby approves the following goals and objectives for the Phased Water System Improvement Program:

Phased WSIP GOALS AND OBJECTIVES

Program Goal	System Performance Objective
Water Quality – *maintain high water quality*	• Design improvements to meet current and foreseeable future federal and state water quality requirements. • Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filtered water from local watersheds. • Continue to implement watershed protection measures.
Seismic Reliability – *reduce vulnerability to earthquakes*	• Design improvements to meet current seismic standards. • Deliver basic service to the three regions in the service area (East/ South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for design of the regional system is 229 mgd. The performance objective is to provide delivery to at least 70 percent of the turnouts in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco, respectively. • Restore facilities to meet average-day demand of up to 300 mgd within 30 days after a major earthquake.

Program Goal	System Performance Objective
Delivery Reliability – *increase delivery reliability and improve ability to maintain the system*	• Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service. • Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages. • Provide operational flexibility and system capacity to replenish local reservoirs as needed. • Meet the estimated average annual demand of up to 300 mgd under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.
Water Supply – *meet customer water needs in non-drought and drought periods*	• Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during non -drought years for system demands through 2018. • Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts. • Diversify water supply options during non-drought and drought periods. • Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.
Sustainability – *enhance sustainability in all system activities*	• Manage natural resources and physical systems to protect watershed ecosystems. • Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat. • Manage natural resources and physical systems to protect public health and safety
Cost-effectiveness – *achieve a cost-effective, fully operational system*	• Ensure cost-effective use of funds. • Maintain gravity-driven system. • Implement regular inspection and maintenance program for all facilities.

And, be it

FURTHER RESOLVED, This Commission authorizes and directs SFPUC staff to design and develop WSIP facility improvement projects consistent with the Phased WSIP Goals and Objectives.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of October 30, 2008

____

Secretary, Public Utilities Commission

APPENDIX C SFPUC WATER SYSTEM IMPROVEMENT PROJECT INFORMATION (PEIR SUMMARY; APRIL TO JULY QUARTERLY REPORT AND WSIP PROGRESS TO DATE)

SUMMARY

Sections	Figures	Tables
S.1 Introduction and Purpose of the PEIR S.2 Program Description S.3 Environmental Effects S.4 Areas of Controversy and Issues to be Resolved S.5 Required Actions and Approvals S.6 WSIP Variants S.7 Alternatives to the Proposed Program	S.1 Overview of SFPUC Regional System and Water Supply Watersheds S.2 SFPUC Water Service Area – San Francisco and SFPUC Wholesale Customers S.3 Annual Average Historical and Projected Customer Purchase Requests S.4 WSIP Water Supply Sources, Nondrought Years S.5 WSIP Water Supply Sources, Drought Years S.6a Location of WSIP Facility Improvement Projects – Sunol Valley, Bay Division, Peninsula, and San Francisco Regions S.6b Location of WSIP Facility Improvement Projects – San Joaquin Region S.6c Location of WSIP Facility Improvement Projects – Hetch Hetchy Region S.7 Preliminary WSIP Construction Schedule	S.1 WSIP Goals and Objectives S.2 WSIP Facility Improvement Projects S.3 Summary of WSIP Facility Construction and Operation Impacts S.4 Summary of Facility Mitigation Measures by Impact S.5 Summary of Water Supply Impacts and Mitigation Measures – Tuolumne River System and Downstream Water Bodies S.6 Summary of Water Supply Impacts and Mitigation Measures – Alameda Creek Watershed S.7 Summary of Water Supply Impacts and Mitigation Measures – Peninsula Watersheds S.8 Summary of Water Supply Impacts and Mitigation Measures – Westside Groundwater Basin S.9 Summary of Water Supply Impacts and Mitigation Measures – Cumulative Water Supply

S.1 Introduction and Purpose of the PEIR (Chapter 1)

The San Francisco Public Utilities Commission (SFPUC) proposes to adopt and implement the Water System Improvement Program (WSIP or proposed program) to increase the reliability of the regional water system that serves 2.4 million people in San Francisco and the San Francisco Bay Area. The WSIP would improve the regional system with respect to water quality, seismic response, water delivery, and water supply to meet water delivery needs in the service area through the year 2030 and would establish level of service goals and system performance objectives. The WSIP would implement a proposed water supply option, modify system operations, and construct a series of facility improvement projects. The proposed program area spans seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco.

The San Francisco Planning Department, Major Environmental Analysis (MEA) Division, determined that implementation of the WSIP could have a significant effect on the environment and therefore required preparation of a Program Environmental Impact Report (PEIR) in compliance with the California Environmental Quality Act (CEQA). This PEIR is intended to provide the public and responsible and trustee agencies with information about the potentially significant environmental effects of the proposed program, to identify possible ways to minimize the potentially significant effects, and to describe and evaluate feasible alternatives to the proposed program.

S.2 Program Description (Chapter 3)

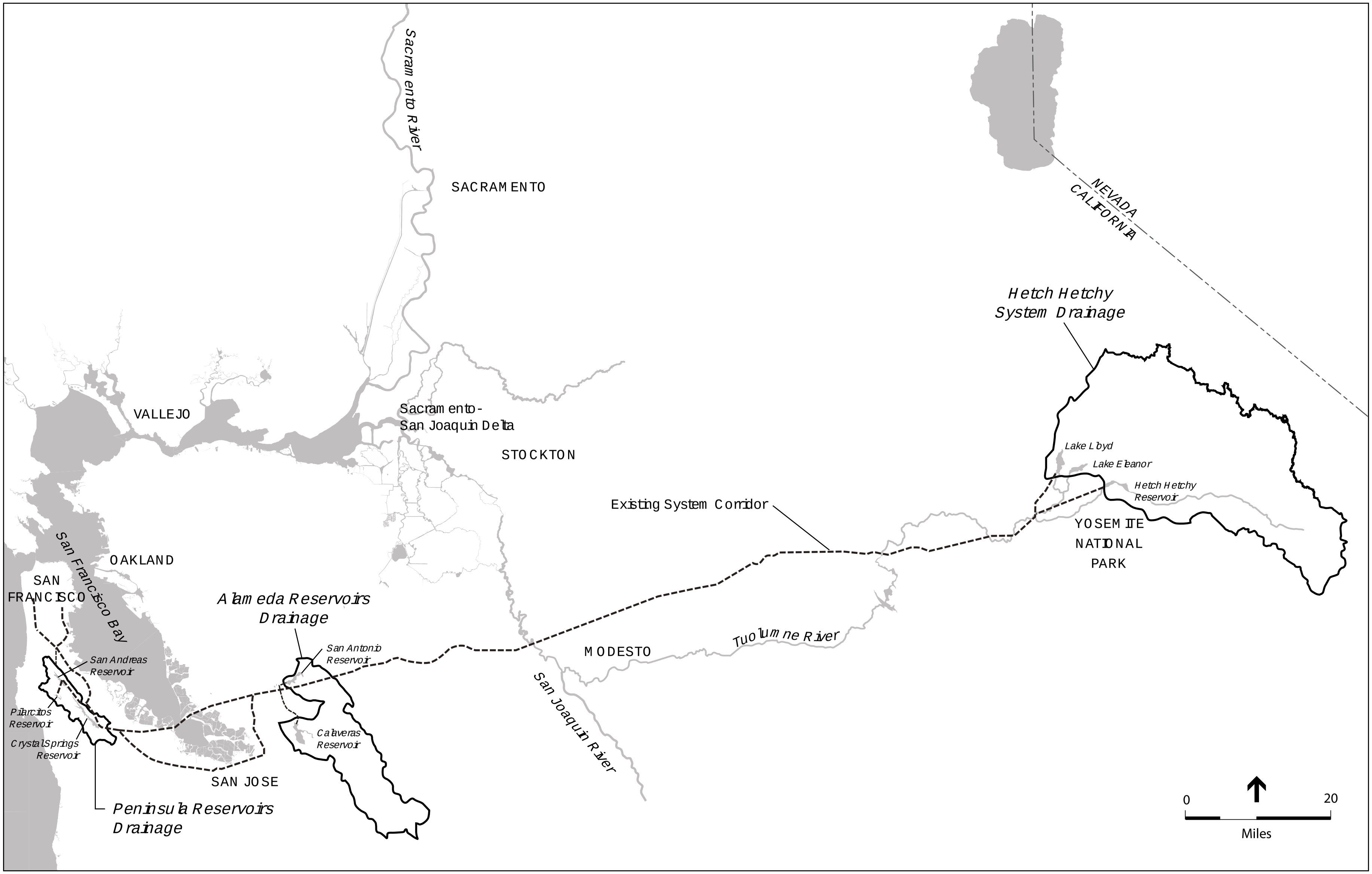
Need for and Objectives of the Program

The City and County of San Francisco (CCSF), through the SFPUC, owns and operates a regional water system that extends from the Sierra Nevada to San Francisco and serves retail and wholesale customers in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties. The existing regional system includes over 280 miles of pipelines, over 60 miles of tunnels, 11 reservoirs, 5 pump stations, and 2 water treatment plants. The SFPUC currently delivers an annual average of about 265 million gallons per day (mgd) of water to its customers. The source of the water supply is a combination of local supplies from streamflow and runoff in the Alameda Creek watershed and in the San Mateo and Pilarcitos Creeks watersheds (referred to together as the Peninsula watersheds), augmented with imported supplies from the Tuolumne River watershed. Local watersheds provide about 15 percent of total supplies and the Tuolumne River provides the remaining 85 percent. **Figure S.1** shows the general location of the SFPUC regional system and water supply watersheds.

The SFPUC serves about one-third of its water supplies directly to retail customers, primarily in San Francisco, and about two-thirds of its water supplies to wholesale customers by contractual agreement. The wholesale customers are largely represented by the Bay Area Water Supply and Conservation Agency (BAWSCA), which consists of 27 total customers, shown in **Figure S.2**. Some of these wholesale customers have other sources of water in addition to what they receive from the SFPUC regional system, while others rely completely on the SFPUC for supply.

While the SFPUC has historically met and is currently serving its customers' water demands, there are numerous factors contributing to the need for a comprehensive, systemwide program such as the WSIP. In order to continue to provide reliable water service to its customers, the SFPUC must plan for the future as well as address existing, known deficiencies, including the following:

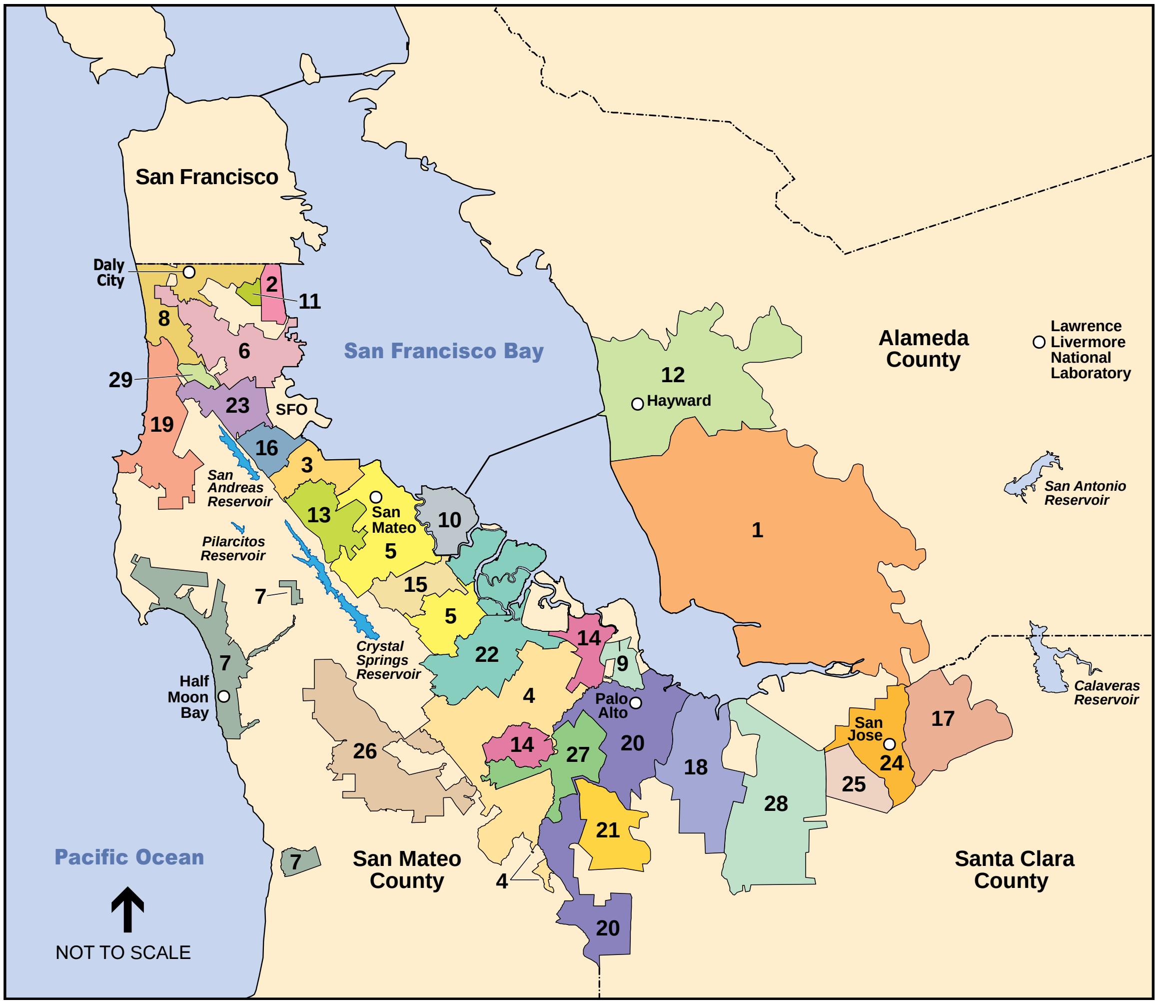
- *Aging Infrastructure*. Many of the components of the SFPUC regional water system were built in the 1800s and early 1900s. As the system ages, its reliability decreases and the risk of failure increases.



SOURCE: ESA + Orion

SFPUC Water System Improvement Program . 203287

Figure S.1
Overview of SFPUC Regional Water System and Water Supply Watersheds



Legend

(Wholesale customers and members of Bay Area Water Supply and Conservation Agency)

1 Alameda County Water District
2 City of Brisbane
3 City of Burlingame
4 CWS – Bear Gulch
5 CWS – Mid-Peninsula
6 CWS – South San Francisco
7 Coastside County Water District
8 City of Daly City
9 City of East Palo Alto
10 Estero Municipal Improvement District
11 Guadalupe Valley Municipal Improvement District
12 City of Hayward
13 Town of Hillsborough
14 City of Menlo Park
15 Mid-Peninsula Water District
16 City of Millbrae
17 City of Milpitas
18 City of Mountain View
19 North Coast County Water District
20 City of Palo Alto
21 Purissima Hills Water District
22 City of Redwood City
23 City of San Bruno
24 City of San Jose (North)
25 City of Santa Clara
26 Skyline County Water District
27 Stanford University
28 City of Sunnyvale
29 Westborough Water District

NOTE: For the purposes of this PEIR, the California Water Service (CWS) Company is a single wholesale customer with three different water service districts.

SOURCE: BAWSCA, 2006a

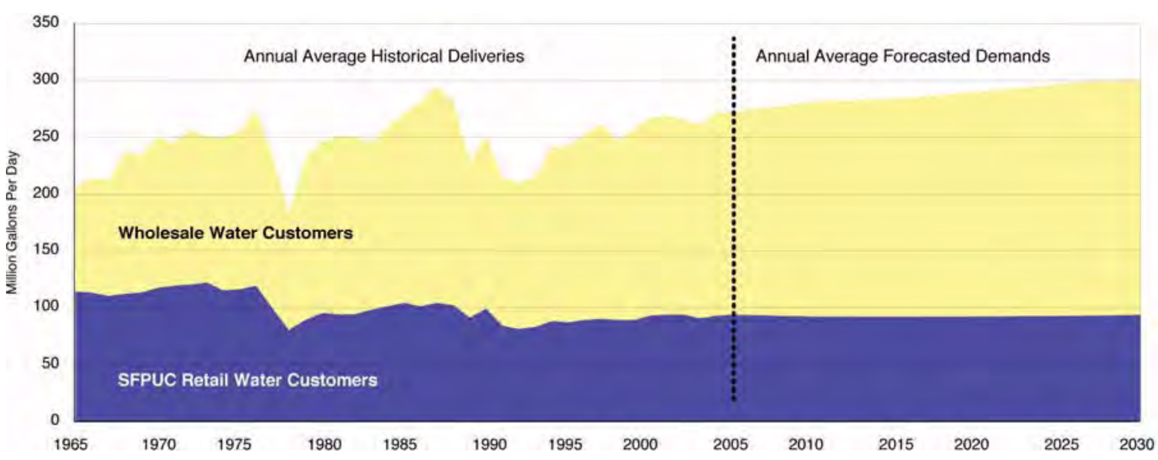
Figure S.2
SFPUC Water Service Area -
San Francisco and SFPUC Wholesale Customers

- *Exposure to Seismic and Other Hazards*. The system crosses five active earthquake faults, and many of the existing facilities do not meet modern seismic standards. The California Division of Safety of Dams (DSOD) imposed operating restrictions on two of the system's reservoirs, Calaveras and Lower Crystal Springs Reservoirs, due to seismic and flood control safety hazards, respectively. The restricted operations at these reservoirs reduce local storage capacity and impair normal system operations.

- *Water Quality*. The regional system currently meets or exceeds existing water quality standards. However, system upgrades are needed to improve the SFPUC's ability to maintain compliance with current water quality standards and to meet anticipated future water quality standards.

- *Delivery Reliability*. The system requires additional redundancy (i.e., backup) of some critical facilities to ensure sufficient operational flexibility to carry out adequate system inspection and maintenance and to be adequately prepared in the event of an earthquake, system failure, or other emergency. These critical facilities are necessary to meeting day-to-day customer water supply needs, and increased operational flexibility is needed in order to maintain service to all customers during a full range of operating conditions.

- *Customer Water Demand*. The regional system currently has insufficient water supply to meet customer demand during a prolonged drought, and this situation will worsen in the future without the WSIP. Additional supplies are needed to satisfy current demand in drought years as well as to meet future demand. Water demand among SFPUC retail and wholesale customers is projected to increase over the next 25 years, from an average annual demand of about 366 mgd to 417 mgd in 2030. Of this total projected demand in the SFPUC service area, retail and wholesale customers would purchase an annual average of about 300 mgd from the SFPUC system in 2030, compared to 265 mgd in 2005, as shown in **Figure S.3**. Thus, the SFPUC would need to provide additional water supplies to serve a projected average annual increase in purchase requests of 35 mgd by 2030.



SFPUC Water System Improvement Program ■ 203287

SOURCE: SFPUC, 2007b

Figure S.3
Annual Average Historical and
Projected Future Customer Purchase Requests

To address these challenges, the SFPUC must replace or upgrade numerous system facilities, add some new facilities, and expand its water supply portfolio—thus the need for the WSIP. In 2005, the SFPUC developed goals and objectives for the WSIP based on a planning horizon through 2030. The goals and objectives are founded on two fundamental principles pertaining to the existing regional water system: (1) maintaining a clean, unfiltered water source from the Hetch Hetchy system, and (2) maintaining a gravity-driven system. The overall goals of the WSIP are to:

- Maintain high-quality water
- Reduce vulnerability to earthquakes
- Increase delivery reliability and improve the ability to maintain the system
- Meet customer water supply purchase requests in nondrought and drought periods
- Enhance sustainability in all system activities
- Achieve a cost-effective, fully operational system

To further these program goals, the WSIP includes objectives that address system performance in the areas of water quality, seismic reliability, delivery reliability, and water supply through the year 2030. **Table S.1** presents the WSIP goals and objectives. The WSIP also includes proposed levels of service for the regional water system, which are intended to further define the system performance objectives through 2030 and provide design guidelines for the facility improvement projects. The levels of service (shown in Table 3.5, in Chapter 3, Program Description) address water quality, seismic response after a major earthquake, delivery during system maintenance, average annual water supply, regional system firm yield, and drought-year rationing.

Key program elements are summarized below and described in more detail in Chapter 3 (also see the SFPUC's 2006 *Water System Improvement Program* and 2007 *Water Supply Options* reports).

- *Water Supply*. Proposed water supply option to meet customer purchase requests during both nondrought and drought years.

- *System Operations*. Proposed system operations strategy to achieve water quality, seismic response, and delivery reliability performance objectives under a range of operating conditions, including the following scenarios: day-to-day, maintenance, unplanned outage, earthquake or other emergencies, and drought.

- *Facilities*. Proposed facility improvement projects to repair, upgrade, and, in some cases, expand the regional system facilities to reliably meet level of service goals and system performance objectives and to provide a cost-effective, fully operational water system.

Proposed Water Supply

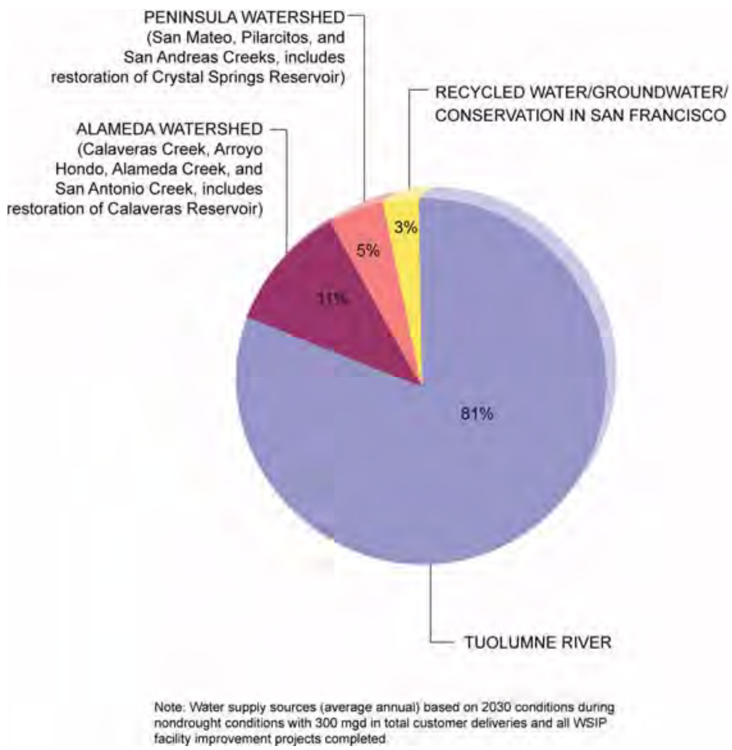
Under the WSIP, the SFPUC proposes to meet the increased 35 mgd in purchase requests by continuing to maximize use of local watershed supplies, increasing diversions from the Tuolumne River under its existing water rights, and developing new local resources consisting of a combination of additional conservation, water recycling, and groundwater supply programs in

TABLE S.1
WSIP GOALS AND OBJECTIVES

Program Goal	System Performance Objective
Water Quality – *maintain high water quality*	• Design improvements to meet current and foreseeable future federal and state water quality requirements. • Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filter all other surface water sources. • Continue to implement watershed protection measures.
Seismic Reliability – *reduce vulnerability to earthquakes*	• Design improvements to meet current seismic standards. • Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for the regional system is 229 million gallons per day (mgd). The performance objective is to provide delivery to at least 70 percent of the turnouts (i.e., water diversion connecting points from the regional system to customers) in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco regions, respectively. • Restore facilities to meet average-day demand of 300 mgd within 30 days after a major earthquake.
Delivery Reliability – *increase delivery reliability and improve the ability to maintain the system*	• Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service. • Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages. • Provide operational flexibility and system capacity to replenish local reservoirs as needed. • Meet the estimated average annual demand of 300 mgd for 2030 under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage.
Water Supply – *meet customer water needs in nondrought and drought periods*	• Meet average annual water purchase requests of 300 mgd from retail and wholesale customers during nondrought years for system demands through 2030. • Meet dry-year delivery needs through 2030 while limiting rationing to a maximum 20 percent systemwide reduction in water service during extended droughts. • Diversify water supply options during nondrought and drought periods. • Improve use of new water sources and drought management, including use of groundwater, recycled water, conservation, and transfers.
Sustainability – *enhance sustainability in all system activities*	• Manage natural resources and physical systems to protect watershed ecosystems. • Meet, at a minimum, all current and anticipated legal requirements for protection of fish and other wildlife habitat. • Manage natural resources and physical systems to protect public health and safety.
Cost-effectiveness – *achieve a cost-effective, fully operational system*	• Ensure cost-effective use of funds. • Maintain gravity-driven system. • Implement regular inspection and` maintenance program for all facilities.

SOURCE: SFPUC, 2005.

San Francisco, as shown in **Figure S.4**. The water recycling and groundwater supply programs would be developed as part of the proposed facility improvement projects. This combination of water supply sources is expected to fully meet customer purchase requests during nondrought years through 2030. However, based on recent experience, these water supply sources would not be adequate during drought periods. The WSIP level of service goals include a policy to limit customer rationing to a maximum of 20 percent systemwide in any one year of a drought.



SFPUC Water System Improvement Program . 203287

Figure S.4
WSIP Water Supply Sources, Nondrought Years

To provide adequate water supply to customers during a prolonged drought, the WSIP includes supplemental sources to augment the nondrought-year water supplies described above. The SFPUC proposes to secure a water transfer with the Turlock Irrigation District (TID) and/or Modesto Irrigation District (MID) to provide supplemental dry-year water from the Tuolumne River. Further, the SFPUC proposes to implement a groundwater banking program in the Westside Groundwater Basin in San Mateo County. Under this program, SFPUC wholesale customers that utilize the Westside Groundwater Basin would use supplemental surface water supplies in nondrought years to reduce their groundwater pumping and allow for in-lieu groundwater banking; these wholesale customers could then increase their groundwater pumping in drought years and reduce their demand for surface water supply in those years. In addition, two of the WSIP facility improvement projects involve the restoration of historical operating capacities at two of the system reservoirs, Calaveras and Lower Crystal Springs Reservoirs, which would further augment drought supplies for the regional system. As shown in **Figure S.5**, during drought years under the WSIP, the SFPUC would also include up to 20 percent systemwide rationing.

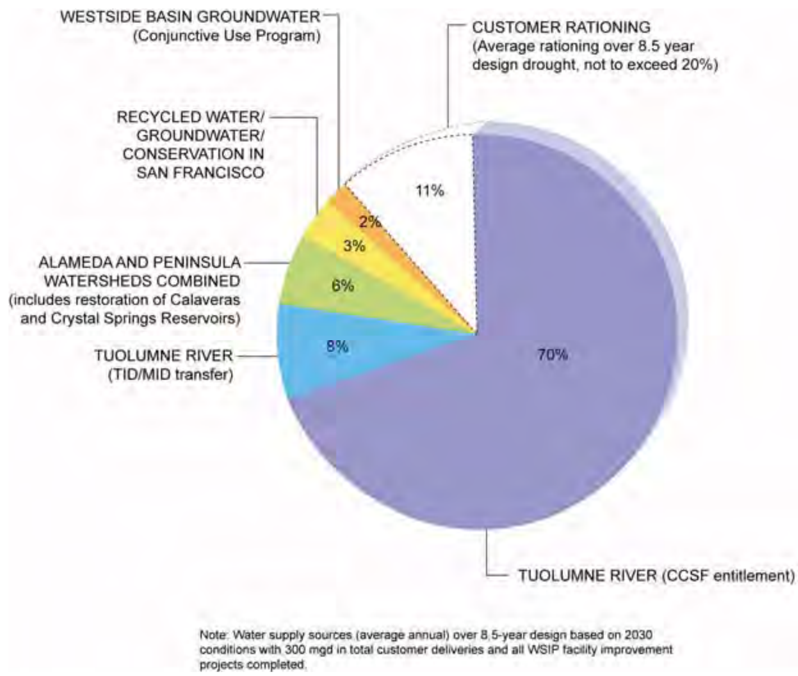


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Figure S.5
WSIP Water Supply Sources, Drought Years

Proposed System Operation Strategy

Operation of the regional water system is affected by numerous factors, including fluctuations in customer demand; meteorological and hydrologic conditions; physical facilities and infrastructure capacity and maintenance requirements; and multiple institutional parameters. The WSIP addresses the condition of the physical facilities and infrastructure while planning for and taking into account these various factors. The operating strategy addresses four components of system operation: water supply and storage, water quality, water delivery, and asset management.

Under the WSIP, general day-to-day operation of the regional water system would be similar to existing operations but would provide for additional facility maintenance activities and improved emergency preparedness. Implementation of the program would allow for a refinement of the operations strategy to meet the WSIP goals and objectives and would thereby increase system reliability and provide additional flexibility for scheduling repairs and maintenance. The proposed operations strategy would also include a multistage drought response program during an extended drought. Under the WSIP, regional system operations would continue to comply with all applicable institutional and planning requirements, including:

- Complying with all water quality, environmental, and public safety regulations
- Maximizing the use of water from local watersheds
- Assigning a higher priority to water delivery over hydropower generation
- Meeting all downstream flow requirements

Proposed Facility Improvement Projects

The WSIP includes 22 facility improvement projects along the regional system, from Oakdale Portal in Tuolumne County on the east end to San Francisco on the west. The projects, described in **Table S.2**, have been identified as necessary to achieve the level of service goals and system performance objectives of the WSIP. **Figure S.6** indicates the location of each facility improvement project.

Standard Construction Measures

The SFPUC has established standard construction measures that would be implemented as part of all WSIP projects. The main objective of these measures is to minimize potential disruption of surrounding neighborhoods during construction and to reduce impacts on environmental resources to the extent feasible. The construction measures would be implemented individually for the facility improvement projects; some measures might not be applicable to some projects, while some projects would require the development of more detailed construction measures and implementation steps as the individual projects are designed. The standard construction measures to be included in WSIP construction contracts address the following topics: neighborhood notice, seismic and geotechnical studies, onsite air and water quality measures during construction, groundwater, traffic, noise, hazardous materials, biological resources, cultural resources, and project site (i.e., the use of non-CCSF-owned land during construction).

Proposed Construction Schedule

Figure S.7 presents a preliminary master schedule of the construction phases for the facility improvement projects. The SFPUC developed the preliminary schedule to assure that water delivery service is maintained throughout construction of the numerous projects, but is preparing schedule refinements and adjustments as the projects are further developed and more information is known about construction requirements. All WSIP projects are scheduled to be completed by the end of 2014. The acquisition of supplemental water supplies during droughts would be implemented as needed to match the water supply needs of the retail and wholesale customers (see Chapter 5, Section 5.1) and is not included on the construction schedule.

TABLE S.2
WSIP FACILITY IMPROVEMENT PROJECTS

No.[a]	Project Title	Principal Type of Facility/ Objectives[b]	Location of Preferred Project[c]	Project Description
San Joaquin Region				
SJ-1	Advanced Disinfection	Treatment / Water Quality	Tesla Portal	This project would provide for the planning, design, and construction of a new advanced disinfection facility for the Hetch Hetchy water supply to comply with the new federal drinking water regulatory requirements contained in the Long Term 2 Enhanced Surface Water Treatment Rule. This regulation is designed to provide treatment for the parasite *Cryptosporidium*. The project is in the planning phase and the SFPUC is evaluating applicable technologies and possible locations to identify the most technologically sound and cost-effective alternative. In addition, the project includes planning and conceptual engineering for providing advanced disinfection facilities at the Sunol Valley and Harry Tracy Water Treatment Plants (WTPs). This project may be combined with the Tesla Portal Disinfection Station project along with portal modifications, and the need for the Lawrence Livermore Supply Improvements project may be affected by the location and technology selected for this project.
SJ-2	Lawrence Livermore Supply Improvements	Treatment / Water Quality	Thomas Shaft	This project includes design and construction of treatment upgrades for the water supplied to the Lawrence Livermore Laboratory. The project would construct water treatment facilities from the Thomas Shaft of the Coast Range Tunnel. An advanced disinfection facility planned at an upstream location under the Advanced Disinfection project could affect project design.
SJ-3	San Joaquin Pipeline System	Pipeline / Water Supply, Delivery Reliability	Isolated locations along the existing San Joaquin Pipeline corridor	The preferred project would generally be located within the existing San Joaquin Pipeline (SJPL) right-of-way and would include: • Construction of a new 6.4-mile-long, up to 86-inch-diameter fourth San Joaquin Pipeline parallel to the existing three pipelines at the east end of the pipelines, starting at Oakdale Portal, and associated portal modifications. • Construction of two additional crossover facilities between the San Joaquin Pipelines within the existing right-of-way, both located in Stanislaus County, with one about 20 miles east of Modesto and the other about 15 miles west of Modesto, and improvements at the existing Roselle Crossover. • Construction of a new 10-mile-long, up to 86-inch-diameter fourth San Joaquin Pipeline parallel to the existing three pipelines at the west end of the pipelines ending at Tesla Portal. This project would provide additional facilities to upgrade the hydraulic capacity of the San Joaquin Pipeline system to 314 mgd (and a 271-mgd average during system maintenance when a pipeline segment must be taken out of service) and to provide redundancy for prestressed concrete cylinder pipe for reliability. Note: While the current preferred alternative would construct 16 miles of pipeline, as much as 22 miles of pipeline could be constructed depending on the results of a conditions assessment of the existing pipelines.
SJ-4	Rehabilitation of Existing San Joaquin Pipelines	Pipeline / Water Supply, Delivery Reliability	Rehabilitation could occur anywhere along the pipeline corridor, which extends from Oakdale Portal to Tesla Portal	Reconditioning/rehabilitation of the existing San Joaquin Pipelines. There are three existing pipelines, each 47.7 miles long, extending from Oakdale Portal to Tesla Portal: • SJPL-1, riveted steel pipe, 56- to 72-inch internal diameter • SJPL-2, reinforced concrete pipe and welded steel pipe, 61- to 62-inch internal diameter • SJPL-3, prestressed concrete cylinder pipe and welded steel pipe, 78-inch internal diameter

TABLE S.2 (Continued)
WSIP FACILITY IMPROVEMENT PROJECTS

No.[a]	Project Title	Principal Type of Facility/ Objectives[b]	Location of Preferred Project[c]	Project Description
San Joaquin Region (cont.)				
SJ-5	Tesla Portal Disinfection Station	Treatment / Water Quality, Seismic Reliability	Tesla Portal	This project includes the planning, design, and construction of new disinfection facilities for the Hetch Hetchy water supply. The project would replace and upgrade the existing disinfection facilities at the Tesla Portal Disinfection Facility to meet current seismic, safety/fire, and building code standards. The preferred project would include construction of: • New control building and storage room • Pump houses • Chemical storage tanks and feed equipment and sampling systems • Emergency generator, including primary and standby power supplies • Access road It should be noted that the design and location of the Advanced Disinfection project would affect the design and location of this project.
Sunol Valley Region				
SV-1	Alameda Creek Fishery Enhancement	Other / Water Supply, Sustainability	Structural Alternatives: Alameda Creek in Sunol Valley, downstream of Calaveras Dam	This project would recapture the water released as part of the Calaveras Dam project and return it back to the regional system for use. A number of structural and non-structural recovery alternatives are under consideration for this project, including: a water recapture facility downstream of the Sunol Valley WTP, conjunctive groundwater use, horizontal collector wells, or other groundwater recovery systems yet to be defined. Other alternative designs for this project could be developed.
SV-2	Calaveras Dam Replacement	Storage / Water Supply, Delivery and Seismic Reliability	Sunol Valley, immediately downstream of existing dam	This project would provide for the planning, design, and construction of a replacement dam at Calaveras Reservoir to meet seismic safety requirements. The new dam would provide for a reservoir with the same storage capacity as the original reservoir (96,800 acre-feet), but the replacement dam would be designed to accommodate enlargement of the dam in the future. The preferred project would include construction of: • New earthfill dam • New intake tower and new outlet valve for water releases for instream flow requirements • New or rehabilitated outlet works for seismic safety and improved operations and maintenance As part of this project, Calaveras Reservoir would be operated to release up to 6,300 acre-feet per year (5.5 mgd) of water to Alameda Creek in support of fisheries.
SV-3	Additional 40-mgd Treated Water Supply	Treatment / Water Quality, Delivery Reliability	Sunol Valley WTP and pipeline to connect to the Alameda Siphons or Irvington Tunnel	This project would provide for the planning, design, and construction of an additional 40 mgd of treatment capacity at the Sunol Valley WTP. The project would increase the sustainable capacity of the Sunol Valley WTP to 160 mgd. The planning-level study would evaluate treatment operations protocol and an alternative treatment process. The project would include either retrofitting the existing facilities with a membrane treatment process or expanding the existing facilities with: • New flocculation and sedimentation system • Upgrade of existing filters or addition of three new filters and a new flow distribution chamber

TABLE S.2 (Continued)
WSIP FACILITY IMPROVEMENT PROJECTS

No.[a]	Project Title	Principal Type of Facility/ Objectives[b]	Location of Preferred Project[c]	Project Description
Sunol Valley Region (cont.)				
SV-3 (cont.)				• New filtered water and backwash piping Additionally, the project would include: • New chemical feed and piping system • Upgrade of the electrical supply system • Miscellaneous piping, valves, and mechanical and electrical work • Approximately two miles of 78-inch-diameter pipe to connect to the Alameda Siphons or Irvington Tunnel
SV-4	New Irvington Tunnel	Tunnel / Delivery and Seismic Reliability	Sunol Valley to Fremont, parallel to and just south of the existing Irvington Tunnel	This project would construct a new tunnel parallel to and just south of the existing Irvington Tunnel to convey water from the Hetch Hetchy system and the Sunol Valley WTP to the Bay Area. The new tunnel would be a redundant water transmission facility to the existing Irvington Tunnel. The preferred project would include construction of: • New 18,200-foot-long, 10-foot-diameter tunnel • New portal at the east end adjacent to the existing Alameda West Portal in the Sunol Valley with connections to the existing Alameda Siphons and proposed new siphon • New portal at the west end adjacent to the existing Irvington Portal in Fremont with connections to the existing Bay Division Pipelines and proposed new pipeline (Bay Division Pipeline Reliability Upgrade) • Valves and equipment to control and monitor flows • Modifications to the existing Alameda West and Irvington Portals
SV-5	SVWTP – Treated Water Reservoirs	Storage and Treatment / Delivery Reliability	North of the Sunol Valley WTP	This project would provide for the planning, design, and construction of new treated water storage reservoirs at the Sunol Valley WTP to comply with requirements of the California Department of Health Services. The preferred project would include construction of: • One 5-million-gallon chlorine contact basin • Two 8.75-million-gallon storage basins • New inlet and outlet piping and reservoir drainage system • Pipe bridge over Alameda Creek • Chemical (ammonia and chlorine) storage and feed system • Backup filter washwater supply and filter washwater supply system • Instrumentation and controls and miscellaneous pumping appurtenances to integrate the reservoirs into the existing treatment plant • Expansion of the existing Sunol Valley WTP electrical substation • Two 750-kilowatt diesel-powered emergency generators

TABLE S.2 (Continued)
WSIP FACILITY IMPROVEMENT PROJECTS

No.[a]	Project Title	Principal Type of Facility/ Objectives[b]	Location of Preferred Project[c]	Project Description
Sunol Valley Region (cont.)				
SV-6	San Antonio Backup Pipeline	Pipeline / Delivery and Seismic Reliability	Sunol Valley between San Antonio Reservoir and San Antonio Pump Station	This project would consist of three proposed facilities: (1) San Antonio Backup Pipeline, a new pipeline (size undetermined) from San Antonio Reservoir to San Antonio Pump Station, about two miles long; (2) San Antonio Creek discharge facilities (improvements allowing for the discharge of Hetch Hetchy water and associated road improvements); and (3) Alameda East Portal vent overflow pipeline and portal modifications.
Bay Division Region				
BD-1	Bay Division Pipeline Reliability Upgrade	Pipeline and Tunnel / Water Supply, Delivery and Seismic Reliability	Along existing Bay Division Pipelines Nos. 1 and 2 easement from Fremont to Redwood City	This project would construct a new Bay Division Pipeline No. 5 (BDPL No. 5) from Irvington Tunnel Portal in Fremont to Pulgas Tunnel Portal near Redwood City, consisting of 16 miles of new pipeline and 5 miles of tunnel under San Francisco Bay. Portions of the section of BDPL No. 1 between Edgewood Valve Lot and Pulgas Valve Lot would be removed (approximately 1.4 miles), and existing aboveground and submarine sections of BDPL Nos. 1 and 2 over the five-mile-long section from Newark Valve House to Ravenswood Valve House would be decommissioned (decommissioning is not part of this project). The redundancy provided by the project would increase the overall transmission capacity of the Bay Division Pipeline system. The preferred project would include construction of: • New welded-steel pipeline, approximately 72 inches in diameter, extending along the seven-mile reach from Irvington Portal to Newark Valve Lot, located within the existing SFPUC right-of-way of BDPL Nos. 1 and 2 • New “Bay Tunnel” segment of BDPL No. 5, approximately 120 inches in diameter, extending five miles from Newark Valve Lot to Ravenswood Valve Lot, crossing under San Francisco Bay and adjacent marshlands; BDPL Nos. 1 and 2 would tie into the tunnel at both ends and would be decommissioned between Newark and Ravenswood Valve Lots • New welded-steel pipeline, approximately 60 inches in diameter extending along the nine-mile reach from Ravenswood Valve Lot to Pulgas Portal, located within the existing SFPUC right-of-way of BDPL Nos. 1 and 2 • New facilities at eight valve vault lots along the alignment, containing new concrete vaults and control structures that house electrical control panels, isolation valves, mechanical equipment, and cross-connections between BDPL No. 5 and the existing Bay Division Pipelines • Two flow metering vaults at or near Mission Boulevard (in Fremont) and Pulgas Portal areas • New Isolation valves and piping for connecting BDPL No. 5 to Irvington and Pulgas Portals

TABLE S.2 (Continued)
WSIP FACILITY IMPROVEMENT PROJECTS

No.[a]	Project Title	Principal Type of Facility/ Objectives[b]	Location of Preferred Project[c]	Project Description
Bay Division Region (cont.)				
BD-2	BDPL Nos. 3 and 4 Crossovers	Valve House / Delivery and Seismic Reliability	Three locations adjacent to where BDPL Nos. 3 and 4 traverse Guadalupe River, Barron Creek, Bear Gulch Reservoir	This project would construct three additional crossover facilities along BDPL Nos. 3 and 4 to provide operational flexibility for maintenance or during emergencies. The new crossover facilities would reduce the length of pipe to be removed from service, either for maintenance or for emergencies, and would reduce the duration of outages. Each crossover facility would include construction of: • Four mainline valves and one cross-connect valve • Automatic controlled actuators • Discharge facilities to enable release of water that meets water quality discharge requirements within discrete pipeline segments to surface waters, either for maintenance or emergencies
BD-3	Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault	Pipeline / Seismic Reliability	Along existing BDPL Nos. 3 and 4 in Fremont	This project would provide for the planning, design, and construction of upgraded, seismically resistant sections of the BDPL Nos. 3 and 4 where they cross the Hayward fault. The replacement pipelines would be located between the two new crossover/isolation valves that would be built as part of BDPL Nos. 3 and 4 Crossover/Isolation Valve at Hayward Fault project (a WSIP project determined to be independent of the PEIR). In addition to the replacement pipelines, a new bypass pipeline between the two new crossover/isolation valve vaults could also be built as part of one of the several alternatives being considered for this project.
Peninsula Region				
PN-1	Baden and San Pedro Valve Lots Improvements	Valve House / Delivery and Seismic Reliability	Baden Valve Lot, South San Francisco, San Pedro Valve Lot, Daly City	This project would upgrade valve vaults, valves, and piping at the existing Baden and San Pedro Valve Lots to meet current seismic standards. Work could also be performed at the Pulgas Pump Station and Pulgas Valve Lot as part of transmission reliability. The project would include a new pressure-reducing valve at one of the locations to allow transfer of water between high and low pressure zones from the Harry Tracy WTP to the Peninsula under an emergency scenario.
PN-2	Crystal Springs/ San Andreas Transmission Upgrade	Pipeline / Delivery and Seismic Reliability	Lower Crystal Springs Reservoir to San Andreas Reservoir, including Crystal Springs Pump Station	This project would consist of seismic improvements of facilities that convey water from Crystal Springs Reservoir to the Harry Tracy WTP. This project would increase the transmission capacity of the existing raw water pipeline from Crystal Springs Reservoir to San Andreas Reservoir in order to reliably supply 140 mgd of raw water for treatment at the Harry Tracy WTP. The project would include: • Repair of Upper Crystal Springs Dam discharge culverts • Upgrade and repair of Lower Crystal Springs Dam outlet structures and tunnels conveying water to Crystal Springs Pump Station • Replacement or refurbishment of Crystal Springs Pump Station • Upgrade and repair of the chemical system and Crystal Springs chlorine emergency feed • Improvements to the Crystal Springs/San Andreas Pipeline, including replacement of approximately 1,350 feet of 66-inch-diameter pipeline, general renewal of the remaining pipeline, and addition of new manholes, blowoff valves, and isolation valves; or construction of a new redundant pipeline along a new alignment.

TABLE S.2 (Continued)
WSIP FACILITY IMPROVEMENT PROJECTS

No.[a]	Project Title	Principal Type of Facility/ Objectives[b]	Location of Preferred Project[c]	Project Description
Peninsula Region (cont.)				
PN-2 (cont.)				• Seismic and hydraulic upgrade and repair of San Andreas outlet facilities • Addition of fish screens on the outlet structures for both Crystal Springs and San Andreas Reservoirs • Repair of two pipelines that convey raw water from San Andreas Reservoir to the Harry Tracy WTP raw water pump station
PN-3	HTWTP Long-Term Improvements	Treatment / Water Quality, Delivery and Seismic Reliability	Harry Tracy WTP	This project would be a seismic retrofit and rehabilitation of the existing building and facility to provide long-term reliability and process improvements. The project would increase the sustained treatment capacity of the plant from 120 to 140 mgd for 60 days. The proposed improvements would include: • Replacement and upgrade of the ozone generation system for primary disinfection • Replacement or upgrade of the existing sedimentation basins at the same location • Improvements to sludge handling facilities • New, redundant pipeline from the treatment works to the finished water storage reservoir • Raw water pump station improvements • Upgrade and replacement of electrical and instrumentation components, including improvements to process and plant security facilities
PN-4	Lower Crystal Springs Dam Improvements	Storage / Water Supply and Delivery Reliability	Lower Crystal Springs Dam	This project would consist of major repairs and improvements to Lower Crystal Springs Dam to provide adequate protection of the dam and downstream areas from the probable maximum flood, as defined by the California Division of Safety of Dams (DSOD). The DSOD has placed operational restrictions on the dam, and the capacity of the reservoir is limited to 58,400 acre-feet. The project would restore the historical reservoir capacity of 69,300 acre-feet. The project would be coordinated with San Mateo County, which is concurrently planning the replacement of the existing county bridge built above the crest of the dam. Project elements would include: • Lowering the existing parapet wall on either side of the existing spillway to lengthen the overflow weir (central spillway) from the reservoir • Raising the remaining parapet walls and adding two new spillway bays, one on each side of the existing central spillway • Enlarging the spillway stilling basin to accommodated the probable maximum flood • Installing four gates (with control building) or installing a fixed weir within the spillway to restore the historical storage capacity

TABLE S.2 (Continued)
WSIP FACILITY IMPROVEMENT PROJECTS

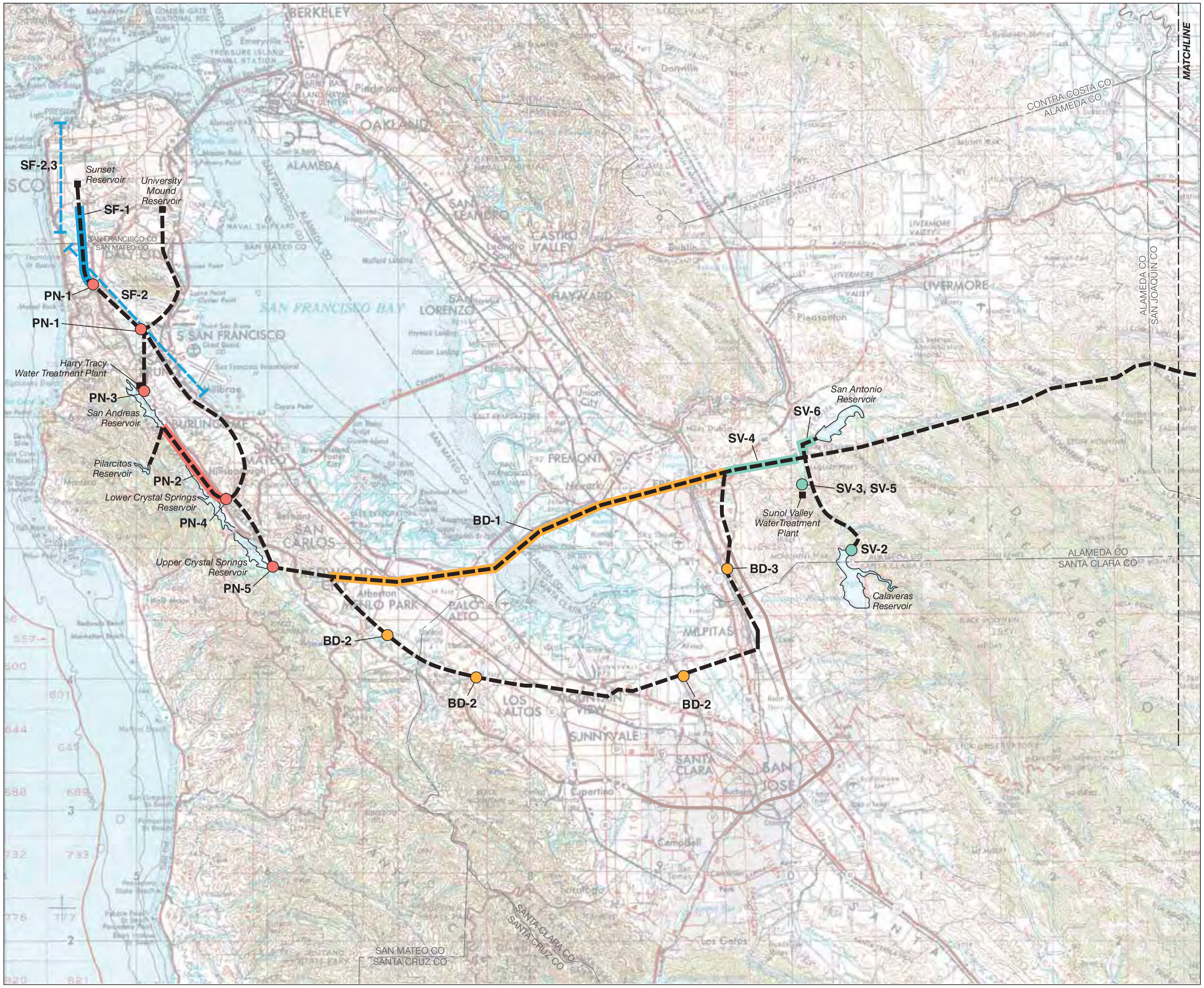
No.[a]	Project Title	Principal Type of Facility/ Objectives[b]	Location of Preferred Project[c]	Project Description
Peninsula Region (cont.)				
PN-5	Pulgas Balancing Reservoir Rehabilitation	Storage / Water Quality, Delivery and Seismic Reliability	Pulgas Balancing Reservoir and mouth of Laguna Creek at south end of Upper Crystal Springs Reservoir	This project would provide for the planning, design, and construction of improvements to the existing Pulgas Balancing Reservoir and associated facilities. The project would include: • Modifications to the inlet/outlet piping (Phase 1, currently under construction) • Design and construction to rehabilitate and/or expand the discharge channel to Crystal Springs Reservoir (or to install a parallel channel) (Phase 2) • Geotechnical investigations, design, and construction of recommended seismic improvements, including repair/replacement of the reservoir walls, floor, and roof (Phase 3) • Restoration of a six- to eight-acre sediment catchment basin in Laguna Creek to also serve as sustainable habitat for San Francisco garter snake and California red-legged frog, including culvert replacement, sediment removal, revegetation, and protective measures to avoid impacts on sensitive species (Phase 4) • Modification of the existing dechlorination process, including modifications to the chemical feed system to enable pH adjustment and dechlorination system to operate reliably (Phase 5)
San Francisco Region				
SF-1	San Andreas Pipeline No. 3 Installation	Pipeline / Delivery and Seismic Reliability	Daly City to San Francisco	This project would replace the out-of-service Baden-Merced Pipeline, which is beyond repair, and would construct a new pipeline extension of the existing San Andreas Pipeline No. 3 from San Pedro Valve Lot in Daly City to Merced Manor Reservoir in San Francisco. It would also connect the existing San Andreas Pipeline No. 2 at Sloat Boulevard in San Francisco and install an additional pipeline to serve the water turnouts along San Andreas Pipeline No. 2. The project would provide seismic reliability and system redundancy for Peninsula and San Francisco customers. The project would include: • New 3.8-mile-long, 36-inch-diameter pipeline • Approximately 0.27 mile of 36-inchdiameter pipeline for three connections between San Andreas Pipelines Nos. 2 and 3 • Removal of the Baden-Merced Pipeline where the new San Andreas Pipeline No. 3 alignment matches the Baden-Merced alignment • Less than 0.1 mile of 12- to 16-inch-diameter new pipeline for five branch connections to user turnouts (three turnouts to Daly City, two turnouts to San Francisco distribution lines) • Installation of line valves and vaults, manholes, cathodic protection and monitoring stations, sample taps, air valves, blowoffs, and other pipeline appurtenances
SF-2	Groundwater Projects	Other / Water Supply	West side of San Francisco and northern San Mateo County	This project includes three groundwater projects: Lake Merced, Local Groundwater, and Regional Groundwater. • The Lake Merced project would address raising the level of Lake Merced in San Francisco using a supplemental source of water, such as treated stormwater, recycled water, groundwater, or SFPUC system water.

TABLE S.2 (Continued)
WSIP FACILITY IMPROVEMENT PROJECTS

No.[a]	Project Title	Principal Type of Facility/ Objectives[b]	Location of Preferred Project[c]	Project Description
San Francisco Region (cont.)				
SF-2 (cont.)				• The Local Groundwater Projects would include development of 2 mgd of new local groundwater for blending with water in the potable water system in San Francisco. An estimated four wells and well stations would be constructed to develop this new local groundwater. This project would also include the use of an additional 2 mgd of groundwater through replacement of existing irrigation wells at the San Francisco Zoo, Golden Gate Park, and/or other locations, once recycled water were available for irrigation (to be developed under the Recycled Water Projects). Two existing wells would be modified to enable emergency supply to local residents in the event of a major earthquake or other disaster. This project would include the pipelines, water treatment equipment, and controls needed to add the groundwater to the municipal supply. The additional water supply developed under this project would be used during both nondrought and drought years. • As part of a regional conjunctive-use project, the SFPUC would construct about 10 new groundwater production wells in San Mateo County to develop about 6 mgd of potable groundwater for use as a supplemental drought-year supply. In nondrought years under this project, the SFPUC would provide potable water from the regional system to customers in Daly City, San Bruno, and South San Francisco to substitute for groundwater currently used for municipal purposes, thereby reducing groundwater pumping and allowing the groundwater basin to recharge naturally. In drought years, the groundwater would be available for local use to supplement the regional system water. This project would require agreements with the affected agencies see (Section 3.13).
SF-3	Recycled Water Projects	Other / Water Supply, Sustainability	Various locations on west side of San Francisco	This project includes recycled water projects in San Francisco and other locations. Projects include Westside Baseline and Harding Park/Lake Merced. This project would provide treatment, storage, and distribution facilities for about 4 mgd of recycled water to users on the west side of San Francisco. Primary users would include Golden Gate Park, Lincoln Park, Lincoln Park Golf Course, Harding Park Golf Course, San Francisco Zoo, Sunset Boulevard medians, and San Francisco State University. As described under Groundwater Projects, the SFPUC is also investigating appropriate sources of supply for increasing and maintaining Lake Merced lake levels, including recycled water that has undergone advanced treatment.

a The numbering system is consistent, to the extent possible, with that presented in the Notice of Preparation (NOP) regarding preparation of an environmental impact report on the WSIP issued in September 2005. However, due to a regrouping of the projects after publication of the NOP, some projects have been renumbered.
b General types of facilities. Objectives refer to the WSIP objectives met by each project; see Table S.1 for a complete description of WSIP goals and objectives.
c See Figure S.6 for the approximate locations of preferred projects; many of the projects are still in development, and the SFPUC may ultimately consider other design options.

SOURCE: SFPUC, 2006.



SFPUC WATER SYSTEM IMPROVEMENT PROGRAM, FACILITY IMPROVEMENT PROJECTS

SUNOL VALLEY REGION

SV-1 Alameda Creek Fishery Enhancement (not shown)
SV-2 Calaveras Dam Replacement
SV-3 Additional 40-mgd Treated Water Supply
SV-4 New Irvington Tunnel
SV-5 SVWTP – Treated Water Reservoirs
SV-6 San Antonio Backup Pipeline

BAY DIVISION REGION

BD-1 Bay Division Pipeline Reliability Upgrade
BD-2 BDPL Nos. 3 and 4 Crossovers (3 locations)
BD-3 Seismic Upgrade of BDPL Nos. 3 and 4 at Hayward Fault

PENINSULA REGION

PN-1 Baden and San Pedro Valve Lots Improvements (2 locations)
PN-2 Crystal Springs / San Andreas Transmission Upgrade
PN-3 HTWTP Long-Term Improvements
PN-4 Lower Crystal Springs Dam Improvements
PN-5 Pulgas Balancing Reservoir Rehabilitation

SAN FRANCISCO REGION

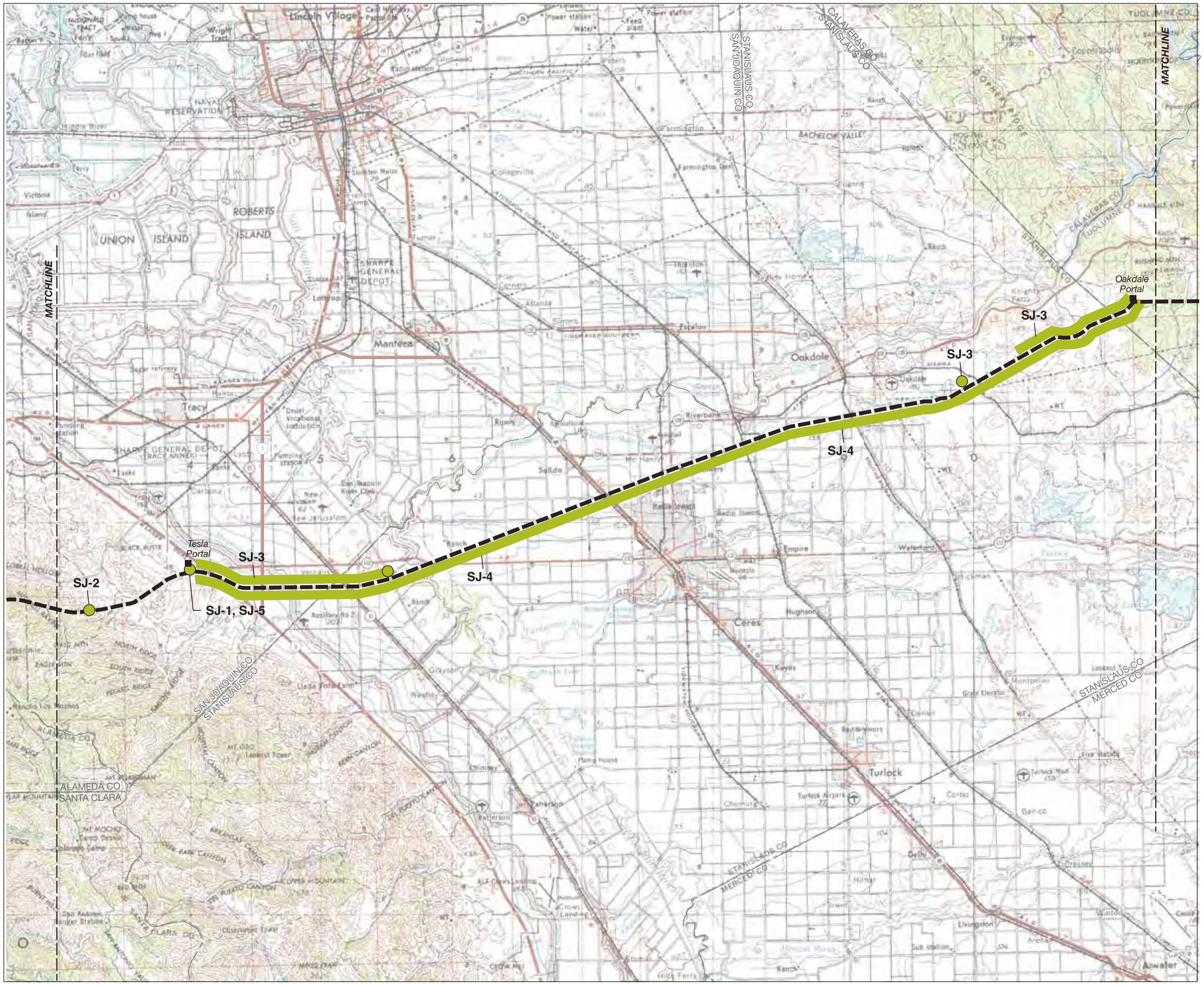
SF-1 San Andreas Pipeline No. 3 Installation
SF-2 Groundwater Projects (general geographic area indicated)
SF-3 Recycled Water Projects (general geographic area indicated)

Existing System Corridor
Existing System Facility
Proposed Facility Corridor
Proposed Facility Site
Proposed Facility, General Location

SOURCE: ESA + Orion; SFPUC, 2006; USGS 1978

SFPUC Water System Improvement Program . 203287

Figure S.6a
Location of WSIP Facility Improvement Projects- Sunol Valley, Bay Division, Peninsula, and San Francisco Regions



SFPUC WATER SYSTEM IMPROVEMENT PROGRAM, FACILITY IMPROVEMENT PROJECTS

SAN JOAQUIN REGION

SJ-1 Advanced Disinfection
SJ-2 Lawrence Livermore Supply Improvements
SJ-3 San Joaquin Pipeline System
SJ-4 Rehabilitation of Existing San Joaquin Pipelines
SJ-5 Tesla Portal Disinfection Station

Existing System Corridor
Existing System Facility
Proposed Facility Corridor
Proposed Facility Site
Proposed Facility, General Location

0 5
Miles

SOURCE: ESA + Orion; SFPUC, 2006; USGS 1969

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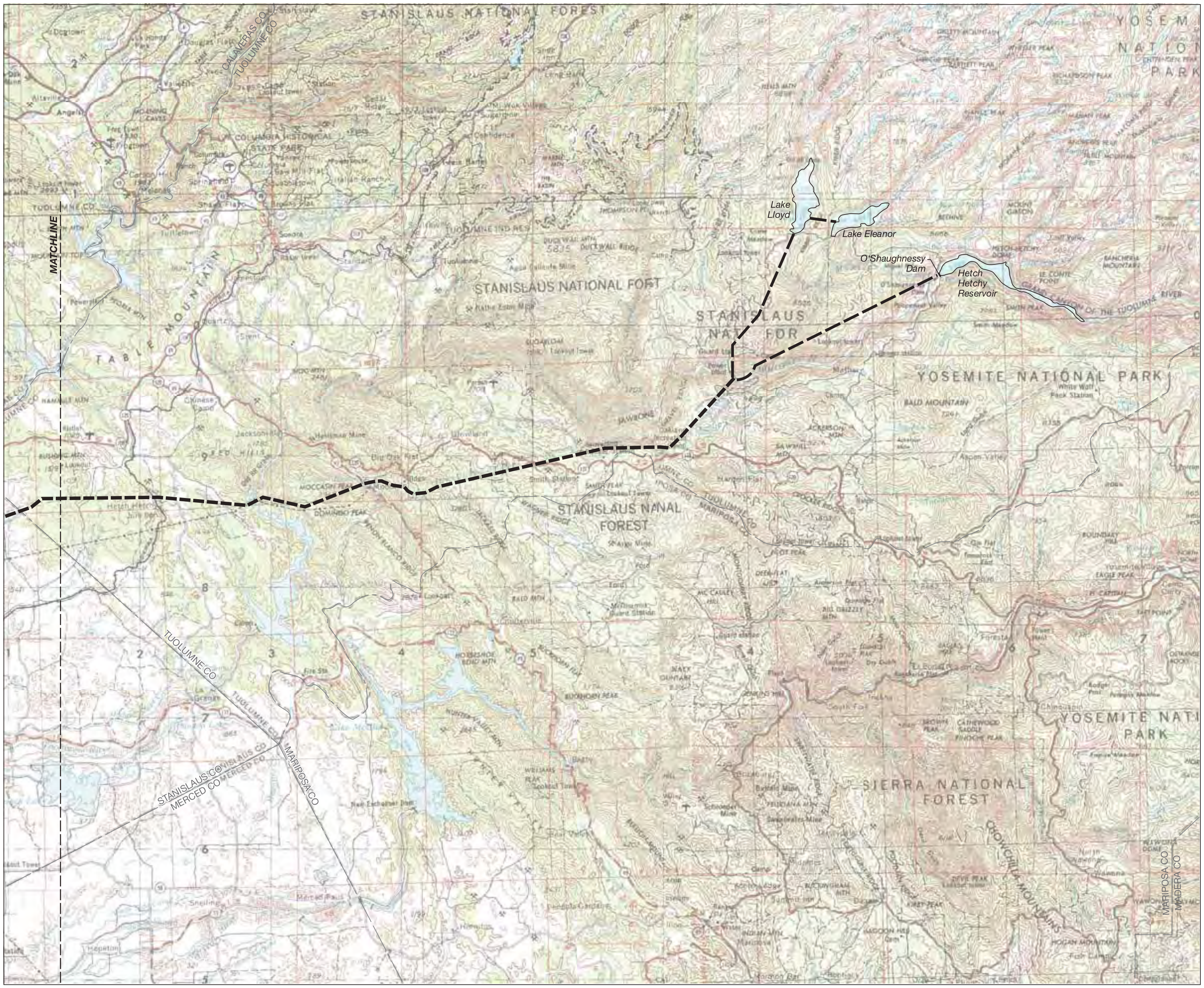
Figure S.6b
Location of WSIP Facility Improvement Projects - San Joaquin Region



SFPUC WATER SYSTEM IMPROVEMENT PROGRAM, FACILITY IMPROVEMENT PROJECTS

- Existing System Corridor
- Existing System Facility
- Proposed Facility Corridor
- Proposed Facility Site
- Proposed Facility, General Location

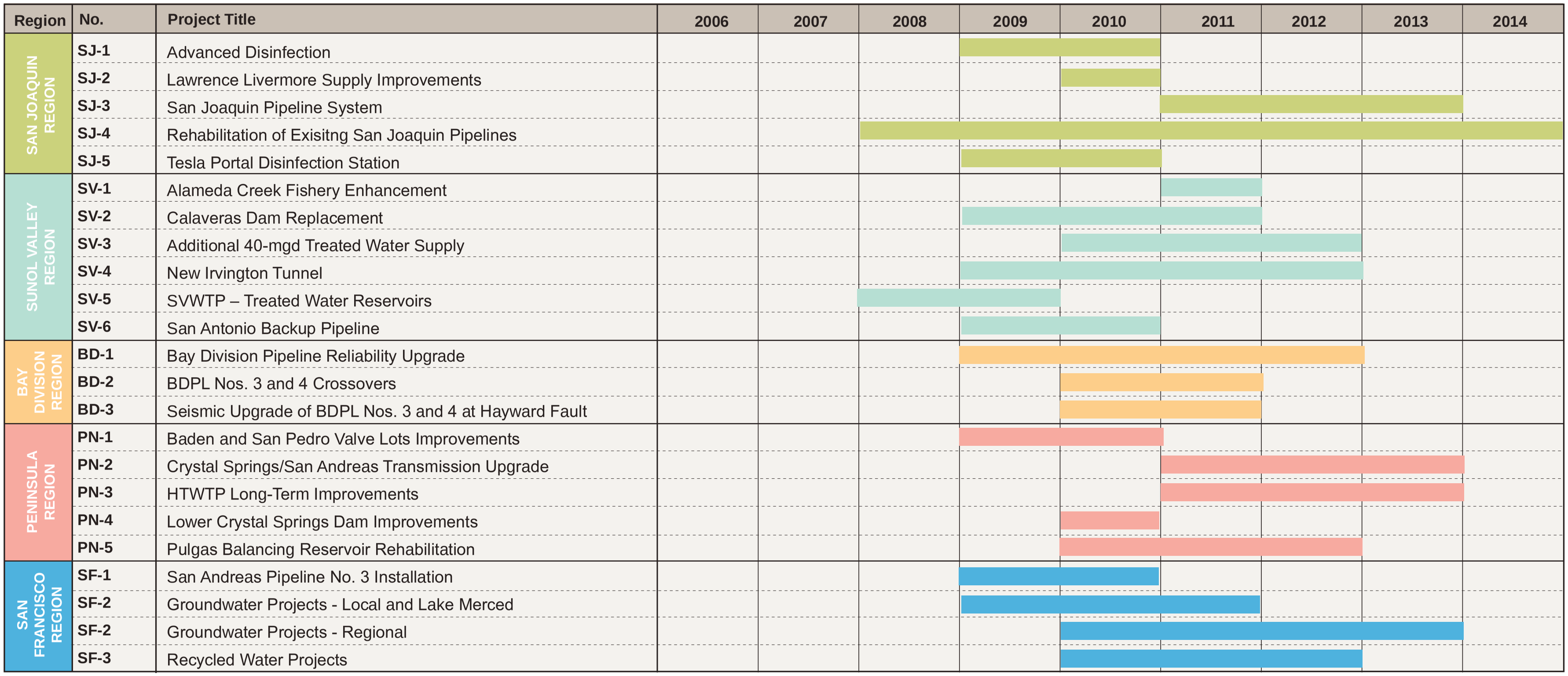
NOTE: No WSIP facilities are proposed in this region.

0 — 5 Miles

SOURCE: ESA + Orion; SFPUC, 2006; USGS 1970

SFPUC Water System Improvement Program . 203287

Figure S.6c
Location of WSIP Facility Improvement Projects - Hetch Hetchy Region



SOURCE: SFPUC, 2006

SFPUC Water System Improvement Program . 203287

Figure S.7
Preliminary WSIP Construction Schedule

SFPUC
WATER
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POWER

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

Julie Labonte, Director – Water System Improvement Program
1155 Market Street, 6th Floor, San Francisco, CA 94103 • Tel. (415) 554-1856 • Fax (415) 551-4515

DATE: August 20, 2009

TO: The Honorable Ann Moller Caen, President
The Honorable F.X. Crowley, Vice President
The Honorable Francesca Vietor
The Honorable Juliet Ellis
The Honorable Anson B. Moran

THROUGH: Ed Harrington, General Manager EH

FROM: Michael Carlin, Deputy General Manager MPC
Harlan L. Kelly, Jr., Assistant General Manager HK
Julie L. Labonte, WSIP Director JLL

RE: WSIP Regional Projects Quarterly Report
4th Quarter / Fiscal Year 2008-2009

Enclosed is the Water System Improvement Program (WSIP) Regional Projects Quarterly Report for the 4th Quarter of Fiscal Year 2008-2009. The primary intent of the report is to provide the Commission, stakeholders and the public with a status summary of the program's regional projects for the period of April 5, 2009 through July 1, 2009.

Report Organization

The report has three main sections. The *Program Summary* section includes a program overview and performance summary, and a program update on the following topics: program management, planning/design, environmental, right-of-way, construction and project achievements. The *Regional Summary* section provides a regional performance summary for each WSIP region, and an update on each region's planning, environmental, design and construction efforts. The *Project Status* section contains the Quarterly Project Status Reports (PSRs) for all regional projects.

June 2009 Revised WSIP

This Quarterly Report incorporates all changes to the WSIP Regional Program made in the June 2009 Revised WSIP and approved by the San Francisco Public Utilities Commission (SFPUC) on July 28, 2009, including project name changes, modification of the WSIP organizational structure, the addition of a new regional project, and revised budgets and schedules.

The names of two regional projects were changed as part of the adoption of the June 2009 Revised WSIP. The name changes are as follows:

- Project CUW30103: Groundwater Project C - South Westside Basin changed to Regional Groundwater Storage and Recovery
- Project CUW35201: Alameda Creek Fishery Enhancement changed to Upper Alameda Creek Filter Gallery

In the June 2009 Revised WSIP and as reflected in the enclosed report, all of the WSIP Water Supply Region Projects, except for Project CUW30103: Regional Groundwater Storage and Recovery Project, moved from the Regional Program to the Local Program. Project CUW30101: Regional Groundwater Storage and Recovery Project was moved to the San Francisco Regional Region.

One regional project was added as part of the adoption of the June 2009 Revised WSIP to ensure the program continues to meet the level of service (LOS) goals established for the program. Project CUW36702: Peninsula Pipelines Seismic Upgrade, which was included in the Peninsula Region, will provide the seismic reliability required for key transmission pipelines that transport water from the Harry Tracy Water Treatment Plant (HTWTP).

It should be noted that the approved June 2009 Revised WSIP does not include revisions to all project budgets and schedules. Projects with cost and schedule variances that can potentially be mitigated were not re-baselined (i.e., changes to the budget and schedule of these projects were not made). Therefore the Baseline (Approved) Budget and/or and Baseline (Approved) Schedule for those projects remain the same and cost and/or schedule variances are recorded in the enclosed report based on the latest project forecasts.

Major changes were made to the scope, schedule, and/or budget of four regional projects as part of the June 2009 Revised WSIP. These changes are summarized below.

Significant scope changes were made to the WSIP's two San Joaquin Pipelines (SJPLs) projects to maximize the reliability of the overall system, provide additional maintenance flexibility and facilitate construction.

Project CUW37301: San Joaquin Pipeline System – The revised project scope includes the addition of a 6.7-mile, 78-inch diameter pipeline (referred to as the Eastern Segment) from Oakdale Portal to a new connection point corresponding to the end of the pre-stressed concrete cylinder pipe (PCCP) segment of SJPL No. 3. This change allowed for the downsizing of the 10.3-mile Western Segment from a 96-inch to a 78-inch diameter pipeline. Also added to the project scope are new valve facilities on SJPL Nos. 3 & 4 along the Eastern Segment to allow for better control of system pressure. The project budget has been increased $7,708,570 to $278,055,413. The project approved completion date remains the same (March 25, 2014) and the first construction contract for this project will be advertised in November 2009.

Project CUW37302: Rehabilitation of Existing San Joaquin Pipelines – The benefits provided by the increased scope of the SJPL System Project allowed for a reduction of the scope of this project without compromising levels of service. The revised project scope includes the rehabilitation of the Roselle Crossover Facility, the repair of the system's cathodic protection system, and the upgrade of the system's SCADA system. It also includes more detailed development of the SJPL Condition Assessment and Maintenance Program to enhance system sustainability. Finally, project funding is also set aside for additional priority work on the existing pipelines, which will be identified upon conclusion of the conditions assessment in December 2009. This resulted in a reduction of the project budget of $58,147,236 to $31,852,309. The project approved completion date remains the same (June 30, 2014). Bids for the first construction package for the Roselle Crossover Facility were received in June 2009 and contract award is scheduled for July 2009.

Project CUW37401: Calaveras Dam Replacement – The scope has been revised to include a flow bypass tunnel at the Alameda Creek Diversion Dam to provide minimum bypass flow in Alameda Creek. This additional scope was one of the mitigation requirements adopted as part of the WSIP Programmatic Environmental Impact Report (EIR). Delivery of this project has been impacted significantly by the need to address the potential presence of steelhead trout in the Alameda Creek Watershed and the presence of high concentrations of Naturally Occurring Asbestos (NOA) at the project site. It should be noted that formal consultation with the National Marine Fisheries Service (NMFS) is now required for this project. These issues have a substantial cumulative effect on both ongoing pre-construction activities and upcoming construction work in the field that resulted in a 42-month delay in the project schedule (revised completion date of December 4, 2015), and a $101,688,640 increase in the project budget (revised project budget of $409,444,761). The project schedule calls for publication of the project Draft EIR in September 2009 and advertisement for construction in August 2010.

Project CUW36701: Harry Tracy Water Treatment Plant (HTWTP) Long-Term Improvements – The discovery of a new strand of the Serra Fault in the vicinity of the plant's two treated water reservoirs (TWRs) triggered the need for additional investigations which confirmed that additional improvements were required to address seismic risks and ensure compliance with the program's Levels of Service (LOS) goals. As a result, the following scope revisions were proposed and adopted: abandon two existing TWRs and build a new 11.0 mg TWR, seismically retrofit pipelines in the vicinity of the Serra Fault, and build interim improvements to address short-term seismic risks. The scope changes resulted in a $183,303,228 increase in the project budget (revised project budget of $359,063,409). The project approved completion date remains the same (June 12, 2014). The project EIR is being prepared and 35% design has been completed. Advertisement for construction is scheduled for April 2011.

It is important to underscore that the project scopes in the June 2009 Revised WSIP continue to meet all the LOS goals established for the system. No changes were made to the program's LOS goals to accommodate project scope revisions.

<u>Status and Performance Summary</u>

The program performance metrics for planned and actual performance had to be updated following approval of the June 2009 Revised WSIP. It should be noted that incorporation of the revised schedule and cost baselines resulted in a slight reduction of the planned and actual performance metrics from what was reported in the previous WSIP Quarterly Report. Overall, actual performance (16.6%) on the program is tracking very close to planned performance (16.7%). Planning activities are nearing completion at 96%, whereas environmental, design and construction efforts are 67%, 75% and 6% complete, respectively. As of July 1, 2009, there are two (2) regional projects in the Planning Phase, eleven (11) in the Design Phase, six (6) in the Bid & Award Phase, five (5) in the Construction Phase, two (2) in the Close-Out Phase, eight (8) regional projects have been completed, one (1) project has not been initiated, and eleven (11) are active in multiple phases.

The approved WSIP Regional Program completion date is December 4, 2015 and the current forecast completion date is the same. The approved WSIP Regional Program budget is $3,514,026,000 and the current forecast at completion is $3,532,336,000 ($18,310,000 over the approved budget). The total approved WSIP budget (Local and Regional Programs including Finance Cost) is $4,585,556,000 and the current total forecast at completion is $4,608,583,000 ($23,027,000 over the approved budget).

Major program milestones reached during this reporting quarter include:

Environmental Approvals:
- CUW36103: Pulgas Balancing - Structural Rehabilitation and Roof Replacement (Mitigated Negative Declaration)

Construction Contract Advertised:
- CUW36103: Pulgas Balancing - Structural Rehabilitation and Roof Replacement
- CUW36401: Lawrence Livermore Water Quality Improvement
- CUW38001: BDPL No. 3 and 4 - Crossovers
- CUW37901: San Andreas Pipeline No. 3 Installation
- CUW38601: San Antonio Pump Station Upgrade

Construction Contract Awarded:
- CUW35901: Alameda Siphon #4
- CUW37201: University Mound Reservoir - North Basin
- CUW37901: San Andreas Pipeline No. 3 Installation
- CUW38001: BDPL Nos. 3 and 4 Crossovers

Construction Notice to Proceed Issued
- CUW36102: Pulgas Balancing - Discharge Channel Modifications
- CUW39101: Baden & San Pedro Valve Lot Improvements

The WSIP Team continues to work collaboratively with other City Departments, the SFPUC Regional Wholesale customers, and all program stakeholders to ensure the successful delivery of the WSIP.

HETCH HETCHY
WATER SYSTEM IMPROVEMENT PROGRAM

Quarterly Report

Q4 FY 2008 | 2009

Regional Projects

4.5.09 - 7.1.09

Rebuilding Today
for a Better Tomorrow

SFPUC
WATER
WASTEWATER
POWER

Published: 8.20.09

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1.0 PROGRAM SUMMARY

1.1 PROGRAM OVERVIEW

The Water System Improvement Program (WSIP) is a multi-billion dollar, multi-year capital program to upgrade the City of San Francisco's regional and local drinking water systems. The program will deliver improvements that enhance the City's ability to provide reliable, affordable, high quality drinking water to its 27 wholesale customers and regional retail customers in Alameda, Santa Clara, and San Mateo Counties, and to 800,000 retail customers in San Francisco, in an environmentally sustainable manner. The proposed WSIP is structured to cost-effectively meet water quality requirements, improve seismic and delivery reliability, and achieve water supply goals.

This Fourth (4th) Quarterly Report for Fiscal Year (FY) 2008-2009 presents the progress made on the WSIP regional projects between April 5, 2009 and July 1, 2009. The program's schedule and budget were last approved by the San Francisco Public Utilities Commission (SFPUC or Commission) on July 28, 2009.

June 2009 Revised WSIP:
Consistent with other large and complex infrastructure programs, the WSIP needs to periodically go through a comprehensive review and revision. The process of formally approving new project scopes, schedules and budgets is referred to as re-baselining. Making periodic adjustments in the WSIP through a re-baselining process is required to:

- incorporate the latest available information, including new project scopes, risk mitigation measures and value engineering proposals;
- capture low construction bids in revised project budgets;
- provide more realistic project baselines for performance measurements;
- ensure that adequate funding is available in future supplemental appropriations; and
- ensure compliance with the California Water Code #73500 (Assembly Bills 1823 and 2437).

The adjustments to the program scope, schedule and budget reflected in the June 2009 Revised WSIP were based on an analysis of monthly forecasting and change management data over the past two quarters and a program re-alignment review undertaken by the WSIP Senior Management Team in April 2009. A Notice of Public Hearing describing proposed changes to regional project schedules and scopes was posted on June 26, 2009, in compliance with the notification requirements of the California Water Code. Additional material of proposed cost changes were subsequently posted on July 23, 2009. The June 2009 Revised WSIP was adopted by the SFPUC Commission on July 28, 2009. The approval included an endorsement of recommendations made by the Bay Area Water Supply and Conservation Agency

(BAWSCA). For more information on the program changes adopted by the SFPUC Commission, refer to documents posted on the SFPUC Website under following headings:

Web Address: (http://sfwater.org/detail.cfm/MC_ID/35/MSC_ID/397/C_ID/4660)

- Notice of public Hearing 7/28/09: Proposed Revisions to the WSIP-2
- Notice of public Hearing 7/28/09: Proposed Revisions to the WSIP-1

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It should be noted that the approved June 2009 Revised WSIP does not include revisions to all project budgets and schedules. Projects with cost and schedule variances that can potentially be mitigated were not re-baselined (i.e., changes to the budget and schedule of these projects were not made). Therefore the Baseline (Approved) Budget and/or and Baseline (Approved) Schedule for those projects remain the same and cost and/or schedule variances continue to be reported based on the latest project forecasts.

1.0 PROGRAM SUMMARY

1.2 PROGRAM PERFORMANCE

The overall performance of the WSIP at the program and regional level is assessed using the Earned Value Management (EVM) method. EVM has the unique ability to combine measurements of scope, schedule, and cost in a single integrated system. It allows the WSIP Management Team to (1) measure the amount of work actually performed on the program, (2) forecast the program's cost and completion date using historical and statistical projections, (3) determine how well the program is "performing" compared to its original plan, and (4) forecast how well the program will perform in the future. The Earned Value (or Budgeted Cost of Work Performed) is the cost originally budgeted to accomplish the work completed by the report date. In other words, it is the value of the work completed and it is defined as the percent of work accomplished multiplied by the Approved Budget for that work. Planned Value (or Budgeted Cost of Work Scheduled) is the budgeted cost for the work scheduled to be performed by the report date. The Actual Cost (or Actual Cost of Work Performed) is cost incurred to accomplish the work completed by the report date. EVM uses a number of calculations, indices and variances to assess performance. The Schedule Performance Index (SPI) reported herein is a measure of how well the program is doing in terms of following the WSIP approved schedule. It is calculated by dividing the Earned Value by the Planned Value.

At the project-level, WSIP performance is measured using both the EVM and the reporting of schedule and cost variances. These variances are not based on EVM calculations but instead on an overall progress assessment by Project Managers. Appendices D and E include a summary of schedule and cost variances for all WSIP Regional Projects. The "Schedule Variance of WSIP Regional Project" Table in Appendix D summarizes the schedule variance between the projects' Approved Finish Date and the Current Forecast at Completion (or Forecasted Completion Date). The "Cost Variance of WSIP Regional Projects" Table in Appendix E summarizes the cost variance between the projects' Approved Budget and Current Forecast at Completion (or Forecasted Cost at Completion).

Current Program Performance

WSIP activities during the reporting quarter continued to focus primarily on environmental review and design efforts. To date, planning of the WSIP Regional Program is approximately 96% complete, whereas environmental review/permitting, design and construction efforts are about 67%, 75% and 6% complete, respectively. The Schedule Performance Index (SPI) for the Regional Program is 0.99, indicating that 99% of the overall work planned was performed as of the end of this reporting quarter.

1.0 PROGRAM SUMMARY

Earned Value exceeds Actual Cost to date by $31.5 million. The Planned versus Actual % Completion of all phases of the WSIP Regional Program are summarized in Table 1.1.

Table 1.1 Program Performances (1, 2)

			July 1, 2009	
			% Planned	**% Actual**
Project Management			42.6%	42.8%
Planning			97.3%	96.4%
Environmental			70.1%	66.5%
Right-of-Way			33.4%	30.4%
Design			75.8%	74.6%
Bid & Award			39.0%	39.9%
Construction Management			6.1%	6.1%
Construction			6.1%	6.2%
Close-Out			23.4%	21.8%
Program Management			36.0%	35.9%
Program Cumulative			**16.7%**	**16.6%**

Comparison with last quarter data not provided because program baseline was changed and such comparison would not be meaningful.

Notes:

1. Includes performance from San Joaquin, Sunol Valley, Bay Division, Peninsula, and San Francisco Regional Regions.
2. See Appendix A.2 (Definition and How to Read PSR's) for explanation of percentage calculations.

Overall, the actual performance of the Project Management, Planning, Design, Bid & Award, Construction Management, Construction, and Program Management Phases is tracking planned performance relatively well. The Environmental, Right-of-Way, and Close-out Phases are slightly behind schedule.

The overall Environmental Phase delay is associated with the complex environmental issues to be thoroughly analyzed under the California Environmental Quality Act (CEQA). No delays have been experienced to date in the environmental permits to be issued by various Federal, State and Regional Resource Agencies prior to construction. The delay recorded for the Environmental Phase is due to the addition of a 3rd Admin

1.0 PROGRAM SUMMARY

Draft EIR, a screen check review, and extended review periods requested by Division of Major Environmental Analysis for CUW35901 - New Irvington Tunnel, CUW38101 - SVWTP Expansion & Treated Water Reservoir, and CUW35401 – Lower Crystal Springs Dam Improvements Projects. It should be noted that CUW35901 - New Irvington Tunnel and CUW38101 - SVWTP Expansion & Treated Water Reservoir projects were not re-baselined for schedule under the June 2009 Revised WSIP.

The delay recorded for the ROW Phase is to a great extent a carryover from the delay in the Environmental Phase since some land entitlement and encroachment removal actions cannot be initiated until after a project has formally been approved following CEQA certification. It should be noted that the ROW Phase has not delayed any project to date.

The delay recorded for the Close-Out Phase is attributed to 2 projects – CUW37001 – Pipeline Repair & Readiness Improvements, and CUW35801 – Sunset Reservoir – North Basin. In both cases, additional construction work had to be completed, which delayed the Close-Out Phase. It should be noted that both projects were not re-baselined for schedule under the June 2009 Revised WSIP.

The relative progress of the different regions is summarized in Table 1.2.

Table 1.2 Regional Performance (1)

			July 1, 2009	
			% Planned	**% Actual**
San Joaquin Region	Comparison with last quarter data not provided because program baseline was changed and such comparison would not be meaningful.		17.1%	16.7%
Sunol Valley Region			12.3%	12.0%
Bay Division Region			14.6%	14.8%
Peninsula Region			14.8%	14.8%
San Francisco Regional Region			48.7%	48.5%
System-Wide			30.1%	29.0%
Regional Program Cumulative			**16.7%**	**16.6%**

Notes:
1. See Appendix A.2 (Definition and How to Read PSR's) for explanation of percentage calculations

1.0 PROGRAM SUMMARY

All regions are tracking within +/_ 10% of early planned performance, which is considered acceptable. The delay recorded for San Joaquin Region is due to slippage in attainment of the Draft Environmental Impact Report (DEIR) certification for CUW37301 – San Joaquin Pipeline System Project, which was resulted from a couple of weeks delay in completion of response to public review comments. However, the San Francisco Planning Commission certified the EIR for the CUW37301 – San Joaquin Pipeline System Project on 07/14/09. The overall delay recorded for the Sunol Valley Region is due to delays in the Environmental Phase of the CUW35901 - New Irvington Tunnel and CUW38101 - SVWTP Expansion & Treated Water Reservoir Projects. The delay recorded for the San Francisco Regional is due to delay in completion of Close-out phase for CUW35801 – Sunset Reservoir – North Basin. However, the Sunset Reservoir was placed in active service on January 16, 2009. The delay recorded for the System-Wide Region is due to delay in the Planning Phase of CUW39401 – Watershed Environmental Improvement Program. It should be noted that in accordance with the June 2009 Revised WSIP adopted by the SFPUC Commission on July 28, 2009, the baseline (approved) schedules for all above mentioned projects were not changed.

Project Phase Status

As of July 1, 2009, there are two (2) projects in the Planning Phase, eleven (11) projects in the Design Phase, six (6) projects in the Bid and Award Phase, five (5) projects in the Construction Phase, two (2) projects in the Close-Out Phase, eight (8) projects are completed, one (1) project has not been initiated, and eleven (11) projects have multiple active phases. As of July 1, 2009, one (1) project has not initiated their Environmental Phase, twenty (20) are undergoing environmental review, and twenty-two (22) have completed their Environmental Phase.

1.0 PROGRAM SUMMARY

Table 1.3 Projects Status

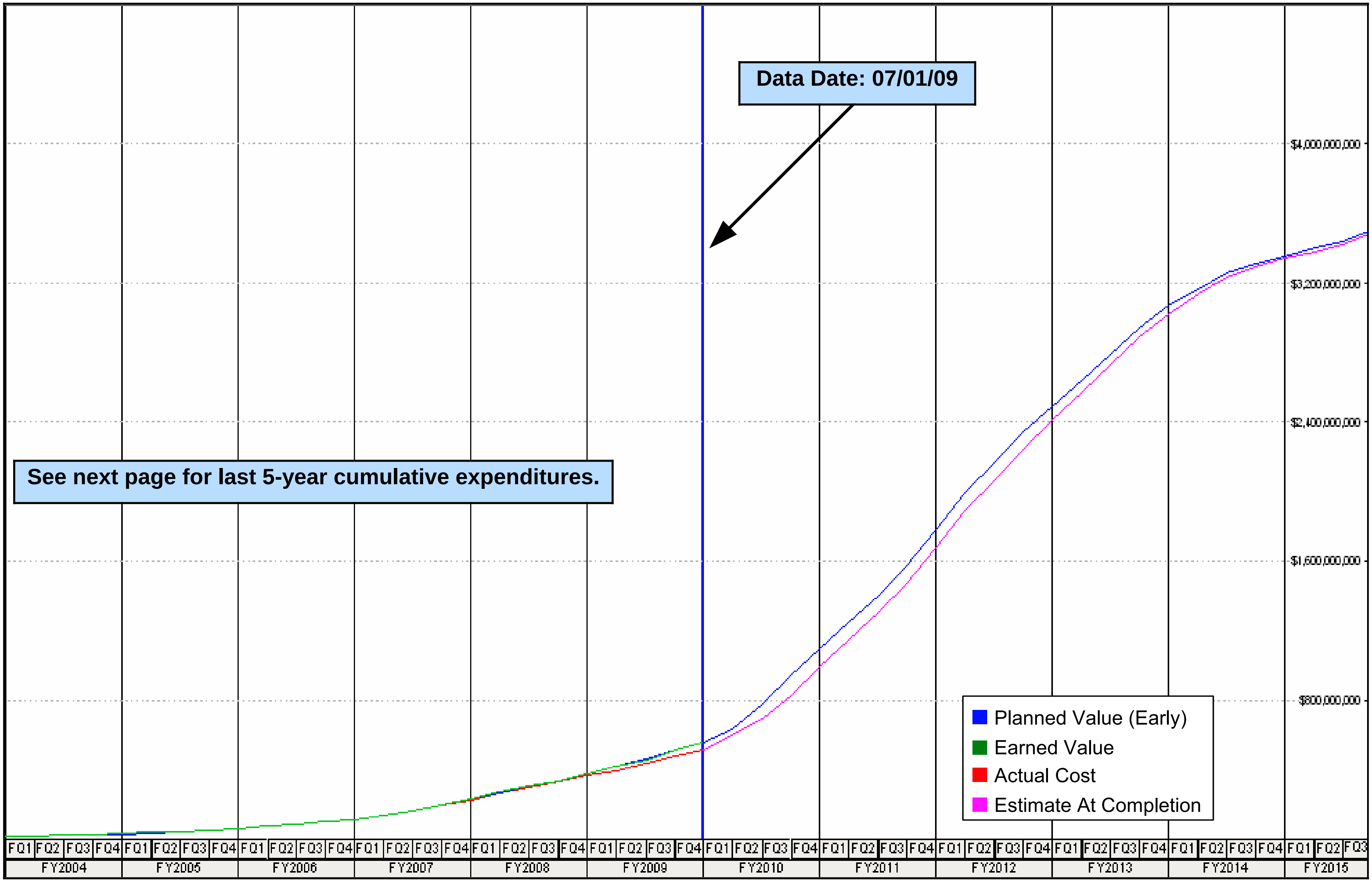
CUW	Project	Active Phase	Environmental Phase
San Joaquin Region			
36401	Lawrence Livermore Water Quality Improvement	Bid & Award	Completed
37301	San Joaquin Pipeline System	Design	Active
37302	Rehabilitation of Existing San Joaquin Pipelines	Planning, Design, Bid & Award	Active
38401	Tesla Treatment Facility	Design, Construction	Completed
38701	Tesla Portal Disinfection Station (combined with 38401)	Combined with 38401	Not Applicable
Sunol Valley Region			
35201	Upper Alameda Creek Filter Gallery	Planning	Active
35501	Standby Power Facilities - Various Locations	Construction	Completed
35901	New Irvington Tunnel	Design	Active
35902	Alameda Siphon #4	Bid & Award	Active
37001	Pipeline Repair & Readiness Improvements	Completed	Completed
37401	Calaveras Dam Replacement	Design	Active
37402	Calaveras Reservoir Upgrades (Completed)	Completed	Completed
37403	San Antonio Backup Pipeline	Design	Active
38101	SVWTP Expansion & Treated Water Reservoir	Design	Active
38102	SVWTP Calaveras Road (Deleted)	Deleted	Not Applicable
38103	SVWTP New Pipeline	Combined with 38101	Not Applicable
38201	SVWTP Treated Water Reservoir (Combined with CUW38101)	Combined with 38101	Not Applicable
38601	San Antonio Pump Station Upgrade	Bid & Award	Completed
Bay Division Region			
35301	BDPL Nos. 3 & 4 Crossover/Isolation Valves	Close-Out	Completed
35302	Seismic Upgrade of BDPL Nos. 3 & 4	Design	Active

1.0 PROGRAM SUMMARY

CUW	Project	Active Phase	Environmental Phase
36301	SCADA System - Phase II	Design, Bid & Award, Construction	Active
36302	System Security Upgrades	Planning, Design, Bid & Award, Construction	Active
36801	BDPL Reliability Upgrade - Tunnel	Design, Bid & Award	Active
36802	BDPL Reliability Upgrade - Pipeline	Design, Bid & Award	Part of 36801
36803	BDPL Reliability Upgrade - Relocation of BDPL Nos. 1 & 2	Bid & Award	Completed
38001	BDPL Nos. 3 and 4 Crossovers	Bid & Award, Construction	Completed
38901	SFPUC/EBMUD Intertie	Close-Out	Completed
39301	BDPL No. 4 Condition Assessment PCCP Sections	Completed	Completed
Peninsula Region			
35401	Lower Crystal Springs Dam Improvements	Design	Active
35601	New Crystal Springs Bypass Tunnel	Construction	Completed
35701	Adit Leak Repair - Crystal Springs/Calaveras (Completed)	Completed	Completed
36101	Pulgas Balancing - Inlet/Outlet Work (Completed)	Completed	Completed
36102	Pulgas Balancing - Discharge Channel Modifications	Construction	Completed
36103	Pulgas Balancing - Structural Rehabilitation and Roof Replacement	Design, Bid & Award	Active
36104	Pulgas Balancing - Laguna Creek Sedimentation (Closed)	Closed	Completed
36105	Pulgas Balancing - Modifications of the Existing Dechlorination Facility	Design	Active
36501	Cross Connection Controls	Completed	Completed
36601	HTWTP Short-Term Improvements - Demo Filters (Completed)	Completed	Completed
36602	HTWTP Short-Term Improvements - Remaining Filters (Combined with CUW36603)	Combined with 36603	Not Applicable

1.0 PROGRAM SUMMARY

CUW	Project	Active Phase	Environmental Phase
36603	HTWTP Short-Term Improvements - Coagulation & Flocculation/ Remaining Filters	Construction	Completed
36701	HTWTP Long-Term Improvements	Design	Active
36702	Peninsula Pipelines Seismic Upgrade	Not Initiated	Not Initiated
36901	Capuchino Valve Lot Improvements (Completed)	Completed	Completed
37101	Crystal Springs/San Andreas Transmission Upgrade	Design	Active
37801	Crystal Springs Pipeline No. 2 Replacement	Design	Active
37901	San Andreas Pipeline No. 3 Installation	Bid & Award	Completed
39101	Baden and San Pedro Valve Lots Improvements	Construction	Completed
San Francisco Regional Region			
30103	Regional Groundwater Storage and Recovery	Design, Bid & Award, Construction	Active
35801	Sunset Reservoir - North Basin	Construction, Close-Out	Completed
37201	University Mound Reservoir - North Basin	Bid & Award	Completed
System-Wide Region			
38801	Programmatic EIR	Completed	Completed
38802	Habitat Reserve Program	Design, Construction	Active
39401	Watershed Environmental Improvement Program	Planning	Not Initiated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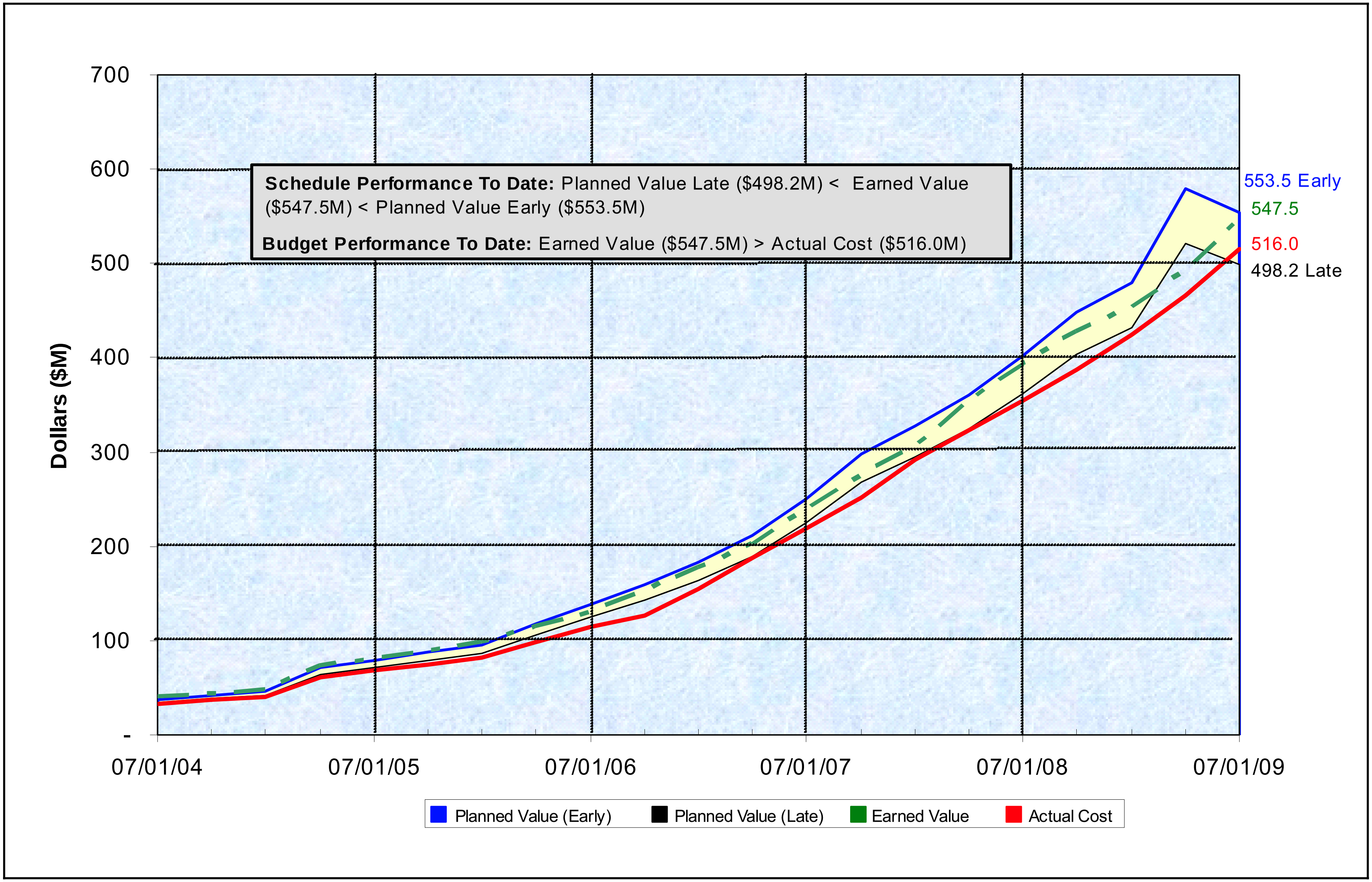
See next page for last 5-year cumulative expenditures.
$4,000,000,000
$3,200,000,000
$2,400,000,000
$1,600,000,000
$800,000,000
Planned Value (Early)
Earned Value
Actual Cost
Estimate At Completion
FY2004
FY2005
FY2006
FY2007
FY2008
FY2009
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015

CUMULATIVE EXPENDITURES (LAST 5 YEARS)



Phase	Schedule				Budget							
	Approved Start	Current Start	Approved Finish	Current Finish	Planned Expenditure To Date	Planned % Complete	Expended To Date	Actual % Expended	Progress % Complete	Earned Value Cost	Approved Budget	Current Forecast
Project Management	03/31/00	03/31/00A	12/04/15	12/04/15	$57,870,000	42.6	$53,302,000	39.2	42.8	$58,107,000	$135,886,000	$135,323,000
Planning	03/31/00	03/31/00A	12/30/10	12/30/10	$62,756,000	97.3	$61,403,000	94.8	96.4	$62,183,000	$64,789,000	$65,053,000
Environmental	10/14/02	10/14/02A	12/31/12	12/31/12	$62,899,000	70.1	$52,394,000	57.3	66.5	$59,689,000	$91,473,000	$91,279,000
Right-of-Way	03/27/06	03/27/06A	09/13/12	09/13/12	$7,823,000	33.4	$6,329,000	27.0	30.4	$7,126,000	$23,406,000	$23,386,000
Design	10/01/01	10/01/01A	10/31/12	10/31/12	$155,172,000	75.8	$141,502,000	69.1	74.6	$152,655,000	$204,917,000	$204,854,000
Bid and Award	03/05/04	03/05/04A	04/30/13	04/30/13	$2,190,000	39.0	$1,654,000	29.3	39.9	$2,238,000	$5,644,000	$5,531,000
Construction Management	01/18/05	01/18/05A	06/03/15	06/03/15	$18,468,000	6.1	$16,306,000	5.4	6.1	$18,395,000	$302,875,000	$303,327,000
Construction	07/01/03	07/01/03A	06/03/15	06/03/15	$144,764,000	6.1	$146,030,000	5.7	6.2	$145,703,000	$2,566,573,000	$2,585,086,000
Close-Out	10/06/05	10/06/05A	12/04/15	12/04/15	$1,858,000	23.4	$783,000	9.9	21.8	$1,732,000	$7,937,000	$7,972,000
Program Management	08/01/05	08/01/05A	12/04/15	12/04/15	$39,747,000	36.0	$36,336,000	32.9	35.9	$39,688,000	$110,525,000	$110,525,000
Regional Total	**03/31/00**	**03/31/00A**	**12/04/15**	**12/04/15**	**$553,548,000**	**16.7**	**$516,039,000**	**14.7**	**16.6**	**$547,516,000**	**$3,514,026,000**	**$3,532,336,000**
Local Total	**01/02/01**	**01/02/01A**	**10/14/14**	**10/14/14**	**$231,105,000**	**40.5**	**$227,164,000**	**37.9**	**40.3**	**$230,106,000**	**$599,830,000**	**$604,547,000**
										Budgeted Finance Cost:	**$471,700,000**	**$471,700,000**
										WSIP Total Cost:	**$4,585,556,000**	**$4,608,583,000**

1.0 PROGRAM SUMMARY

1.3 PROGRAM UPDATE

Program Management

During the reporting quarter, WSIP Program Management efforts continued to focus on several key activities including program level contracts, various ongoing program control initiatives, and system shutdown planning and public and contractor outreach efforts. In addition, efforts were spent on addressing follow up comments provided by regulatory agencies and the Bay Area Water Supply & Conservation Agency (BAWSCA) on the WSIP proposed changes, as well as on a number of other activities related to the implementation of the program.

The 2nd Quarter - Fiscal Year 2008-2009 (Q2-FY08/09) Regional Projects Quarterly Report listed commitments that were made to the California Department of Public Health (CDPH) and the California Seismic Safety Commission (CSSC) in response to their concerns about the program changes approved in 2008. Progress was made during the last quarter on some of the commitments to CDPH that were included in a letter to them from the SFPUC on November 13, 2008, as reported below:

Conduct independent technical review for the CUW35902 - Alameda Siphon #4 project to assure seismic reliability; investigate potential additional capital and operational response improvements that may increase seismic reliability in the Sunol Valley; create and implement a seismic response strategy for the Sunol Valley, as well as update Operational Response Plans to address response procedures including operation of WSIP facilities following major seismic events. A review by seismic design experts was performed for the Alameda Siphon #4 project, focusing on the adequacy of the design to withstand a Calaveras design earthquake. In the draft report "Draft: Seismic Review of Alameda Siphon #4 Project" (URS, March 12, 2009), the Review Team concluded that an "acceptable standard of care" was applied to the design, and that the "project uses appropriate technology to achieve the WSIP goals." The report was finalized May 21, 2009. In addition to this review, the Sunol Valley Seismic Reliability Assessment final draft was completed May 2009. It presents the results of various reviews and evaluations that the SFPUC has conducted regarding the level of seismic reliability that will be provided in the Sunol Valley following completion of the WSIP. The intent is to:

- Verify the adequacy of the existing and proposed facilities and operational requirements to meet their intended purposes in satisfying the seismic reliability level of service (LOS) goals.
- Identify potential weaknesses.

- Identify additional improvements that might increase reliability beyond the requirements of the seismic reliability LOS goals.

There has been a significant amount of detailed evaluation and design performed to date on the individual facilities in the Sunol Valley so that these facilities comply with the seismic reliability LOS goals. However, in some cases, reliability may be further increased through a combination of synergistic improvements to multiple projects, including both capital and operational, that would not be achievable by a single project. Key recommendations from the document have been incorporated or are being considered for incorporation in several projects.

Progress was made during the last quarter on the SFPUC's commitments to the CSSC that were included in a letter to the CSSC dated November 13, 2008. During the past quarter, SFPUC facilitated URS Consultants' presentation on their approach to the design of a seismically reliable pipeline at the Bay Division Pipelines Nos. 3 and 4 Hayward Fault crossing to the independent Seismic Safety Task Force (SSTF), as well as AECOM's approach to seismic reliability modeling and analysis. The Seismic Safety Task Force will be following up with written recommendations regarding "Revised General Seismic Requirements for Design of New Facilities and Upgrade of Existing Facilities – Revision 1" (SFPUC, December 22, 2008) in the next quarter. In addition, they will also provide their written recommendations regarding the proposed reduction of redundant seismically reliable pipeline at the Bay Division Pipelines Nos. 3 and 4 Hayward Fault crossing.

SFPUC staffs are scheduling to meet with the SSTF again in the next quarter to follow up on two remaining items:

a) Magnitude of design earthquakes for WSIP projects impacted by the Calaveras Fault;
b) Size and consistency of design fault displacements at pipeline crossings. The SSTF confirmed in a meeting on May 11, 2009 that the size of design fault displacements used for WSIP projects is reasonable and consistency has been maintained among projects, and the SSTF indicated they will be providing written recommendations in the upcoming quarters.

During the CSSC meeting on October 28, 2008, the SFPUC concurred with the CSSC that two issues warranted evaluations by external experts/consultants:

a) **Redundancy of the Alameda Siphon Project and alternative connections between the Sunol Valley Water Treatment Plant and the Irvington Tunnel.** A draft report titled, "Sunol Valley Seismic Reliability Assessment" by CH2M Hill has been completed. The final draft report was completed in May 2009. As discussed above, key recommendations from the document have been incorporated or are being considered for incorporation in several projects.

b) **Faulting and slope stability issues at the Harry Tracy Water Treatment Plant (HTWTP): Status of the two reports for HTWTP is as follows:**
   - "Draft Seismic Risk Assessment for Treated Water Reservoirs" by Exponent Failure Analysis Associates (December 2008). Final draft report was submitted to SFPUC at the end of June 2009. The consultant will issue the final report this quarter.
   - "Supplemental Fault Rupture Hazard Assessment" by William Lettis & Associates, Inc. was finalized in March 2009.

The SFPUC continued to prepare a Preliminary Official Statement in anticipation of issuing the second round of WSIP bonds in August 2009. The expected total bond size is an estimated $375 million in one or more series and proceeds will be used to defease outstanding commercial paper as well as continue funding WSIP capital projects.

During this reporting period, ongoing efforts aimed at improving the WSIP Program Controls System and processes included the following accomplishments: (1) Performing a thorough and systematic analysis of program scope, cost and schedule to generate the proposed program changes; (2) establishing detailed project baselines for monitoring, controlling and reporting purposes; (3) providing online "dashboard" access to the Construction Management Consultants to view respective projects schedule at the program level; and (4) holding cost estimating training sessions.

Planning efforts associated with system shutdowns continued during the reporting quarter. The WSIP Management Team held multiple meetings with the SFPUC Water Enterprise to coordinate the planning, scheduling, staffing, and work-around plans for the WSIP system shutdowns required through 2014. A number of special shutdown meetings were also held to plan for the Coast Range Tunnel shutdown in January 2010. The WSIP Master System Shutdown schedule and a summary of the changes made to the schedule since it was last updated in October 2008 was issued and distributed to the BAWSCA on May 8, 2009.

WSIP Communications orchestrated two major groundbreaking events for regional projects in the Peninsula and San Joaquin Regions during the quarter. These events resulted in significant media coverage regarding WSIP. Additionally, Communications collaborated with the WSIP Construction Management team in the first of several orientation trainings for staff and consultant teams managing WSIP projects in construction. Communications also activated its program consultant to audit Communications planning and execution in all regions and implement new action plans and procedures for WSIP communications in the field.

The groundbreaking for the CUW35601- New Crystal Springs Bypass Tunnel coincided with the anniversary of the 1906 earthquake and was collaboration with US Geological Survey as well as San Mateo Board of Supervisors. The event received widespread media coverage. In May 2009, the USGS prominently displayed WSIP projects and efforts to seismic retrofit the regional water system as part of its annual open house that drew 10,000 guests. In San Joaquin, the Mayor of San Francisco and President of the San Joaquin Board of Supervisors along with representatives of the U.S. Environmental Protection Agency (EPA) broke ground for the CUW38401 - Tesla Treatment Facility Project near Tracy, CA. Again, this event brought significant media attention to WSIP around the state.

San Joaquin regional Communications Liaison coordinated briefings before the Stanislaus and San Joaquin Board of Supervisors, Riverbank City Council and respective Irrigation Districts' Commissions. In the Sunol region, briefings continue with key Alameda County representatives and the Sunol Citizens Advisory Committee. Additionally, Communications is planning an event with the Sunol School to kick-off the first WSIP project in the Sunol Valley: CUW35902 - Alameda Siphon #4. As the Bay Division region prepares for environmental certification hearings, Communications is taking the lead to arrange final meetings with all municipalities and counties on the Memorandums of Understanding (MOU) for CUW36801/36802 - BDPL Reliability Upgrade – Tunnel/Pipeline Projects. In the Peninsula region, Communications is onsite regularly at New Crystal Springs Tunnel site, as well as focusing on outreach around Daly City and Sawyer Camp Trail projects. With final approval of CUW 37901 - San Andreas Pipeline #3 Installation Project, Communications is refining outreach plans for 4.4 mile pipeline between Daly City and San Francisco's Stonestown neighborhood.

Coordination with the Arts Commission Civic Design Review Committee has produced a design charrette for water supply groundwater projects. This innovative solution will help streamline approvals for more than 20 ground well sites in northern San Mateo County and within San Francisco.

Social marketing continues to be an increasingly popular platform to promote the WSIP projects among neighbors and others. Upcoming refinements to the WSIP website will enable visitors to access blogs quicker for project updates. Additionally, WSIP will add an environmental section to highlight environmental management on projects throughout the regions.

Contracting Outreach staff held a successful Contractor's Fair on April 1 in San Mateo, coordinating with both the Peninsula Builder's Exchange and the WSIP Small Business Advisory Committee. More than 75 contractors and primes from the area attended as did San Mateo Supervisor Rose Jacobs Gibson. Throughout the quarter, this team certified 13 new local business enterprise (LBE) contractors and subcontractors in the regions. Since July 1, 2008, 103 LBE contractors have been certified.

Contracting Outreach also assisted with numerous pre-bid conferences for WSIP Projects. In June, the team hosted another successful Contractor's Breakfast with a film highlighting labor's successful involvement within WSIP and the strides SFPUC has made to improve the contracting process. WSIP's presence at Rapid Excavation and Tunneling Conference (RETC), also in June, provided national exposure to several upcoming WSIP projects that will be out for bid in the coming year.

Planning/Design

Planning and design efforts continue with most projects achieving their key scheduled milestones. All regional projects with the exception of two projects (CUW35201 – Upper Alameda Creek Filter Gallery and CUW39401 – Watershed Environmental Improvement Program) have now entered the Design Phase. During this reporting period, the Design Phase for the CUW37901 - San Andreas Pipeline No. 3 Installation, and CUW38601 - San Antonio Pump Station Upgrade Projects were completed. The 35% design package for the CUW35302 – Seismic Upgrade of BDPL Nos. 3 & 4 Project, and the 95% design package for the CUW38401 – Tesla Treatment Facility, CUW36301 – SCADA System – Phase II, CUW35401 – Lower Crystal Springs Dam Improvements, CUW38101 – SVWTP Expansion & Treated Water Reservoir, and CUW5901 – New Irvington Tunnel Projects were all completed.

In addition, the construction bid packages for the CUW36401 - Lawrence Livermore Water Quality Improvement, CUW37302 - Rehabilitation of Existing San Joaquin Pipelines (Roselle Crossover), CUW37901 - San Andreas Pipeline No. 3 Installation, CUW36103 -Pulgas Balancing – Structural Rehabilitation and Roof Replacement, and CUW38601 - San Antonio Pump Station Upgrade Projects were advertised.

A Cooperative Agreement with Caltrans District 4 for proposed improvements in connection with WSIP within the State Highway System ROW was executed on February 19, 2009, and will be effective through December 31, 2017. To date, WSIP has received sixteen (16) encroachment permits from Caltrans. As a part of this agreement, the SFPUC agreed to establish a Construction Zone Enhancement Enforcement Program (COZEEP), working with the California Highway Patrol (CHP) for traffic safety on State highways. This quarter, an agreement with the California Highway Patrol (CHP) to provide the COZEEP services during construction of the improvements has been drafted. This agreement will help facilitate construction around State highways by providing supplemental CHP officers to assist the SFPUC and its contractors in the management of traffic in order to enhance the safety of motorists, pedestrians, and construction workers.

To ensure all WSIP projects share a common contract basis, the Engineering Management Bureau (EMB) has completed work on the "baseline template" for the Division 0 (Procurement and Contracting Requirements) and Division 1 (General Requirements) Specifications.

Environmental

Keeping the environmental review process on track with scheduled performance has been one of the program's greatest challenges. This challenge encompasses the following factors: (1) the early decision to conduct the Pre-Construction Phases (planning, design, and environmental) for the WSIP in parallel. Although this approach saves time overall and is practiced on major infrastructure programs, it requires several iterations of environmental reviews as design progresses and projects scopes are modified. (2) Preparation of the Draft PEIR in parallel with individual project EIRs. Additional time was needed to accomplish the necessary level of consistency of individual documents with the PEIR. (3) New environmental resource issues surfaced during report preparation that was initially excluded from consideration. For example, Steelhead fisheries analyses, previously anticipated to be completed under a separate permitting process, are now required for completion of the environmental review for the CUW37401 - Calaveras Dam Replacement Project. (4) Inadequate consultant resources have resulted in prolonged document reviews by the Major Environmental Analysis Division of the San Francisco Planning Department (MEA) and termination of two consultant contracts. Having released two consulting firms, the transition to new consultants extended the schedule. (5) Several projects were delayed as a result of the decision by MEA to prepare EIRs instead of Mitigated Negative Declarations (MNDs) on some projects, thus prolonging the Environmental Phase.

The SFPUC Bureau of Environmental Management (BEM) continues to work closely with the SFPUC Water Enterprise, MEA, the Office of the City Attorney and the environmental consultants to mitigate delays in the environmental review process. In addition to hiring new consultants for some projects, additional consultants have been hired to supplement MEA's staff and to supplement some existing consulting contracts.

During the reporting quarter, significant progress was made in certification of several Environmental Impact Reports (EIRs), completion and publication of several Draft EIRs and receipt of other California Environmental Quality Act (CEQA) clearances. Specific CEQA review accomplishments include the following:

The San Francisco Planning Department approved the Mitigated Negative Declaration (MND) for the CUW36103 – Pulgas Balancing - Structural Rehabilitation and Roof Replacement Project on May 14, 2009.

The San Francisco Planning Commission certified the Environmental Impact Report for the CUW37901 – San Andreas Pipeline No. 3 Installation - Project on April 2, 2009

Response to Comments documents were published for the CUW37301 - San Joaquin Pipeline System and CUW36801/CUW36802 – BDPL Reliability Upgrade – Tunnel/ Pipeline Projects on May 14, 2009 and June 18, 2009 respectively.

The Notice of Preparation (NOP) document for the Environmental Impact Report for CUW30103 - Regional Groundwater Storage and Recovery Project was published on June 22, 2009.

Draft Environmental Impact Reports (EIR) were published for the CUW35901 – New Irvington Tunnel and CUW38101 – SVWTP Expansion & Treated Water Projects, both on June 1, 2009.

Resource agency permitting involves the environmental permits that must be obtained prior to construction from the following agencies: US Army Corps of Engineers (USACE), the US Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the State Historic Preservation Officer (SHPO), the California Department of Fish and Game (CDFG), and the Regional Water Quality Control Board (RWQCB).

Significant progress was made on environmental permitting activities. Specific permitting accomplishments during the reporting period are summarized below.

<u>*Permits Applications Submitted:*</u>

- CUW36801 – BDPL Reliability Upgrade - Tunnel:
    - USACE submitted Letter to SHPO for 106 concurrence

- CUW 35901 - New Irvington Tunnel:
  - Submitted 404 Application to USACE
  - Submitted Biological Assessment to USFWS
- CUW37401 – Calaveras Dam Replacement:
  - Submitted Draft Biological Assessment to NMFS
  - Submitted Section 404 Individual Permit Application to the USACE
  - Submitted Biological Assessment to USFWS
- CUW 38101 – SVWTP Expansion & Treated Water Reservoir:
  - Submitted 404 Application to USACE
  - Submitted Biological Assessment to USFWS

Permits Received:

- CUW35902 – Alameda Siphon #4:
  - Completed 401 Water Quality Certification from the RWQCB
- CUW37401 – Calaveras Dam Replacement:
  - Received Approval on Second Supplemental Wetland Delineation Report for verification

Environmental Construction Compliance Management

During this reporting period, the WSIP Environmental Construction Compliance Manager (ECCM) coordinated completion of the Environmental Mitigation Section of the Contract Specifications for one (1) project (CUW36801 – BDPL Reliability Upgrade – Tunnel (East Bay Segment)) and four (4) others are in progress (CUW35901 – New Irvington Tunnel, CUW37301 - San Joaquin Pipeline System, CUW36801 – BDPL Reliability Upgrade – Tunnel (Peninsula Segment), and CUW38101 – SVWTP Expansion & Treated Water Reservoir Projects). Preconstruction planning efforts focused on finalizing environmental construction compliance contracts for Peninsula Region and performing other tasks supporting the environmental compliance program for this region. In addition, agency coordination/reporting and minor project modification approvals supported pre-construction and construction phases for the CUW35601 - New Crystal Springs Bypass Tunnel, CUW38401 - Tesla Treatment Facility, CUW36102-Pulgas Balancing - Discharge Channel Modifications, CUW39101 - Baden and San Pedro Valve Lots Improvements, and CUW38001 – BDPL No. 3 & 4 Crossovers Projects. A training manual for Environmental Inspectors was developed.

Right-of-Way

The ROW engineering, surveys and appraisals have been completed for the CUW36801 - BDPL Reliability Upgrade - Tunnel Project. The project passes through the lands of

USFWS, State Lands, Mid-Peninsula Open Space, Sam-Trans and Leslie Salt. Each of these ownerships will involve different and challenging land acquisition processes.

Encroachment removal activities continues for the CUW36802 - BDPL Reliability Upgrade - Pipeline Project. The Right-of-Way (ROW) Team is now focusing on the remaining difficult encroachments and is diligently working with the City Attorney's Office to find solutions for removal which may include litigation if absolutely necessary. The ROW Team is also mapping and appraising the Bay Road parcel and the City of Fremont Access Road.

The appraisal process was completed for the CUW38001 - BDPL No. 3 & 4 - Crossovers Project and the land acquisition process is underway. Negotiations resulted in a successful settlement on the Guadalupe site in Santa Clara. Discussions continue with Cal Water.

The ROW Team received the final alignment for the CUW35901 - New Irvington Tunnel Project and the ROW mapping has been completed. A significant portion of the appraisal work is underway on this project and the Project Team is meeting with the property owners to explain the ROW process. Initial relocation planning has also commenced.

A ROW Encroachment Team was set up for the CUW37301 - San Joaquin Pipeline System Project. Sixty-nine (69) encroachments have been identified and contact has been initiated via letter and personally. ROW engineering and surveys work have commenced and are ongoing. The appraisal process was also initiated on this project.

Overall, the ROW Team is making steady progress; however, delays in the environmental review of some projects have impacted the ROW Team's ability to initiate some tasks that require CEQA approval first.

Construction

Significant efforts continued on implementing the construction management (CM) approach, structure, processes, procedures and systems, and recruiting the consultants and staffing required managing all upcoming construction activities.

Pre-construction planning:
Pre-construction planning efforts focused on: (1) finalizing of CM Procedures based on the WSIP CM Plan: 46 out of 49 procedures are posted as final on the WSIP section of the SFPUC website (sfwater.org/WSIP) and the SFPUC network drives; (2) implementing

the SFPUC revised construction specifications (Perfectus Version 3 for Division 0 and Division 1) on WSIP projects; (3) updating the CM Staffing Plan to manage consultant needs and internal hiring/re-assignment requirements based on schedule update of several WSIP projects and the transition of City staff to CMB; and (4) implementing the WSIP CM Management Information System (CMIS) to provide efficient and consistent management of various CM processes such as submittals, requests for information, written communications, and changes. Preparation of CM Construction Procedures is 98% complete as of the end of the reporting quarter. A thorough QA review has been completed and revisions to incorporate all comments are currently in progress for the WSIP Business Processes, CM Procedures, and the CM Plan.

<u>Construction Management Information System (CMIS)</u>:
The WSIP CMIS continued to be transitioned into use on WSIP projects. The CMIS was implemented on the following projects:

- CUW35601 - New Crystal Springs Bypass Tunnel Project, which had its NTP in December 2008.

- CUW38401 - Tesla Treatment Facility Project, which had its construction NTP in March 2009.

- CUW39101 - Baden and San Pedro Valve Lot Improvements Project, which had its NTP in April 09.

- CUW36102 –Pulgas Balancing - Discharge Channel Modifications Project, which had its NTP in April 09.

As of this reporting quarter, a total of about 80 individuals consisting of construction contractors, CM Consultants and SFPUC WSIP employees had received CMIS training.

<u>CM Contract Agreements and Progress</u>:
Significant efforts were made continuing to select and put in place Construction Management Consultants for the WSIP. As of the end of the quarter, the following CM Contract Agreements were in effect:

- CS-910: Construction Management (CM) Services for WSIP - San Francisco Region/Local;
- CS-912: Construction Management (CM) Services for WSIP - New Crystal Springs Bypass Tunnel Project;
- CS-913: Construction Management (CM) Services for WSIP - Bay Tunnel Project;

- CS-914: Construction Management (CM) Services for WSIP – Bay Division Region;
- CS-917: Construction Management (CM) Services for WSIP - San Joaquin Region

Two other Contract Agreements for CM services were awarded and were in process of negotiations:
- CS-915R: Sunol Regional Construction Management (CM) Services and
- CS-918: Construction Management (CM) services for WSIP - New Irvington Tunnel Project.

An additional contract Agreement for CS-916: Peninsula Regional Construction Management (CM) Services has been advertised and is in the selection process for ranking and award to the most qualified proposer.

Three (3) other Construction Management (CM) services RFPs have yet to be advertised: CS-911R Calaveras Dam, HTWTP Long-term Improvement project and Seismic Upgrade of BDPL No. 3 & 4. (CS numbers have not been assigned to the last two projects).

<u>Partnering/Disputes Review Advisors (DRA)/Disputes Review Boards (DRB)</u>:
Formal partnering and informal partnering is being conducted with Project CM teams including CM Consultants, City CM Staff and Construction Contractors. Additionally, alternative dispute resolution methods involving independent third party Disputes Review Advisors or Disputes Review Boards are being put into place on all medium to large WSIP construction contracts.

<u>Supplier Quality Surveillance (SQS)</u>:
During this reporting period, Parsons as a part of their Pre-construction services has developed SQS Plans for scoping independent third party quality assurance in SFPUC and Construction Contractor vendor fabrication facilities which are providing permanent plant equipment and materials for WSIP construction projects. This is being done to assure that complex equipment and equipment critically needed as a prerequisite to major system shutdowns is delivered on time and to specified quality requirements. SQS Plans for the following projects were developed this reporting period:
- CUW38401 - Tesla Treatment Facility
- CUW37301 – San Joaquin Pipeline System (Contract 1)
- CUW35902 - Alameda Siphon #4
- CUW38001 - BDPL Nos. Crossovers
- CUW39101 – Baden and San Pedro Valve Lots Improvements

1.0 PROGRAM SUMMARY

Program Construction Management:
AECOM began work as Program Construction Management (PCM) team in March, 2009 providing management oversight of construction and implementation of the WSIP CM Plan and processes at the program level. As of June 30, 2009, the PCM team is fully mobilized.

WSIP Construction Management Training:
The first Construction Management (CM) Orientation and Training Session was conducted in June, 2009. The session provided a one-day hands-on workshop to provide a practical overview and working knowledge of the WSIP CM Plan and Procedures, key contractual and regulatory requirements, and the CM role in implementing these in a correct and consistent manner. These sessions will continue to be provided as Project CM teams are mobilized and put in place.

Project Achievements

Planning Phase Completed:
- None

Environmental Phase Completed:
- CUW37901 - San Andreas Pipeline No. 3 Installation
- CUW38801 - Programmatic EIR

Design Phase Started:
- None

Design Phase Completed:
- CUW37901 - San Andreas Pipeline No. 3 Installation
- CUW38601 - San Antonio Pump Station Upgrade

Construction Contract Advertised:
- CUW36103 - Pulgas Balancing - Structural Rehabilitation and Roof Replacement
- CUW36401 - Lawrence Livermore Water Quality Improvement
- CUW38001 – BDPL No. 3 and 4 – Crossovers
- CUW37901 - San Andreas Pipeline No. 3 Installation
- CUW38601 - San Antonio Pump Station Upgrade

Construction Contract Awarded:

1.0 PROGRAM SUMMARY

- CUW35901 – Alameda Siphon #4
- CUW37201 - University Mound Reservoir - North Basin
- CUW37901 - San Andreas Pipeline No. 3 Installation
- CUW38001 - BDPL Nos. 3 and 4 Crossovers

Construction Final Completion:
- None

1.0 PROGRAM SUMMARY

2.0 SUB PROGRAM SUMMARY

2.5 WATER SUPPLY

Overall, the Water Supply projects are on schedule with an actual completion of 8.0% as compared to a planned completion of 8.8%. The Schedule Performance Index (SPI) for the Region is 0.91. This indicates that 91% of the work planned was performed as of the end of the reporting quarter. Earned Value exceeds actual costs to date by $2.1 million. The table below summarizes the overall progress of the Water Supply Sub Program during the reporting quarter.

Table 2.5 Sub Program Performance – Water Supply

			July 1, 2009	
			% Planned	**% Actual**
Project Management			26.5%	24.6%
Planning			65.6%	63.7%
Environmental			27.3%	16.0%
Right-of-Way			3.0%	0.5%
Design			7.8%	7.2%
Bid & Award			0.0%	0.0%
Construction Management			2.3%	2.3%
Construction			2.2%	2.2%
Close-Out			0.0%	0.0%
Program Cumulative			**8.8%**	**8.0%**

Comparison with last quarter data not provided because program baseline was changed and such comparison would not be meaningful.

In accordance with the June 2009 Revised WSIP adopted by the SFPUC Commission on July 28, 2009, a Water Supply sub program comprising of seven (7) projects was added to the Local projects. The following changes were made to the Baseline (Approved) Budget and Schedule of the seven (7) projects in this sub program:

<u>Projects with Changes to Baseline (Approved) Schedule and Budget</u>

- CUW30201 – San Francisco Westside Recycled Water
- CUW30204 – Harding Park Recycled Water

<u>Projects with Changes to Baseline (Approved) Schedule</u>

2.0 SUB PROGRAM SUMMARY

- CUW30102 – San Francisco Groundwater Supply

Projects with Changes to Baseline (Approved) Budget

- CUW30101 – Lake Merced Water Levels Restoration
- CUW30202 – Recycled Water Project – Pacifica (Closed)

Projects with No Changes to Baseline (Approved) Budget and Schedule

- CUW39001 – SF Bay Area Desalination Plant (On Hold)

Additionally, one (1) new project, CUW30205 – San Francisco Eastside Recycled Water was added to this sub program.

Planning
Planning phase is slightly behind schedule with an actual completion of 63.7% versus 65.6% for planned. Planning Phase activities for the CUW30201 – San Francisco Westside Recycled Water–completed the Final Preliminary Project Scope Description. Planning activities for the CUW30101 –Lake Merced Water Levels Restoration involve revision to the Draft CER.

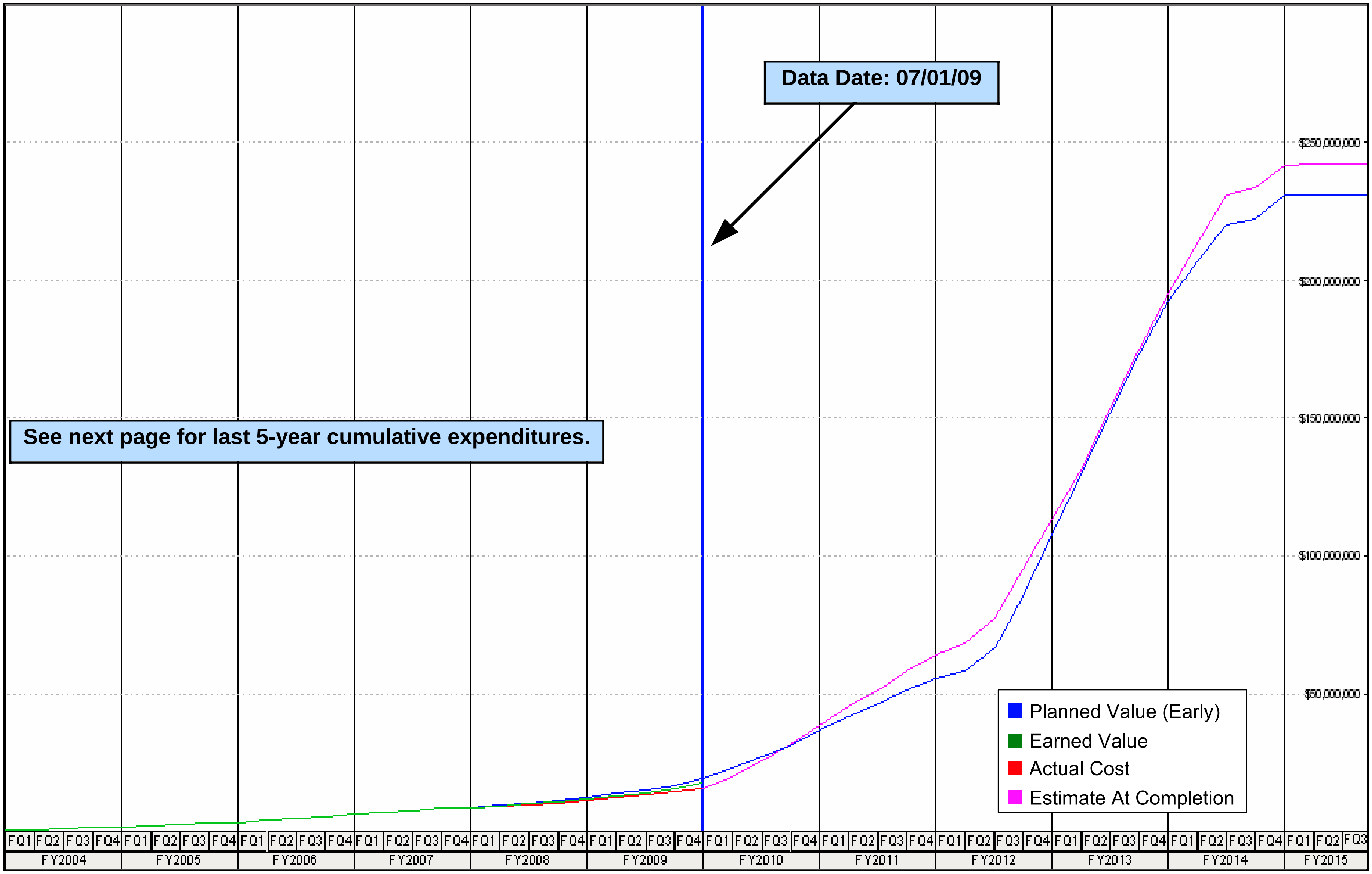
Environmental
Environmental phase is behind schedule with an actual completion of 16.0% versus 27.3% for planned. Environmental Phase activities for the CUW30201 –Recycled Water Project – San Francisco Project resumed this quarter after the scope revision. The Administrative Draft EIR was issued for internal review for CUW30204 – Harding Park Recycled Water.

Design
Design phase is behind schedule with an actual completion of 7.2% versus 7.8% for planned. CUW30102 – San Francisco Groundwater Supply project team completed the 35% design milestone this quarter. For CUW30204 – Harding Park Recycled Water, 95% design completion is anticipated by next quarter.

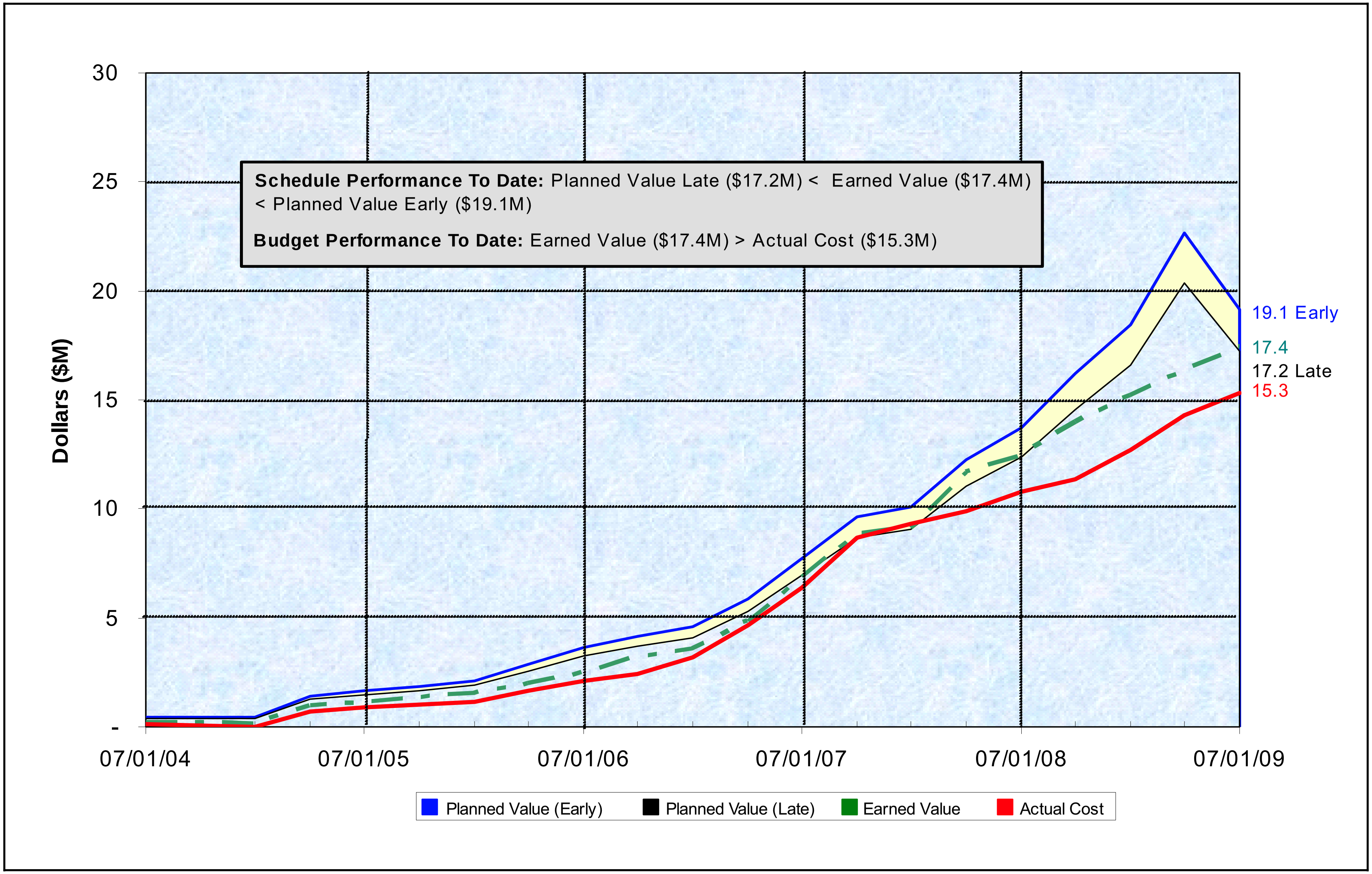
Construction
Construction phase is on schedule with an actual completion of 2.2% versus 2.2% for planned. There were no significant Construction Phase activities on any of the projects in the Water Supply Sub Program.

2.0 SUB PROGRAM SUMMARY

Figure 2.7 San Francisco Groundwater Supply Test Well Drilling


Data Date: 07/01/09
See next page for last 5-year cumulative expenditures.
$250,000,000
$200,000,000
$150,000,000
$100,000,000
$50,000,000
Planned Value (Early)
Earned Value
Actual Cost
Estimate At Completion
FQ1 FQ2 FQ3 FQ4
FY2004
FY2005
FY2006
FY2007
FY2008
FY2009
FY2010
FY2011
FY2012
FY2013
FY2014
FY2015

CUMULATIVE EXPENDITURES (LAST 5 YEARS)



SUB PROGRAM SUMMARY

Phase	Schedule				Budget							
	Approved Start	Current Start	Approved Finish	Current Finish	Planned Expenditure To Date	Planned % Complete	Expended To Date	Actual % Expended	Progress % Complete	Earned Value Cost	Approved Budget	Current Forecast
Project Management	01/06/03	01/06/03A	10/14/14	10/14/14	$3,982,000	26.5	$3,493,000	23.3	24.6	$3,689,000	$15,017,000	$15,017,000
Planning	01/06/03	01/06/03A	10/03/11	10/03/11	$6,944,000	65.6	$6,208,000	58.2	63.7	$6,738,000	$10,672,000	$10,672,000
Environmental	10/13/03	10/13/03A	04/08/13	04/08/13	$2,463,000	27.3	$1,351,000	14.4	16.0	$1,447,000	$9,375,000	$9,375,000
Right-of-Way	02/02/07	02/02/07A	05/20/13	05/20/13	$21,000	3.0	$0	0.0	0.5	$4,000	$697,000	$697,000
Design	05/12/04	05/12/04A	04/11/13	04/11/13	$2,387,000	7.8	$1,236,000	4.0	7.2	$2,205,000	$30,845,000	$30,845,000
Bid and Award	04/18/05	04/18/05A	09/24/13	09/24/13	$0	0.0	$0	0.0	0.0	$0	$450,000	$450,000
Construction Management	10/20/04	10/20/04A	04/15/14	04/15/14	$439,000	2.3	$439,000	2.3	2.3	$439,000	$18,802,000	$18,802,000
Construction	08/02/04	08/02/04A	04/15/14	04/15/14	$2,896,000	2.2	$2,561,000	1.8	2.2	$2,896,000	$144,501,000	$149,218,000
Close-Out	11/05/09	06/30/09A	10/14/14	10/14/14	$0	0.0	$0	0.0	0.0	$0	$730,000	$730,000
Water Supply Cumulative	**01/06/03**	**01/06/03A**	**10/14/14**	**10/14/14**	**$19,133,000**	**8.8**	**$15,289,000**	**6.6**	**8.0**	**$17,418,000**	**$231,088,000**	**$235,805,000**

3.5 WATER SUPPLY

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30101 - Lake Merced Water Level Restoration**	PE: Debra Temple, DPW
PM: Betsey Eagon	CM: Ben Leung
Phone: 415-554-1871	EPM: Yin Lan Zhang
AB1823: No	PCE: JP Torres

PROJECT STATUS:

Project Description:

The project consists of the development of a plan for operations and maintenance; construction of a stormwater treatment wetland, which will yield approximately 315 acre-feet (103 MG) per year for lake augmentation; and installation of up to two groundwater wells that will be used as the secondary water source to fill the lake.

Planning Status:

* The project is in the conceptual engineering phase. The Draft Conceptual Engineering Report (CER) is currently being revised, and the lake demand and a lake level response model were updated.
* The Final CER and the Planning Phase are expected to be completed by 10/01/09.

Environmental Status:

* The San Francisco Planning Department determined that this project requires an Environmental Impact Report (EIR).
* Environmental review is underway.

Right-of-Way Status:

* This project requires no land acquisitions and no encroachment removal actions.
* Discussions are being held with SFPUC Real Estate Services, City Attorney's office, and landowners to determine potential Right-of-Way and land acquisition/leasing issues.

Design Status:

* The Design Phase was initiated and procurement of the design consultant is underway.
* Bid Advertisement Date: Current Forecast: 04/23/12 / Approved: 10/17/11

Construction Status:

* Construction NTP Date: Current Forecast: 09/24/12 / Approved: 03/26/12
* The main Construction Phase has yet to be initiated. Construction costs to date reflect installation of an interim lake fill de-chlorination system completed in early 2005.

Major Issues/Potential Obstacles and Recommended Solutions:

* None at this time.

Schedule Variances:

In accordance with the June 2009 Revised WSIP adopted by the SFPUC Commission on July 28, 2009, the baseline (approved) schedule for this project was not changed.

The following variances are between the Current Forecast Date and Approved Finish Date:

* The 1-month variance for the Planning Phase is due to the additional work required for updating the design criteria and completing the conceptual design.
* The 6-month variance for the Project Management , Bid & Award , Construction Management , Construction and Closeout Phases is due to the inclusion of a Right-of-Way Phase.

Cost Variances:

* None at this time.

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30101 - Lake Merced Water Level Restoration**	PE: Debra Temple, DPW
PM: Betsey Eagon	CM: Ben Leung
Phone: 415-554-1871	EPM: Yin Lan Zhang
AB1823: No	PCE: JP Torres

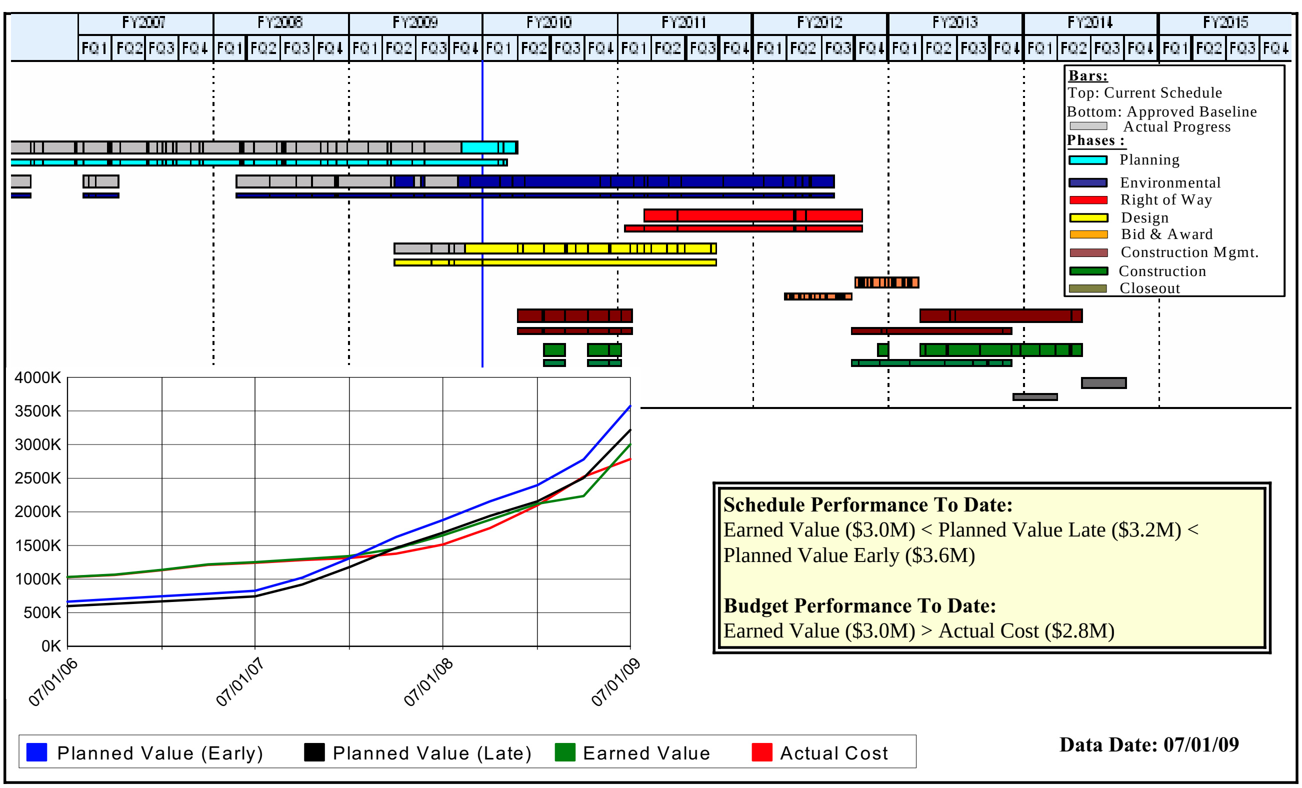
SCHEDULE:

Project Status-Schedule:	Original Start	Approved Start	Original Finish	Approved Finish	Last Forecast	Current Forecast
Project Management	06/16/03	06/16/03	07/19/11	09/27/13	04/04/14	04/04/14
Planning	06/16/03	06/16/03	08/31/07	09/01/09	09/01/09	10/01/09
Environmental	10/22/04	10/22/04	02/18/09	02/02/12	02/02/12	02/02/12
Right-of-Way		07/20/10		04/20/12	04/20/12	04/20/12
Design	05/12/04	05/12/04	09/04/09	03/24/11	03/24/11	03/24/11
Bid and Award	08/27/04	09/23/11	02/01/10	03/23/12	09/21/12	09/21/12
Construction Management	10/20/04	10/20/04	02/01/11	05/31/13	12/04/13	12/04/13
Construction	10/20/04	08/02/04	02/01/11	05/31/13	12/04/13	12/04/13
Close-Out	02/02/11	06/03/13	07/19/11	09/27/13	04/04/14	04/07/14

BUDGET:

Project Status - Budget & Expenditures:	Original Budget *	Planned Expenditure To Date	Planned % Complete	Expended to Date	Actual % Expended	Progress % Complete	Approved Budget *	Last Forecast	Current Forecast
Project Management	$723,000	$940,000	49.2	$843,000	44.1	47.6	$1,911,000	$1,911,000	$1,911,000
Planning	$903,000	$1,838,000	93.1	$1,493,000	75.6	90.7	$1,975,000	$2,005,000	$1,975,000
Environmental	$332,000	$667,000	30.2	$348,000	15.5	8.6	$2,250,000	$2,250,000	$2,250,000
Right-of-Way		$0	0.0	$0	0.0	0.0	$175,000	$175,000	$175,000
Design	$564,000	$38,000	1.7	$11,000	0.5	0.9	$2,418,000	$2,388,000	$2,418,000
Bid and Award	$190,000	$0	0.0	$0	0.0	0.0	$50,000	$50,000	$50,000
Construction Management	$610,000	$43,000	1.9	$43,000	1.9	1.9	$2,269,000	$2,269,000	$2,269,000
Construction	$1,903,000	$48,000	0.2	$48,000	0.2	0.2	$21,409,000	$21,409,000	$21,409,000
Close-Out	$38,000	$0	0.0	$0	0.0	0.0	$209,000	$209,000	$209,000
Total:	$5,264,000	$3,574,000	11.7	$2,786,000	8.5	9.8	$32,668,000	$32,668,000	$32,668,000

Note: * Original Budget and Approved Budget approved by the Commission at the project level (i.e. total of all phases).



Title: **CUW30102 - San Francisco Groundwater Supply**	PE: Debra Temple, DPW
PM: Jeff Gilman	CM: Ben Leung
Phone: 415-551-2952	EPM: Yin Lan Zhang
AB1823: No	PCE: JP Torres

PROJECT STATUS:

Project Description:

This project consists of two phases, each delivering an annual average of 2 mgd. The first phase consists of building three or four new groundwater well stations in the San Francisco Sunset District or Golden Gate Park. All stations will include a building to house the well pump and electrical equipment, with two stations having an additional room for chemical disinfection. Buried piping will be installed to connect the well stations to the Sunset Reservoir. The second phase, consisting of improvements or replacement of two or more irrigation wells in Golden Gate Park, will be operational when the existing wells are no longer needed for irrigation (after implementation of the CUW30201 – San Francisco Westside Recycled Water Project). The facilities in Golden Gate Park will allow groundwater currently used for irrigation to be used as a potable water source. Improvements to the facilities at the existing San Francisco Zoo Well No. 5 have been completed, allowing this well to serve as an emergency potable water source.

Planning Status:

* The Planning Phase was completed on 12/12/06.

Environmental Status:

* The San Francisco Planning Department determined that this project requires an Environmental Impact Report (EIR).
* Environmental review is underway.

Right-of-Way Status:

* This project requires no land entitlement actions and no encroachment removal actions. However, funding is allocated for encroachment permits and other similar activities.
* Completed a Memorandum of Understanding with the San Francisco Recreation and Park Department (RPD) to address use of existing wells, selection of additional well station sites, pipeline routes and groundwater management in Golden Gate Park.

Design Status:

* Completed the 35% design of well stations and pipelines for the South Sunset Playground, West Sunset Playground, and Lake Merced Pump Station (first project phase). The 65% design for this phase is expected to be completed in the next reporting quarter.
* Began review of two existing irrigation wells and well stations in Golden Gate Park (second project phase) and the conceptual design for modifications to use these wells as a potable supply.
* Bid Advertisement Date: Current Forecast: 07/01/11 / Approved: 07/01/11

Construction Status:

* Construction NTP Date: Current Forecast: 12/19/11 / Approved: 12/19/11
* The main Construction Phase has yet to be initiated. Construction costs to date reflect installation of coastal groundwater monitoring wells, construction of Zoo Well No. 5 improvements, and construction of test wells at South Sunset Playground, West Sunset Playground and Lake Merced Pump Station.

Major Issues/Potential Obstacles and Recommended Solutions:

* Reaching concurrence with the RPD on a new well station site and pipeline routes in Golden Gate Park. Additional meetings with RPD staff and resolution of well site/pipeline routes are anticipated in the next reporting quarter.

Schedule Variances:

* None at this time.

Cost Variances:

In accordance with the June 2009 Revised WSIP adopted by the SFPUC Commission on July 28, 2009, the baseline (approved) construction budget for this project was not changed.
* The $4.7M variance between the Current Forecast Cost and the Approved Budget for the Construction Phase is due to revising the pipeline construction estimates based on increased lengths of pipeline routes and to the escalation associated with the extended environmental review period.

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30102 - San Francisco Groundwater Supply**	PE: Debra Temple, DPW
PM: Jeff Gilman	CM: Ben Leung
Phone: 415-551-2952	EPM: Yin Lan Zhang
AB1823: No	PCE: JP Torres

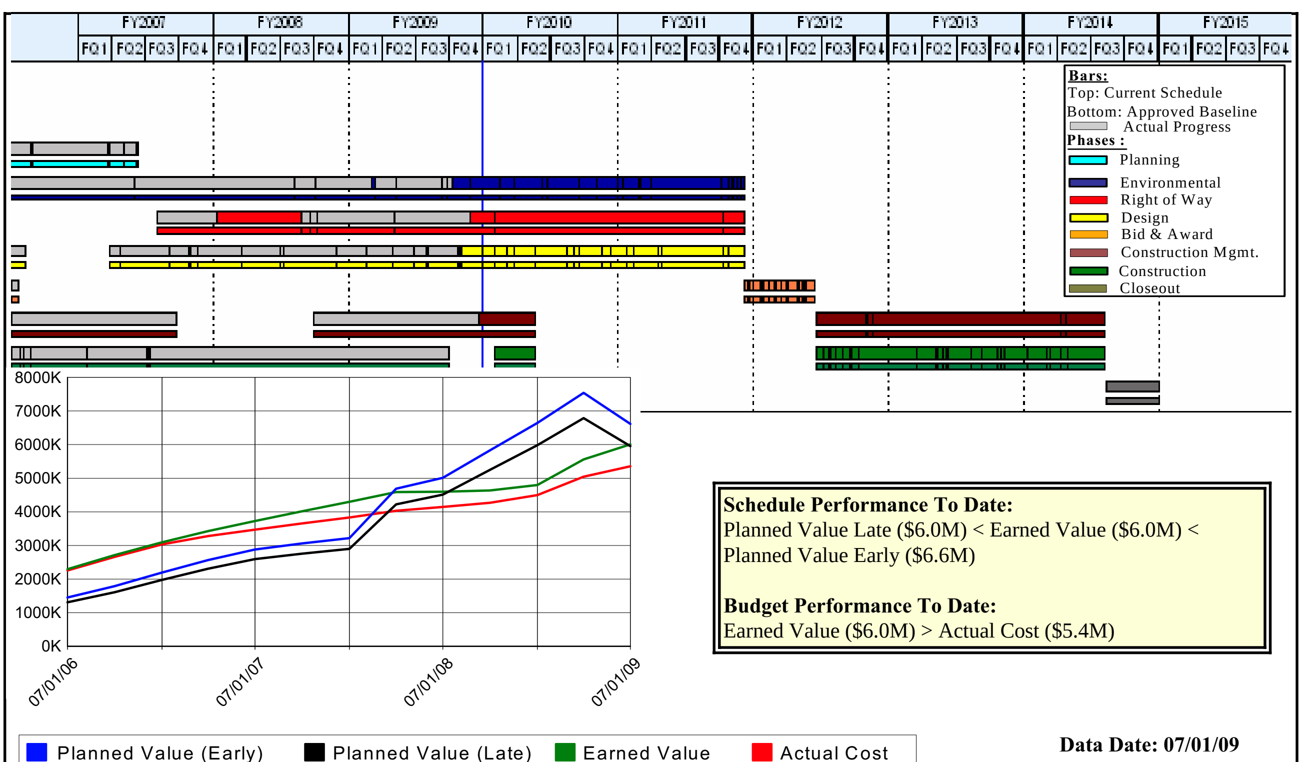
SCHEDULE:

Project Status-Schedule:	Original Start	Approved Start	Original Finish	Approved Finish	Last Forecast	Current Forecast
Project Management	07/01/05	06/16/03	04/30/13	07/01/14	07/01/14	07/01/14
Planning	07/01/05	06/16/03	06/01/06	12/12/06	12/12/06	12/12/06 A
Environmental	07/01/05	07/01/05	05/05/09	06/07/11	06/07/11	06/07/11
Right-of-Way		02/02/07		06/09/11	06/10/11	06/09/11
Design	10/11/06	10/01/04	11/19/09	06/07/11	06/07/11	06/07/11
Bid and Award	11/20/09	04/18/05	05/18/10	12/16/11	12/16/11	12/16/11
Construction Management	05/19/10	08/15/05	11/13/12	02/06/14	02/06/14	02/06/14
Construction	05/19/10	08/15/05	11/13/12	02/06/14	02/06/14	02/06/14
Close-Out	11/15/12	02/07/14	04/30/13	07/01/14	07/01/14	07/01/14

BUDGET:

Project Status - Budget & Expenditures:	Original Budget *	Planned Expenditure To Date	Planned % Complete	Expended to Date	Actual % Expended	Progress % Complete	Approved Budget *	Last Forecast	Current Forecast
Project Management	$854,000	$942,000	43.4	$742,000	34.2	32.8	$2,170,000	$2,170,000	$2,170,000
Planning	$788,000	$910,000	100.0	$910,000	100.0	100.0	$910,000	$910,000	$910,000
Environmental	$599,000	$724,000	42.7	$393,000	22.2	31.2	$1,771,000	$1,771,000	$1,771,000
Right-of-Way	$0	$21,000	14.4	$0	0.0	2.6	$145,000	$145,000	$145,000
Design	$1,677,000	$886,000	25.7	$514,000	14.9	20.9	$3,448,000	$3,448,000	$3,448,000
Bid and Award	$88,000	$0	0.0	$0	0.0	0.0	$50,000	$50,000	$50,000
Construction Management	$1,707,000	$396,000	8.4	$396,000	8.4	8.4	$4,725,000	$4,725,000	$4,725,000
Construction	$18,760,000	$2,735,000	11.7	$2,399,000	9.5	11.7	$25,366,000	$30,082,000	$30,082,000
Close-Out	$42,000	$0	0.0	$0	0.0	0.0	$115,000	$115,000	$115,000
Total:	$24,513,000	$6,614,000	18.1	$5,355,000	13.8	16.4	$38,700,000	$43,417,000	$43,417,000

Note: * Original Budget and Approved Budget approved by the Commission at the project level (i.e. total of all phases).



Schedule Performance To Date:
Planned Value Late ($6.0M) < Earned Value ($6.0M) < Planned Value Early ($6.6M)

Budget Performance To Date:
Earned Value ($6.0M) > Actual Cost ($5.4M)

Data Date: 07/01/09

Title: **CUW30201 - San Francisco Westside Recycled Water**	PE: L. Wong
PM: Barbara Palacios	CM: Ben Leung
Phone: 415-554-0718	EPM: Scott MacPherson
AB1823: No	PCE: JP Torres

PROJECT STATUS:

Project Description:

This project consists of a new recycled water treatment facility at the western end of Golden Gate Park (the site of the former Richmond-Sunset Water Pollution Control Plant), along with the associated distribution system components to produce and deliver an annual average of approximately 2 mgd of recycled water to Golden Gate Park, Lincoln Park, and the SF Zoo. The proposed treatment scheme includes membrane filtration, reverse osmosis, and ultraviolet light disinfection. A 1.6 MG recycled water storage reservoir will be located underneath the treatment facility. Distribution pumping facilities will be located at the new facility, and will pump recycled water to the customers through approximately 5 to 6 miles of new pipelines. The project also includes the retrofitting of the existing irrigation systems to bring them in compliance with Title 22 regulations. The treatment facility includes additional capacity to serve potential future customers such as the Presidio Golf Course, although distribution system components to serve the Presidio are not part of the project scope.

Planning Status:

* SFPUC met with the Recreation & Park Department (RPD) in April 2009 to respond to their comments on the draft Project Scope Description. The Final Preliminary Project Scope Description was completed in June 2009.

Environmental Status:

* The San Francisco Planning Department determined that this project requires an Environmental Impact Report (EIR).

Right-of-Way Status:

* This project requires no land entitlement actions and no encroachment removal actions.

Design Status:

* Work on the 10% Design Report was initiated in May 2009.
* Bid Advertisement Date: Current Forecast: 06/09/11 / Approved: 06/09/11

Construction Status:

* Construction NTP Date: Current Forecast: 11/21/11 / Approved: 11/21/11
* The Construction Phase has yet to be initiated.

Major Issues/Potential Obstacles and Recommended Solutions:

* In June 2009, the RPD raised concerns regarding the exact placement of the treatment facility within the Richmond-Sunset site, noting potential visual impacts from nearby recreational areas. Uncertainties in the siting of the facility could delay aspects of the 10% Design effort, if not addressed immediately. The SFPUC will work with RPD to develop a comprehensive site plan that addresses space needs for the new recycled water facility, the existing South Windmill groundwater well facility (to be converted to potable supply as part of the CUW30102 - San Francisco Groundwater Supply Project), and future recreational uses for the site.

Schedule Variances:

* None at this time.

Cost Variances:

* None at this time.

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30201 - San Francisco Westside Recycled Water**	PE: L. Wong
PM: Barbara Palacios	CM: Ben Leung
Phone: 415-554-0718	EPM: Scott MacPherson
AB1823: No	PCE: JP Torres

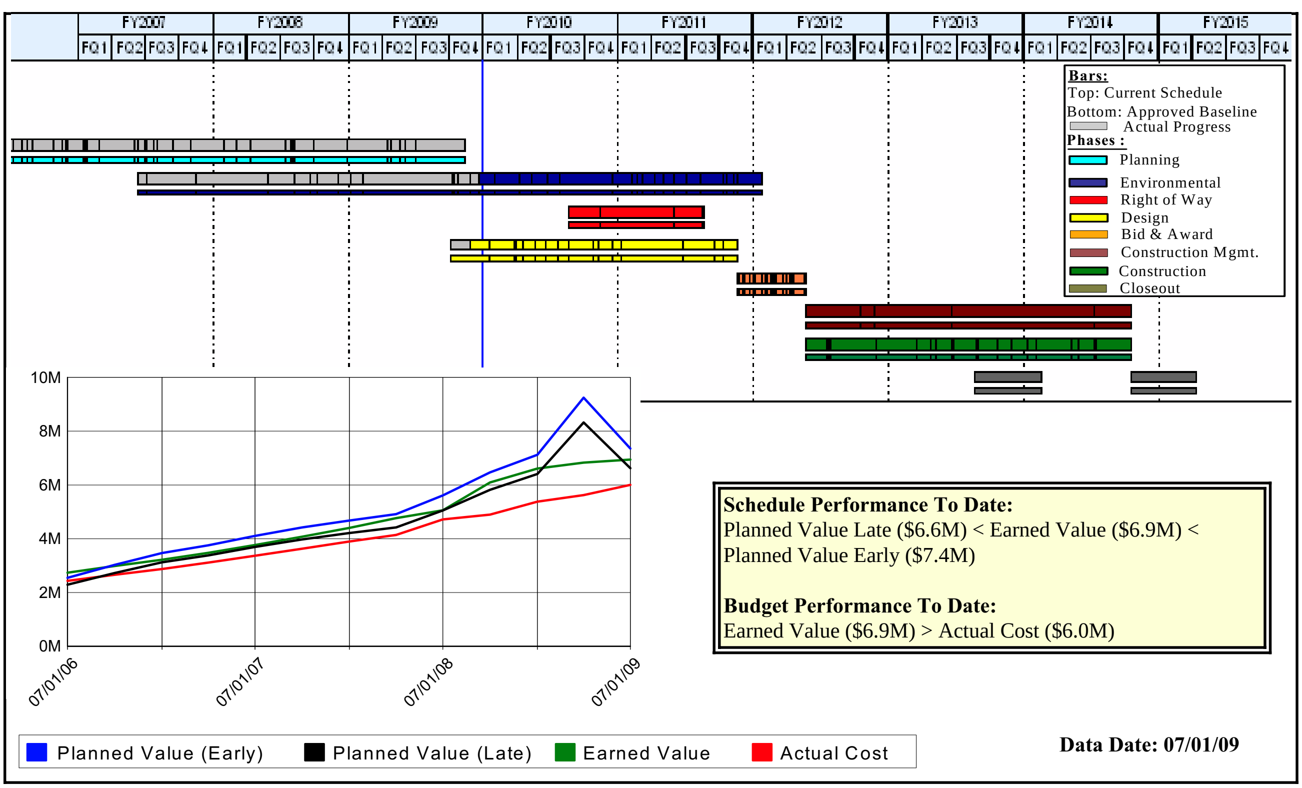
SCHEDULE:

Project Status-Schedule:	Original Start	Approved Start	Original Finish	Approved Finish	Last Forecast	Current Forecast
Project Management	03/03/03	03/03/03	09/04/12	10/14/14	10/14/14	10/14/14
Planning	07/01/03	03/03/03	04/18/08	05/15/09	05/15/09	05/15/09 A
Environmental	10/14/03	12/12/06	02/27/09	07/22/11	07/22/11	07/22/11
Right-of-Way		02/18/10		02/14/11	02/14/11	02/14/11
Design	04/21/08	04/06/09	08/20/09	05/17/11	05/17/11	05/17/11
Bid and Award	08/21/09	05/18/11	02/26/10	11/18/11	11/18/11	11/18/11
Construction Management	07/14/06	11/21/11	03/01/12	04/15/14	04/15/14	04/15/14
Construction	07/14/06	11/21/11	03/01/12	04/15/14	04/15/14	04/15/14
Close-Out	03/02/12	02/21/13	09/04/12	10/14/14	10/14/14	10/14/14

BUDGET:

Project Status - Budget & Expenditures:	Original Budget *	Planned Expenditure To Date	Planned % Complete	Expended to Date	Actual % Expended	Progress % Complete	Approved Budget *	Last Forecast	Current Forecast
Project Management	$5,889,000	$1,831,000	28.5	$1,750,000	27.2	28.4	$6,424,000	$6,424,000	$6,424,000
Planning	$3,682,000	$4,004,000	100.0	$3,774,000	94.3	100.0	$4,004,000	$4,004,000	$4,004,000
Environmental	$2,813,000	$747,000	42.4	$405,000	21.5	24.3	$1,880,000	$1,880,000	$1,880,000
Right-of-Way		$0	0.0	$0	0.0	0.0	$127,000	$127,000	$127,000
Design	$21,045,000	$774,000	6.7	$73,000	0.6	5.9	$11,562,000	$11,562,000	$11,562,000
Bid and Award	$328,000	$0	0.0	$0	0.0	0.0	$150,000	$150,000	$150,000
Construction Management	$16,474,000	$0	0.0	$0	0.0	0.0	$10,174,000	$10,174,000	$10,174,000
Construction	$150,595,000	$0	0.0	$0	0.0	0.0	$91,215,000	$91,215,000	$91,215,000
Close-Out	$510,000	$0	0.0	$0	0.0	0.0	$386,000	$386,000	$386,000
Total:	$201,334,000	$7,356,000	6.3	$6,002,000	4.8	5.9	$125,923,000	$125,923,000	$125,923,000

Note: * Original Budget and Approved Budget approved by the Commission at the project level (i.e. total of all phases).



Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30202 - Recycled Water Project - Pacifica (Closed)**	PE: Sam Young
PM: Barbara Palacios	CM: Ben Leung
Phone: 415-554-0718	EPM: To Be Determined
AB1823: No	PCE: JP Torres

PROJECT STATUS:

Project Description:

The SFPUC, in partnership with North Coast County Water District, is implementing the Pacifica Recycled Water Project. The primary project elements will include a pump station at the recycling plant, a 400,000 gallon above-ground storage tank, and approximately 17,000 feet of pipe up to 18 inches in diameter. The project will also include site retrofits necessary for the use of the recycled water. North Coast County Water District is responsible for the design, environmental review and construction of this project. This project was closed in October 2008. The final project expenditures have been actualized in this Quarterly Report. The project will be completed using funds from the Water Enterprise capital budget instead of the WSIP budget. (No change from the last Quarterly Report)

CLOSED

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30202 - Recycled Water Project - Pacifica (Closed)**	PE: Sam Young
PM: Barbara Palacios	CM: Ben Leung
Phone: 415-554-0718	EPM: To Be Determined
AB1823: No	PCE: JP Torres

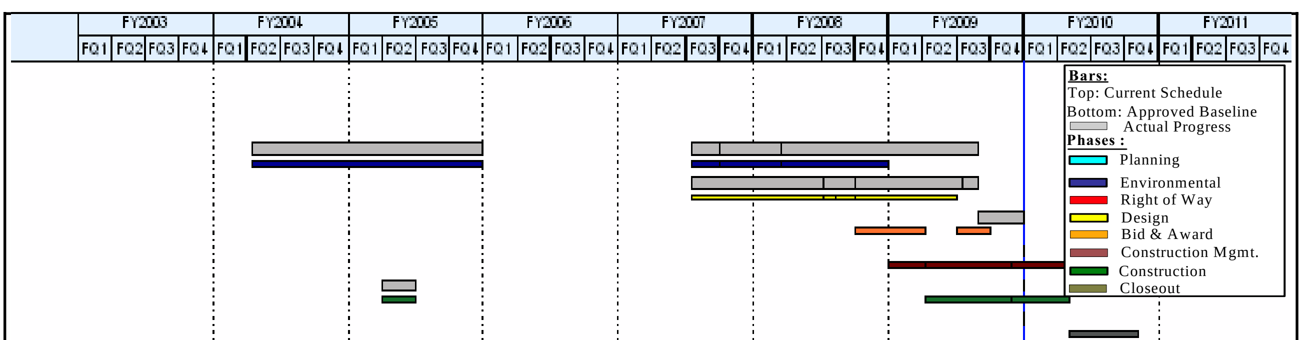
SCHEDULE:

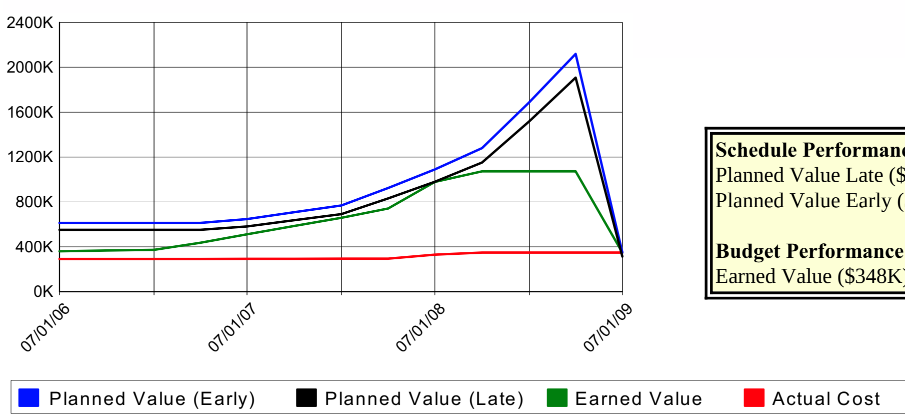
Project Status-Schedule:	Original Start	Approved Start	Original Finish	Approved Finish	Last Forecast	Current Forecast
Project Management	07/01/03	10/13/03	02/09/06	05/07/10	01/12/11	06/30/09 A
Planning	07/01/03		10/10/03			
Environmental	10/03/03	10/13/03	01/31/05	07/01/08	02/27/09	02/27/09 A
Right-of-Way						
Design	07/01/05	01/15/07	02/09/06	12/31/08	02/27/09	02/27/09 A
Bid and Award		04/02/08		04/01/09	01/06/10	06/30/09 A
Construction Management		07/02/08		11/04/09	07/12/10	06/30/09 A
Construction	10/01/04	10/01/04	12/30/04	11/04/09	07/12/10	06/30/09 A
Close-Out		11/05/09		05/07/10	01/12/11	06/30/09 A

BUDGET:

Project Status - Budget & Expenditures:	Original Budget *	Planned Expenditure To Date	Planned % Complete	Expended to Date	Actual % Expended	Progress % Complete	Approved Budget *	Last Forecast	Current Forecast
Project Management	$25,000	$58,000	100.0	$58,000	100.3	100.0	$58,000	$58,000	$58,000
Planning	$0								
Environmental	$153,000	$153,000	100.0	$153,000	100.0	100.0	$153,000	$153,000	$153,000
Right-of-Way									
Design	$0	$25,000	100.0	$25,000	100.2	100.0	$25,000	$25,000	$25,000
Bid and Award		$0	100.0	$0	100.0	100.0	$0	$0	$0
Construction Management		$0	0.0	$0	100.0	100.0	$0	$0	$0
Construction	$113,000	$113,000	100.0	$113,000	100.0	100.0	$113,000	$113,000	$113,000
Close-Out		$0	0.0	$0	100.0	100.0	$0	$0	$0
Total:	$292,000	$348,000	100.0	$348,000	100.1	100.0	$348,000	$348,000	$348,000

Note: * Original Budget and Approved Budget approved by the Commission at the project level (i.e. total of all phases).





Schedule Performance To Date:
Planned Value Late ($313K) < Earned Value ($348K) = Planned Value Early ($348K)

Budget Performance To Date:
Earned Value ($348K) = Actual Cost ($348K)

Data Date: 07/01/09

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30204 - Harding Park Recycled Water**	PE: Sam Young
PM: Barbara Palacios	CM: Ben Leung
Phone: 415-554-0718	EPM: Antonia Fairbanks
AB1823: No	PCE: Mike Elwin

PROJECT STATUS:

Project Description:

The SFPUC, in partnership with the City of Daly City, is implementing the Harding Park Recycled Water Project. This project consists of providing the infrastructure needed to convey water supplied from the existing recycled water facility in Daly City (that is operated by the North San Mateo Sanitation District) to Harding Park. The project consists of approximately 4,700 feet of 18-inch pipe, a 700,000-gallon buried storage reservoir at the park, and two irrigation pumps. The golf course has already been retrofitted to accommodate the use of recycled water; however, some additional retrofits may be required at the park to meet regulatory requirements. The City of Daly City is the agency responsible for the design, environmental review and construction of this project.

Planning Status:

* The Planning Phase was completed on 10/07/08.

Environmental Status:

* The City of Daly City has determined that this project requires an Environmental Impact Report (EIR).
* The Administrative Draft EIR was issued in June 2009 for internal review.

Right-of-Way Status:

* This project requires no land entitlement actions and no encroachment removal actions.

Design Status:

* The design team is currently working on the 95% design package, scheduled to be issued in August 2009.
* Bid Advertisement Date: Current Forecast: 11/10/09 / Approved: 11/10/09

Construction Status:

* Construction NTP Date: Current Forecast: 04/06/09 / Approved: 04/06/09
* The Construction Phase has yet to be initiated.

Major Issues/Potential Obstacles and Recommended Solutions:

* The SFPUC has not been able to secure Phase I/Phase II design approval from the Civic Design Review Committee of the Arts Commission; this could lead to a delay in the completion of the final bid package. The SFPUC will schedule a follow-up meeting with members of the Civic Design Review Committee to better understand their concerns with the architectural design concept, and identify features/concepts that will gain Phase I/II/III design approval in July 2009.

Schedule Variances:

* None at this time.

Cost Variances:

* None at this time.

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30204 - Harding Park Recycled Water**	PE: Sam Young
PM: Barbara Palacios	CM: Ben Leung
Phone: 415-554-0718	EPM: Antonia Fairbanks
AB1823: No	PCE: Mike Elwin

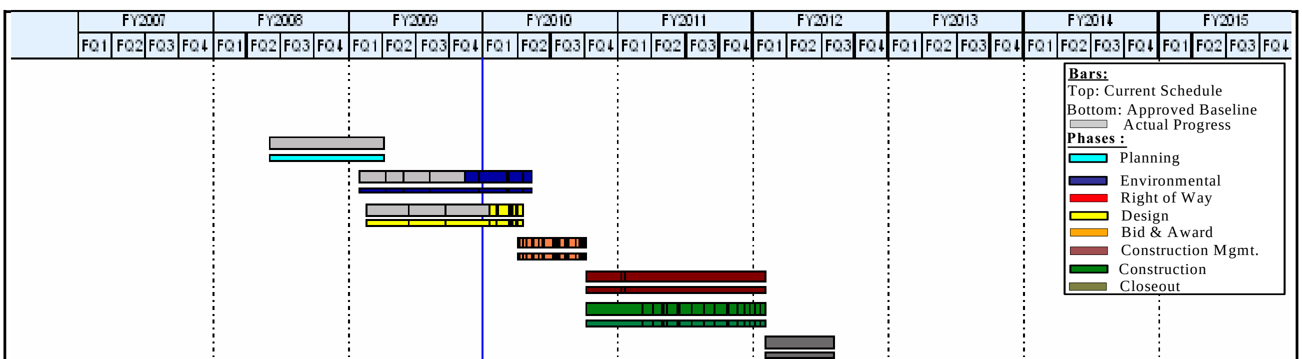
SCHEDULE:

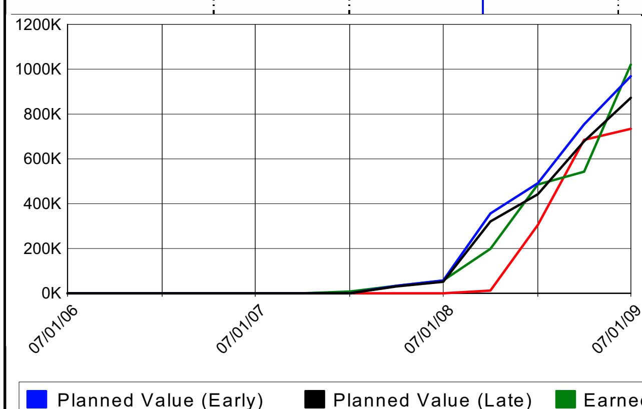
Project Status-Schedule:	Original Start	Approved Start	Original Finish	Approved Finish	Last Forecast	Current Forecast
Project Management		12/03/07		02/03/12	02/03/12	02/03/12
Planning		12/03/07		10/07/08	10/07/08	10/07/08 A
Environmental		08/01/08		11/10/09	11/10/09	11/10/09
Right-of-Way						
Design		08/18/08		10/16/09	10/16/09	10/16/09
Bid and Award		09/30/09		04/05/10	04/05/10	04/05/10
Construction Management		04/06/10		08/01/11	08/01/11	08/01/11
Construction		04/06/10		08/01/11	08/01/11	08/01/11
Close-Out		08/02/11		02/03/12	02/03/12	02/03/12

BUDGET:

Project Status - Budget & Expenditures:	Original Budget *	Planned Expenditure To Date	Planned % Complete	Expended to Date	Actual % Expended	Progress % Complete	Approved Budget *	Last Forecast	Current Forecast
Project Management		$132,000	35.2	$68,000	18.3	32.7	$374,000	$374,000	$374,000
Planning		$0	100.0	$0	100.0	100.0	$0	$0	$0
Environmental		$173,000	70.7	$52,000	21.4	60.0	$244,000	$244,000	$244,000
Right-of-Way									
Design		$665,000	74.6	$613,000	68.8	84.3	$891,000	$891,000	$891,000
Bid and Award		$0	0.0	$0	0.0	0.0	$50,000	$50,000	$50,000
Construction Management		$0	0.0	$0	0.0	0.0	$1,634,000	$1,634,000	$1,634,000
Construction		$0	0.0	$0	0.0	0.0	$6,398,000	$6,398,000	$6,398,000
Close-Out		$0	0.0	$0	0.0	0.0	$19,000	$19,000	$19,000
Total:		$969,000	10.7	$734,000	7.6	11.3	$9,612,000	$9,612,000	$9,612,000

Note: * Original Budget and Approved Budget approved by the Commission at the project level (i.e. total of all phases).





Schedule Performance To Date:
Planned Value Late ($0.9M) < Earned Value ($1.0M) = Planned Value Early ($1.0M)

Budget Performance To Date:
Earned Value ($1.0M) > Actual Cost ($0.7M)

Data Date: 07/01/09

Publication Date: August 20, 2009

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30205 - San Francisco Eastside Recycled Water**	PE: To Be Determined
PM: Barbara Palacios	CM: Ben Leung
Phone: 415-554-0718	EPM: To Be Determined
AB1823: No	PCE: Mike Elwin

PROJECT STATUS:

Project Description:

This project will plan and design a recycled water treatment facility (or facilities) and distribution system to produce and distribute tertiary recycled water to proposed non-potable water customers on the eastern side of the City of San Francisco. The project is in early planning stages and its scope will be further defined as planning efforts progress.

Planning Status:

* The Planning Phase has yet to be initiated.

Environmental Status:

* The Environmental Phase has yet to be initiated.

Right-of-Way Status:

* This project requires no land entitlement actions and no encroachment removal actions.

Design Status:

* The Design Phase has yet to be initiated.
* Bid Advertisement Date: Current Forecast: 05/03/13 / Approved: 05/03/13

Construction Status:

* The Construction Phase has yet to be initiated.

Major Issues/Potential Obstacles and Recommended Solutions:

* None at this time.

Schedule Variances:

* None at this time.

Cost Variances:

* None at this time.

Quarterly Project Status Report

As of July 1, 2009

Title: **CUW30205 - San Francisco Eastside Recycled Water**	PE: To Be Determined
PM: Barbara Palacios	CM: Ben Leung
Phone: 415-554-0718	EPM: To Be Determined
AB1823: No	PCE: Mike Elwin

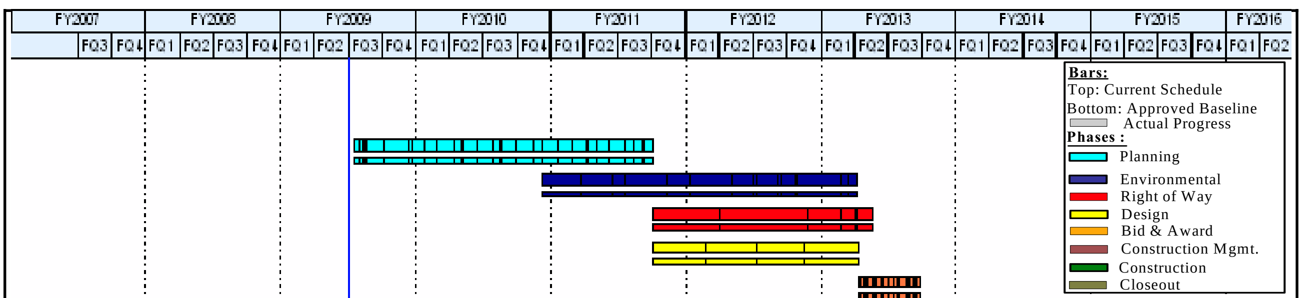
SCHEDULE:

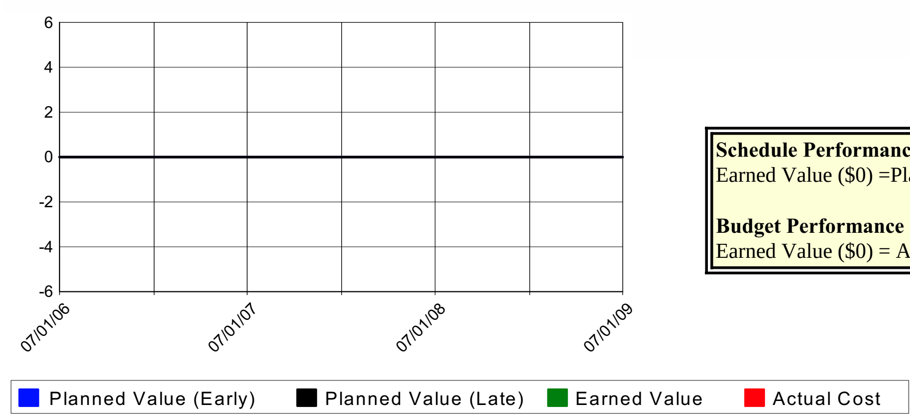
Project Status-Schedule:	Original Start	Approved Start	Original Finish	Approved Finish	Last Forecast	Current Forecast
Project Management		07/15/09		09/24/13		09/24/13
Planning		07/15/09		10/03/11		10/03/11
Environmental		12/08/10		04/08/13		04/08/13
Right-of-Way		10/04/11		05/20/13		05/20/13
Design		10/04/11		04/11/13		04/11/13
Bid and Award		04/12/13		09/24/13		09/24/13
Construction Management						
Construction						
Close-Out						

BUDGET:

Project Status - Budget & Expenditures:	Original Budget *	Planned Expenditure To Date	Planned % Complete	Expended to Date	Actual % Expended	Progress % Complete	Approved Budget *	Last Forecast	Current Forecast
Project Management		$0	0.0	$0	0.0	0.0	$4,000,000		$4,000,000
Planning		$0	0.0	$0	0.0	0.0	$3,500,000		$3,500,000
Environmental		$0	0.0	$0	0.0	0.0	$2,500,000		$2,500,000
Right-of-Way		$0	0.0	$0	0.0	0.0	$250,000		$250,000
Design		$0	0.0	$0	0.0	0.0	$12,500,000		$12,500,000
Bid and Award		$0	0.0	$0	0.0	0.0	$150,000		$150,000
Construction Management									
Construction									
Close-Out									
Total:		$0	0.0	$0	0.0	0.0	$22,900,000		$22,900,000

Note: * Original Budget and Approved Budget approved by the Commission at the project level (i.e. total of all phases).





Schedule Performance To Date:
Earned Value ($0) =Planned Value Early ($0)

Budget Performance To Date:
Earned Value ($0) = Actual Cost ($0)

Data Date: 07/01/09

Title: **CUW39001 - SF Bay Area Desalination Plant (Closed)**	PE: To Be Determined
PM: Manisha Kothari	CM: To Be Determined
Phone: 415-554-3256	EPM: To Be Determined
AB1823: No	PCE: Deepa Rasalkar

PROJECT STATUS:

Project Description:

SFPUC, in partnership with EBMUD, Santa Clara Valley Water District (SCVWD), and Contra Costa Water District (CCWD), are investigating the feasibility of developing a joint desalination plant to meet some of the water needs in the agencies' service areas.

This project is currently on hold pending resolution of funding issues.

ON HOLD

Title: **CUW39001 - SF Bay Area Desalination Plant (Closed)**	PE: To Be Determined
PM: Manisha Kothari	CM: To Be Determined
Phone: 415-554-3256	EPM: To Be Determined
AB1823: No	PCE: Deepa Rasalkar

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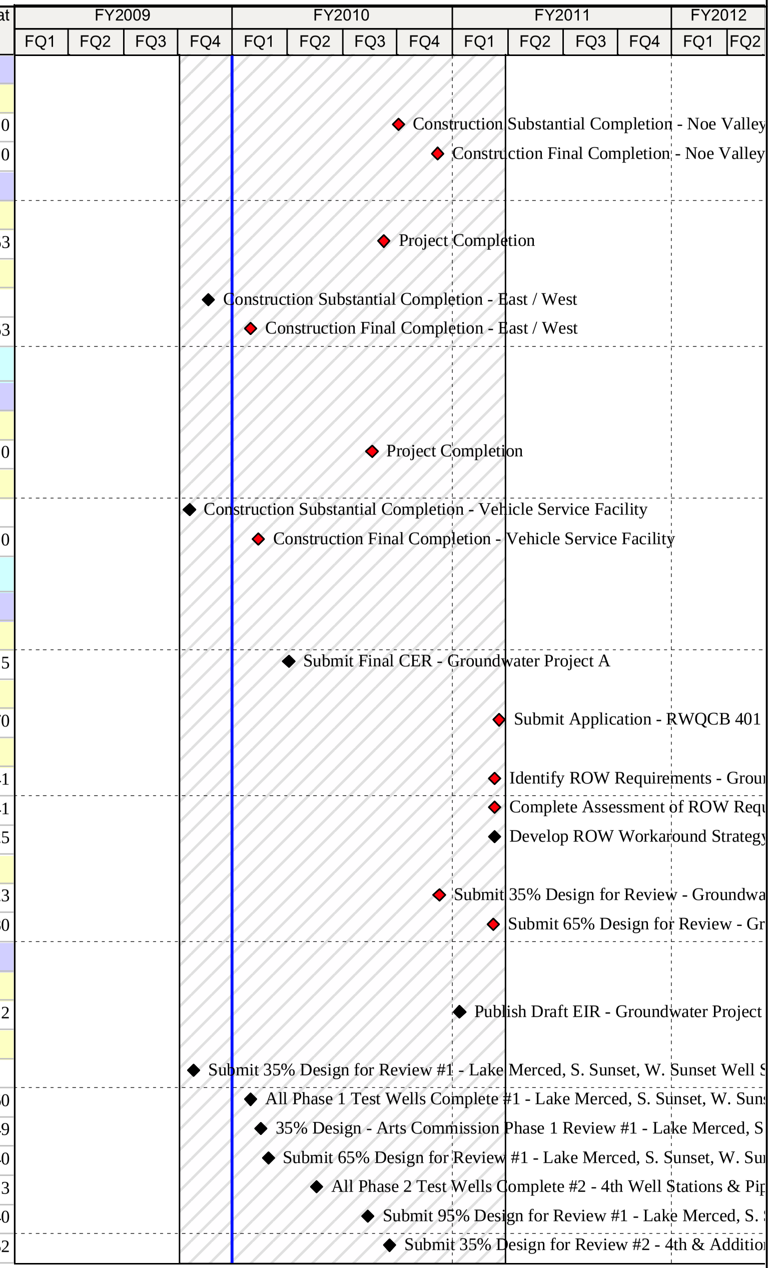
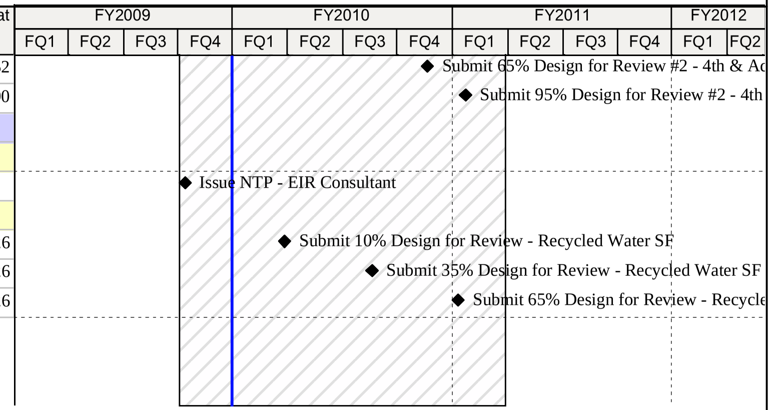
KEY MILESTONE REPORT - ROLLING SIX QUARTERS (04/05/09- 09/30/10)

Activity Name	Approved Date	Current Forecast	Variance	Current Late Date	Total Float
CUW31301 Noe Valley Transmission Main, Phase 2					
Construction					
Construction Substantial Completion - Noe Valley	02-Apr-10	02-Apr-10	0	02-Apr-10	0
Construction Final Completion - Noe Valley	07-Jun-10	07-Jun-10	0	07-Jun-10	0
CUW31501 East / West Transmission Main					
Project Milestones					
Project Completion	09-Mar-10	09-Mar-10	0	04-Dec-09	-63
Construction					
Construction Substantial Completion - East / West	22-May-09	22-May-09A	0	08-Apr-09	
Construction Final Completion - East / West	31-Jul-09	31-Jul-09	0	01-May-09	-63
Miscellaneous					
CUW30301 Vehicle Service Facility Equipment Safety Upgrade					
Project Milestones					
Project Completion	17-Feb-10	17-Feb-10	0	17-Feb-10	0
Construction					
Construction Substantial Completion - Vehicle Service Facility	21-Apr-09	21-Apr-09A	0	01-Jul-09	
Construction Final Completion - Vehicle Service Facility	12-Aug-09	12-Aug-09	0	12-Aug-09	0
Water Supply					
CUW30101 Lake Merced Water Level Restoration					
Project Planning					
Submit Final CER - Groundwater Project A	01-Sep-09	01-Oct-09	-21	08-Oct-09	5
Environmental Review					
Submit Application - RWQCB 401 Certification - Groundwat	17-Sep-10	17-Sep-10	0	15-Jan-10	-170
Right of Way					
Identify ROW Requirements - Groundwater Project A	08-Sep-10	08-Sep-10	0	18-Feb-10	-141
Complete Assessment of ROW Requirements - Groundwater I	08-Sep-10	08-Sep-10	0	18-Feb-10	-141
Develop ROW Workaround Strategy - Groundwater Project A	08-Sep-10	08-Sep-10	0	14-Mar-11	125
Design					
Submit 35% Design for Review - Groundwater Project A	09-Jun-10	09-Jun-10	0	17-Jul-09	-223
Submit 65% Design for Review - Groundwater Project A	07-Sep-10	07-Sep-10	0	18-Dec-09	-180
CUW30102 San Francisco Groundwater Supply					
Environmental Review					
Publish Draft EIR - Groundwater Project B	13-Jul-10	13-Jul-10	0	15-Jul-10	2
Design					
Submit 35% Design for Review #1 - Lake Merced, S. Sunset,	29-Apr-09	29-Apr-09A	0	17-Jun-10	
All Phase 1 Test Wells Complete #1 - Lake Merced, S. Sunset	31-Jul-09	31-Jul-09	0	16-Aug-10	260
35% Design - Arts Commission Phase 1 Review #1 - Lake Me	17-Aug-09	17-Aug-09	0	16-Aug-10	249
Submit 65% Design for Review #1 - Lake Merced, S. Sunset,	28-Aug-09	28-Aug-09	0	16-Aug-10	240
All Phase 2 Test Wells Complete #2 - 4th Well Stations & Pip	17-Nov-09	17-Nov-09	0	20-Nov-09	3
Submit 95% Design for Review #1 - Lake Merced, S. Sunset,	09-Feb-10	09-Feb-10	0	26-Jan-11	240
Submit 35% Design for Review #2 - 4th & Additional Well St	17-Mar-10	17-Mar-10	0	21-Oct-10	152



KEY MILESTONE REPORT - ROLLING SIX QUARTERS (04/05/09- 09/30/10)

Activity Name	Approved Date	Current Forecast	Variance	Current Late Date	Total Float
Submit 65% Design for Review #2 - 4th & Additional Well St	19-May-10	19-May-10	0	29-Dec-10	152
Submit 95% Design for Review #2 - 4th & Additional Well St	23-Jul-10	23-Jul-10	0	28-Apr-11	190
CUW30201 San Francisco Westside Recycled Water					
Environmental Review					
Issue NTP - EIR Consultant	13-Apr-09	13-Apr-09A	0	12-Aug-09	
Design					
Submit 10% Design for Review - Recycled Water SF	25-Sep-09	25-Sep-09	0	03-Nov-09	26
Submit 35% Design for Review - Recycled Water SF	17-Feb-10	17-Feb-10	0	25-Mar-10	26
Submit 65% Design for Review - Recycled Water SF	09-Jul-10	09-Jul-10	0	16-Aug-10	26



APPENDIX E COST VARIANCE OF WSIP LOCAL PROJECTS

Projects	2009 Approved Budget	Current Forecast	Variance
CUW33301 - Mount Davidson Tank Seismic Upgrade	$2,894,000	$2,894,000	-
CUW33801 - La Grande Pump Station Upgrades	$7,205,000	$7,205,000	-
CUW33901 - Potrero Heights Pump Station Upgrades (Completed)	$606,000	$606,000	-
CUW34001 - Vista Francisco Pump Station Upgrades	$6,951,000	$6,951,000	-
Pipeline / Valves			
CUW30401 - North University Mound System Upgrade	$12,850,000	$12,850,000	-
CUW30801 - Key Motorized and Other Critical Valves (Completed)	$10,985,000	$10,985,000	-
CUW31101 - Sunset Circulation Improvements (Completed)	$6,984,000	$6,984,000	-
CUW31201 - Lincoln Way Transmission Line	$13,950,000	$13,950,000	-
CUW31301 - Noe Valley Transmission Main, Phase 2	$7,382,000	$7,382,000	-
CUW31501 - East / West Transmission Main	$28,600,000	$28,600,000	-
CUW31601 - Fulton @ Sixth Ave - 30" Main Replacement (Completed)	$4,708,000	$4,708,000	-
Miscellaneous			
CUW30301 - Vehicle Service Facility Equipment Safety Upgrade	$4,461,000	$4,461,000	-
CUW30501 - Fire Protection @ CDD (Completed)	$1,675,000	$1,675,000	-
Water Supply			
CUW30101 - Lake Merced Water Level Restoration	$32,668,000	$32,668,000	-
CUW30102 - San Francisco Groundwater Supply	$38,700,000	$43,417,000	$4,717,000
CUW30201 - San Francisco Westside Recycled Water	$125,923,000	$125,923,000	-
CUW30202 - Recycled Water Project - Pacifica (Closed)	$348,000	$348,000	-
CUW30204 - Harding Park Recycled Water	$9,612,000	$9,612,000	-
CUW30205 - San Francisco Eastside Recycled Water	$22,900,000	$22,900,000	-
CUW39001 - SF Bay Area Desalination Plant (Closed)	$938,000	$938,000	-

APPENDIX D SFPUC WATER SUPPLY AVAILABILITY STUDY (OCTOBER 2009)

FINAL

Water Supply Availability Study

for

City and County of San Francisco

Prepared for:

San Francisco Public Utilities Commission
Water Enterprise

October 2009

Prepared by:

PBS&J

1410 Rocky Ridge Drive, Suite 190
Roseville, CA 95661
916.782.7275

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B Major Projects Water Demand Estimates from Project Sponsors

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SUMMARY AND FINDINGS

Summary

In an effort to streamline the water supply planning process within the City and County of San Francisco (San Francisco or City), the San Francisco Public Utilities Commission (SFPUC) adopted a resolution in 2002 and 2006 to allow for all development projects requiring a Water Supply Assessment (WSA) under Water Code Section 10910 et seq. to rely solely on the adopted Urban Water Management Plan (UWMP) without having to go through the process of preparing individual WSAs. SB 610 provides a nexus between the regional land use planning process and the environmental review process. The core of this law is an assessment of whether available water supplies are sufficient to serve the demand generated by a project, as well as the reasonably foreseeable cumulative demand in the region over the next 20 years under a range of hydrologic conditions.

The San Francisco Planning Department (SF Planning) and the San Francisco Redevelopment Agency are currently engaged in planning for various proposed land development projects throughout San Francisco that go beyond those future developments considered in the 2005 UWMP update. As a result of these new developments, the SFPUC concluded that its 2005 UWMP no longer accounted for every project requiring a WSA (qualifying project) within San Francisco. Therefore, during this interim period until the 2010 UWMP is prepared, any qualifying projects not accounted in the 2005 UWMP will require preparation of a WSA per Water Code Sections 10910 – 10915 that considers the SFPUC's current and projected supplies when compared to projected demands associated with new growth not covered in the 2005 UWMP.

This Water Supply Availability Study (Study) was developed as an interim period study and follows the format of a WSA. The Study captures the most current water supply planning and demand information, analyzes the various projected change in water demands associated with each qualifying project within San Francisco, evaluates overall supply and demand, assesses the sufficiency of supply, and prepares a conclusion based on the analysis. Upon completion of the Study, a WSA for each qualifying project can rely on the information and conclusions of this Study.

Findings

The 2009 SF Planning projections result in a Retail demand in 2030 of 93.42 mgd (Section 5.0), which is only slightly greater than the 2030 demand estimates projected in the 2005 UWMP. This increase, however, does not change the results of the 2005 UWMP. The SFPUC can still meet the current and future demand of its Retail customers in years of average or above-average precipitation. During a multiple dry year event;[1] however, it is possible that the SPFUC will not be able to meet 100 percent of the Retail demand in 2030. This Study shows the results of implementation of SFPUC's local supply reliability improvements under all hydrologic

1 Multiple dry-year event is defined as a three-year hydrologic condition of below-normal rainfall per the Urban Water Management Planning Act.

conditions beginning in 2010 and extending to 2030. The ability to meet the demand of the Retail customers is in large part due to the development of 10 mgd of local supplies in the City through implementation of the Water Supply Improvement Program (WSIP). These addition sources of groundwater, recycled water, and conservation supplies are essential to provide the City with adequate supply in dry year periods, as well as improving supply reliability during years with normal precipitation.

In years with normal or above-normal precipitation, the City has sufficient supplies to serve its Retail customers. As shown in Table 6-1 (Section 6.0), the supply shortfall shown in 2010 is the result of reducing the Regional Water System (RWS) supply to 81 mgd per the condition of the Phased WSIP Variant, without full development of the additional 10 mgd of additional local supplies available in 2015. However, Retail demand is currently lower than projected 2010 demand of 91.81 mgd – demand in Fiscal Year 2007-2008 was 83.9 mgd.

During a multiple dry-year event as shown in Table 6-1, it is possible that the SFPUC will not be able to meet the full demands of its Retail customers in 2030, and will therefore have to impose reductions on its Retail supply. Under the Water Supply Allocation Plan (WSAP), Retail customers would experience no reduction in RWS deliveries within a 10 percent RWS shortage. However, during a 20 percent system-wide shortage, the Retail customers would experience a 1.9 percent reduction in Retail deliveries. This difference is due to the development of the additional 10 mgd of local supplies in the Retail service area. These additional local supplies are not subject to a reduction under the WSAP, as the WSAP only allocates water from the RWS.

The qualifying projects (Candlestick Point-Hunters Point Shipyard Phase II (CP-HPS II), Treasure Island-Yerba Buena Island (TI-YBI), and Parkmerced) anticipate developing new recycled water projects to help offset potable demand. These new projects could produce up to 1.5 mgd of recycled water. By reducing potable water demand through the use of recycled water, these projects have the ability to eliminate the City's overall water shortage during multiple dry year periods.

Regarding the availability of water supplies to serve the City, beginning in 2015 the SFPUC finds as follows:

- In years of average and above-average precipitation and including development of SFPUC's local WSIP water supply sources the SFPUC has adequate supplies to serve 100 percent of normal, single dry and multiple dry year demand up to 2030.[2]
- In multiple-dry-year events after 2030, when the SFPUC imposes reductions in its supply, the SFPUC has in place the WSAP and RWSAP to balance supply and demand.

2 The deficit shown in 2010 is the result of reducing the RWS supply to 81 mgd per the Phased WSIP Variant, without full development of the additional 10 mgd of new WSIP supplies. 10 mgd of new sources will be developed and available for use in San Francisco by 2015. However, Retail demand is currently lower than the 2010 projected demand (FY 07/08 use was 83.9 mgd). If Retail demand exceeds the available supply of 84.5 mgd between 2010 and 2015, the Water Supply Agreement allows the SFPUC to purchase additional water from the RWS. If combined Retail and Wholesale RWS deliveries exceed 265 mgd, the SFPUC Retail customers would be required to pay an Environmental Surcharge for RWS deliveries over 81 mgd (Total RWS deliveries in FY07/08 were 256.7 mgd).

- If recycled water is implemented as proposed at each of the major development project sites, then it is assumed that potable water demands for the City can decrease by up to 1.5 mgd; thereby, eliminating potential multiple dry-year deficit after 2030.
- With the WSAP and Retail Water Supply Allocation Plan (Section 4)in place, and the addition of local WSIP supplies, the SFPUC finds it has sufficient water available to serve the Retail customers including the demand of its Retail existing customers and planned future uses.

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1.0 INTRODUCTION

1.1 Purpose

In an effort to streamline the water supply planning process within the City and County of San Francisco (San Francisco or City), the San Francisco Public Utilities Commission (SFPUC) adopted a resolution in 2002 and 2006 to allow for all development projects requiring a Water Supply Assessment (WSA) under SB 610 to rely solely on the adopted Urban Water Management Plan (UWMP)[3] without having to go through the process of preparing individual WSAs. SB 610 Water Code Section 10910 et seq. provides a nexus between the regional land use planning process and the environmental review process. The law also reflects the growing awareness of the need to incorporate water supply and demand analysis at the earliest possible stage in the land use planning process. The core of this law is an assessment of whether available water supplies are sufficient to serve the demand generated by a project, as well as the reasonably foreseeable cumulative demand in the region over the next 20 years under a range of hydrologic conditions.

The City of San Francisco Planning Department (SF Planning) and the San Francisco Redevelopment Agency are currently engaged in planning for various proposed land development projects that go beyond those future developments considered in the 2005 UWMP update. These developments, which include the Candlestick Point-Hunters Point Shipyard Phase II project (CP-HPS II), the Treasure Island-Yerba Island project (TI-TBI) and the Parkmerced project, hereinafter referred to as Projects, along with additional development throughout San Francisco account for 29,787 new dwelling units in 2030. As proposed, the Projects would contribute 27,400 new dwelling units to San Francisco's housing inventory. Additional development throughout the City accounts for the remaining 2,387 new dwelling units hereinafter referred to as Incremental Growth.

As a result of these new developments, the SFPUC concluded that its 2005 UWMP no longer accounted for every project requiring a WSA (qualifying project) within San Francisco. The SFPUC will not be preparing an updated UWMP until 2010. Therefore, during this interim period, any qualifying projects not accounted in the 2005 UWMP will require preparation of a WSA per Water Code Sections 10910 – 10915 that documents the SFPUC's current and projected supplies when compared to projected demands associated with new growth not covered in the 2005 UWMP.

The SFPUC determined that a WSA for the entire City and County service area, prepared pursuant to Water Code Sections 10910-10915, is the preferred method to evaluate supply and demands over a 20-year planning horizon. However, the Water Code Sections pertain to WSAs for qualifying projects, whereas the SFPUC needs a report to document its current and

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3 California law requires that UWMPs be prepared and submitted in years ending with fives (5) and zeros (0). Pursuant to Water Code Section 10644(a), the SFPUC prepared and adopted its UWMP in 2005. The next UWMP is due prior to December 31, 2010.

projected supplies when compared to projected demands associated with new growth not covered in the 2005 UWMP. Therefore, this Water Supply Availability Study (Study) was developed and modeled on the format of a WSA. The Study captures the most current water supply planning and demand information, analyzes the various projected change in water demands associated with each qualifying project within San Francisco, evaluates overall supply and demand, assesses the sufficiency of supply, and prepares a conclusion based on the analysis. Upon completion of the Study, a WSA for each qualifying project can rely on the information and conclusions of this Study.

1.2 Previous SFPUC Water Resource Studies

In recent years, the SFPUC has been engaged in numerous water resource planning efforts focused on regional and local supplies options and demand management measures, which could potentially reduce the amount of water the SFPUC imports through the Regional Water System (RWS) to meet its Retail water demands. The current status of major local water supply planning efforts is summarized below:

- **San Francisco Retail Water Demands and Conservation Potential**: In November 2004, the SFPUC prepared the "City and County of San Francisco Retail Water Demands and Conservation Potential" study (Demand Report) to project SFPUC future Retail water demands through the year 2030. The study employed a disaggregated water use forecasting procedure, drawing from actual water use data, and reflects current and projected demographics and employment data, changes in use due to existing plumbing codes, and water use trends. The study also identified water savings and implementation costs associated with a number of water conservation measures. Much of the methodologies in the Demand Report became the backbone of the demand analysis used in the SFPUC's 2005 UWMP.

- **Groundwater Planning**: In April 2005, the SFPUC completed the Final Draft North Westside Basin Groundwater Management Plan (GWMP), which identified opportunities for increasing groundwater production in San Francisco.

- **Recycled Water Master Plan Update**: The SFPUC prepared the 2006 Recycled Water Master Plan for the City and County of San Francisco (RWMP). The plan provided guidance for San Francisco in the development of recycled water projects within the City and County. The 2006 RWMP included an assessment of potential recycled water users City-wide and focused on identifying future recycled water projects in the City.

- **Urban Water Management Plan**: The 2005 UWMP addressed SFPUC's Retail water needs and evaluated sources of water supply, described efficient uses of water, demand management measures, and implementation strategies. The projections in the UWMP employed the demand and conservation estimates contained in the Demand Report, and the potential for groundwater and recycled water developed in the aforementioned studies to help in meeting projected demands. For consistency with the UWMP demand analysis, this Study used some of the same demand methodologies as presented in Section 5.2 of this Study.

- **Sewer Master Plan**: The SFPUC is preparing a Sewer System Master Plan (SSMP). The SSMP will present a long-term strategy for the management of the City's wastewater and storm water and identify capital improvements to be implemented over the next 25 to 30 years. The development of the SSMP will also incorporate proposed recycled water projects in the area. The identification and evaluation of potential wastewater management alternatives include an assessment of opportunities to implement recycled water projects to supply potential recycled water users identified in the 2006 RWMP. Environmental review of the Draft SSMP is anticipated to be complete in 2011.

- **Diversifying Retail Water Supply Portfolios**: In May 2006, the SFPUC prepared the "Diversifying San Francisco's Retail Water Supply Portfolio: Technical Memorandum". The study brought together planning data from existing planning projects, such as the North Westside Basin Groundwater Management Plan and the Recycled Water Master Plan, and summarized the potential local water supply options for San Francisco (including recycled water, groundwater, conservation and desalination projects). The memo also presented the implications of implementing different combinations of these local supply options, in terms of costs, ratepayer impacts and drought impact.

- **Water System Improvement Program (WSIP)**: On October 30, 2008, SFPUC certified the Final PEIR for the WSIP, a multiple year, system-wide capital improvements program. Many aspects of the WSIP are rooted in the 2000 Water Supply Master Plan and various water system vulnerability studies. The WSIP investigated the potential options of developing local water resources such as water recycling, groundwater, desalination and improved conservation to meet SFPUC purchase requests or demands.

1.3 Study Outline

This Study is an assessment of whether available water supplies are sufficient to serve the SFPUC's existing and planned Retail water system future uses within San Francisco, including agricultural and manufacturing uses, over the next 20 years under a range of hydrologic conditions. This Study employs the same disaggregated water use forecasting procedures as the Demand Report but incorporates an update of the end-use numbers presented in the Demand Report based on updated housing and employment projections.

This document is divided into six sections as follows:

1. Introduction
2. Water Supply
3. Potential Impact of Climate Change on SFPUC Supply
4. Drought Planning and Water Supply Reliability

5. San Francisco Growth Projections and Water Demand Analysis
6. Supply and Demand Comparison and Conclusion

2.0 WATER SUPPLY

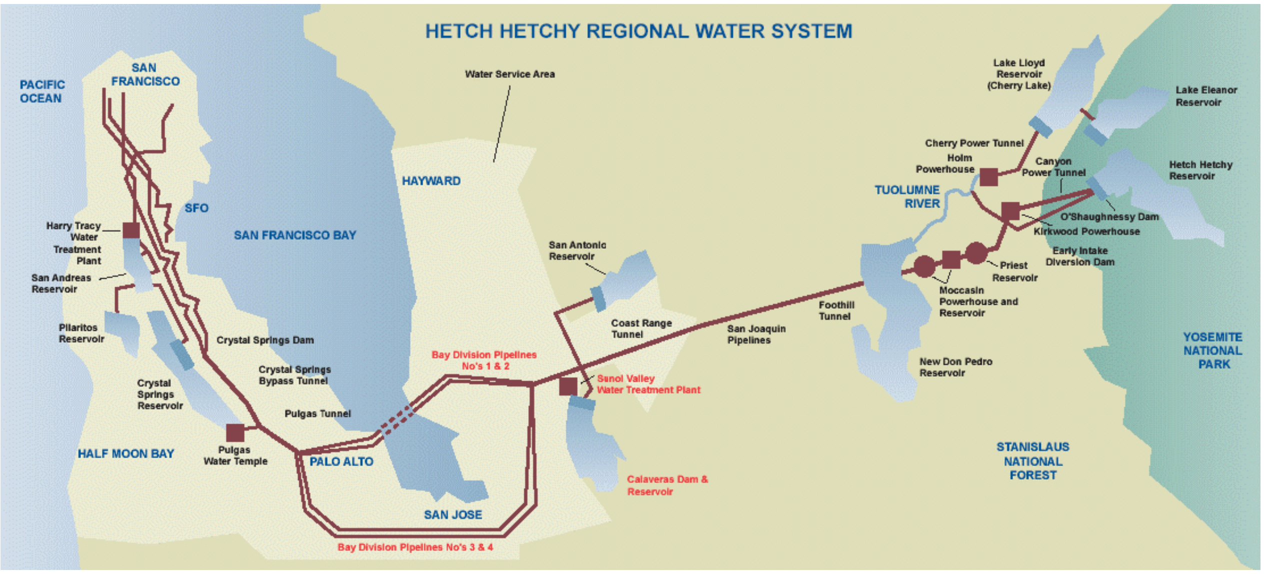
This section reviews San Francisco's existing and projected water supplies. The Regional Water System (RWS) is owned and operated by the City and County of San Francisco, under direction of the SFPUC. Historically, approximately 96 percent of the SFPUC's Retail water demands have been met through deliveries from the RWS. A small portion of San Francisco's water supply portfolio is produced through local groundwater and secondary treated recycled water. The groundwater is used primarily for irrigation at local parks and on highway medians. The recycled water is used mostly at municipal facilities for wastewater treatment process water, sewer box flushing and similar wash down operations.

In 1934, San Francisco combined the Hetch Hetchy system and Spring Valley system to create the SFPUC RWS. The rights to local diversions were originally held by the Spring Valley Water Company, which was formed in 1862.

The RWS currently delivers an annual average of approximately 265 mgd to 2.5 million users in Tuolumne, Alameda, Santa Clara, San Mateo, and San Francisco counties. The RWS is a complex system, shown in Figure 2-1, and supplies water from two primary sources:

- Tuolumne River through the Hetch Hetchy Reservoir, and
- Local runoff into reservoirs in Bay Area reservoirs in the Alameda and Peninsula watersheds.

Figure 2-1: Regional Water Supply System



Water from Hetch Hetchy Reservoir, through the Hetch Hetchy facilities represents the majority of the water supply available to the SFPUC. On average, the Hetch Hetchy Project provides over 85 percent of the water delivered to the Bay Area. During droughts the water received from the Hetch Hetchy system can amount to over 93 percent of the total water delivered.

Bay Area reservoirs provide on average approximately 15 percent of the water delivered by the SFPUC RWS. The local watershed facilities are operated to conserve local runoff for delivery. On the San Francisco Peninsula, the SFPUC utilizes Crystal Springs Reservoir, San Andreas Reservoir, and Pilarcitos Reservoir to capture local watershed runoff. In the Alameda Creek watershed, the SFPUC constructed the Calaveras Reservoir and San Antonio Reservoir. In addition to capturing runoff, San Antonio, Crystal Springs, and San Andreas reservoirs also provide storage for Hetch Hetchy diversions. The local watershed facilities also serve as an emergency water supply in the event of an interruption to Hetch Hetchy diversions.

2.1 Water Rights

The City and County hold pre-1914 appropriative water rights to store and deliver water from the Tuolumne River in the Sierra Nevada and locally from the Alameda and Peninsula watersheds. The City and County also divert and store water in the San Antonio Reservoir under an appropriative water right license granted by the State Water Resources Control Board (SWRCB) in 1959.

Appropriative water rights allow the holder to divert water from a source to a place of use not connected to the water source. These rights are based on seniority and use of water must be reasonable, beneficial, and not wasteful. In 1914, California established a formal water rights permit system, which is administered by the SWRCB. The SWRCB has sole authority to issue new appropriative water rights but cannot define property rights created under a pre-1914 appropriative water right.

The 1912 Freeman Report identified the ultimate diversion rate from the Tuolumne River to the Bay Area as 400 mgd and the City used this as the basis for designing the export capacity of the Hetch Hetchy project. The City has sufficient water rights for current diversions and the ultimate planned diversion rate of the Hetch Hetchy Project.

The federal Raker Act, enacted on December 19, 1913, grants to the City certain rights-of-way and public land use on federal property in the Sierra Nevada Mountains to construct, operate and maintain reservoirs, dams, conduits and other structures necessary or incidental to developing and using water and power. It also imposes restrictions on the City’s use of the Hetch Hetchy Reservoir, including (among others) the requirement that the City recognize the senior water rights of the Turlock and Modesto Irrigation Districts (TID and MID) to divert water from the Tuolumne River. Specifically, the Raker Act requires the City to bypass certain flows through its Tuolumne River reservoirs to TID and MID for beneficial use. By agreement, the City, TID and MID have supplemented these Raker Act obligations to increase the TID and MID entitlements to account for other senior Tuolumne River water rights and allow the City to “pre-pay” TID and MID their entitlement by storing water in the Don Pedro water bank. The

City is required to bypass inflow to TID and MID sufficient to allow them to divert 2,416 cfs or natural daily flow, whichever is less, at all times (as measured at La Grange), except for April 15 to June 13, when the requirement is 4,066 cfs or natural daily flow as measured at La Grange, whichever is less.

2.2 Current Water Supply Sources

2.2.1 The Regional Water System

The RWS, as described above, provides nearly 96% of San Francisco's Retail water supplies from the Hetch Hetchy Reservoir and local Bay Area reservoirs in the Alameda and Peninsula watersheds. On average, the Hetch Hetchy Reservoir provides over 85 percent of the water delivered and Bay Area reservoirs provide approximately 15 percent of the water delivered. The RWS delivers an annual average of 265 mgd – 81 mgd serves the Retail customers within the City and County of San Francisco and the other 184 mgd is delivered to the Wholesale suburban customers on the San Francisco Bay Peninsula.

2.2.2 Local Groundwater

San Francisco overlies all or part of seven groundwater basins. These groundwater basins include the Westside, Lobos, Marina, Downtown, Islais Valley, South and Visitation Valley basins. The Lobos, Marina, Downtown and South basins are located wholly within the City limits, while the remaining three extend south into San Mateo County. The portion of the Westside Basin aquifer located within San Francisco is commonly referred to as the North Westside Basin. With the exception of the Westside and Lobos basins, all of the basins are generally inadequate to supply a significant amount of groundwater for municipal supply due to low yield.

Early in its history, San Francisco made significant use of local groundwater, springs, and spring-fed surface water. However, after the development of surface water supplies in the Peninsula and Alameda watersheds by Spring Valley Water Company and the subsequent completion of the Hetch Hetchy Reservoir and aqueduct in the 1930's, the municipal water supply system has relied almost exclusively on surface water from local runoff, the Alameda and Peninsula watersheds, and the Tuolumne River watershed. Local groundwater use, however, has continued in the City primarily for irrigation purposes. The San Francisco Zoo and Golden Gate Park use groundwater for non-potable purposes.

About one mgd of groundwater is delivered to Castlewood Country Club from well fields operated by the SFPUC in Pleasanton and drawn from the Central Groundwater Sub Basin in the Livermore/Amador Valley. These wells are metered and have been in operation for several decades. For purposes of water accounting and billing, these deliveries to Castlewood are accounted for as part of San Francisco's Retail Customer base.

2.2.3 Local Recycled Water

From 1932 to 1981, San Francisco's McQueen Treatment Plant provided recycled water to Golden Gate Park for irrigation purposes. Due to changes in regulations the City closed the

McQueen plant and discontinued use of recycled water in Golden Gate Park. Currently in San Francisco, disinfected secondary-treated recycled water from the SFPUC's Southeast Water Pollution Control Plant is used on a limited basis for wash-down operations and is provided to construction contractors for dust control and other nonessential construction purposes. Current use of recycled water for these purposes in San Francisco is less than one mgd.

2.2.4 Local Water Conservation

The SFPUC is committed to demand-side management programs and San Francisco's per capita water use has dropped by about one-third since 1977 in part due to these programs. The first substantial decrease came following the 1976-77 drought in which gross per capita water use dropped from 160 to 130 gpcd. Despite continuous growth in San Francisco since then, water demands have remained lower than pre-drought levels.

A second substantial decrease in water use within San Francisco occurred as a result of the 1987-1992 drought when a new level of conservation activities resulted in further water use savings. It is anticipated that through the continuation and expansion of these programs, per capita water use will continue to decrease into the future. Current gross per capita water use within San Francisco is 91.5 gallons per capita per day (gpcd) with residential water use calculated to be approximately 57 gpcd, the lowest use of any major urban area in California.

The SFPUC's demand management programs range from financial incentives for plumbing devices to improvements in the distribution efficiency of the system. The conservation programs implemented by the SFPUC are based on the California Urban Water Conservation Council's list of fourteen Best Management Practices identified by signatories of the Memorandum of Understanding Regarding Urban Water Conservation in California, executed in 1991.

2.3 Water System Improvements and New Supply Reliability

To ensure that the future water needs of its Retail and wholesale customers will be met in a more reliable and sustainable manner, the SFPUC has undertaken water supply projects in the Water System Improvement Program (WSIP) to improve dry-year supplies, and is diversifying San Francisco's water supply portfolio through the development of local water supplies such as increasing recycled water and groundwater production, and bolstering water conservation. Many of the water supply and reliability projects evaluated in the WSIP were originally put forth in SFPUC's Water Master Plan (2000), then summarized in the 2005 UWMP and then investigated further in a Technical Memorandum Diversifying San Francisco's Retail Water Supply Portfolio (May 2006). In addition, specific water resource reports were prepared and released as well. Specifically, in 2005, SFPUC prepared a Recycled Water Master Plan, which updated the 1996 Recycled Water Master Plan and also prepared the North Westside Basin Groundwater Management Plan. Water supply elements of the WSIP are summarized below. The WSIP and its Program Environmental Impact Report are available for review at www.sfwater.org and www.sfgov.org. Sections of the WSIP Phased Variant to support the summaries in this Study are appended hereto.

2.3.1 Water System Improvement Program and the Phased WSIP Variant

The WSIP is a multi-billion dollar, multi-year, capital program to upgrade the RWS. The program will deliver improvements that enhance the SFPUC's ability to provide reliable, affordable, high quality drinking water to its 27 wholesale customers and regional Retail customers in Alameda, Santa Clara, and San Mateo counties, and to 800,000 Retail customers in San Francisco, in an environmentally sustainable manner.

As required under CEQA, SF Planning prepared a Program Environmental Impact Report (PEIR) for the WSIP. The PEIR evaluated the potential environmental impacts of the proposed WSIP and identified potential mitigations to those impacts. The PEIR also evaluated several alternatives to meet the SFPUC service area's projected increase in water demand between now and 2030. The water supply improvement options investigated included 10 alternatives using various water supply combinations from the local watersheds; the Tuolumne and Lower Tuolumne; ocean desalination; and additional recycled water, groundwater, and conservation.

The PEIR was certified by the SF Planning Commission on October 30, 2008. On the same day the SFPUC adopted the Phased WSIP Variant option.

2.3.1.1. Phased WSIP Variant

At the request of the SFPUC, SF Planning studied the Phased WSIP Variant as part of the environmental analysis. The SFPUC identified this variant in order to consider a program scenario that involved full implementation of all proposed WSIP facility improvement projects to insure that the public health, seismic safety, and delivery reliability goals were achieved as soon possible, but phased implementation of a water supply program to meet projected water purchases through 2030. Deferring the 2030 water supply element of the WSIP until 2018 would allow the SFPUC and its wholesale customers to focus first on implementing additional local recycled water, groundwater, and demand management actions while minimizing additional diversions from the Tuolumne River.

The Phased WSIP Variant establishes a mid-term planning milestone in 2018 when the SFPUC would reevaluate water demands through 2030 in the context of then-current information, analysis and available water resources. The SFPUC currently delivers on an annual average approximately 265 million gallons of water per day from local watersheds (Peninsula and Alameda Creek) and the Tuolumne River Watershed. By 2030, demand on the SFPUC system is expected to increase to an annual average of 300 million gallons of water per day. The Phased WSIP Variant would meet the projected 2018 purchase requests of 285 mgd from the RWS by capping purchases from the watersheds at 265 mgd; the remaining 20 mgd would be met through water efficiencies and conservation, water recycling and local groundwater use—10 mgd by Wholesale Customers and 10 mgd in the City and County. Before 2018, the SFPUC and the Wholesale Customers will engage in a new planning process to reevaluate water system demands and supply options, including conducting additional studies and environmental reviews necessary to address water supply needs after 2018.

The Phased WSIP Variant includes the following key program elements:

- Full implementation of all WSIP facility improvement projects.
- Water supply delivery to RWS customers through 2018 only of 265 mgd average annual target delivery originating from the watersheds. This includes 184 mgd for the Wholesale Customers and 81 mgd for the Retail Customers.
- Water supply sources include: 265 mgd average annual from the Tuolumne River and local watersheds and 20 mgd of water conservation, recycled water and local groundwater developed within SFPUC's service area (10 mgd Retail; 10 mgd wholesale).
- Dry-year water transfers of 2 mgd coupled with the Westside Groundwater Basin Conjunctive Use Project.
- Re-evaluation of 2030 demand projections, potential RWS purchase requests and water supply options by December 31, 2018 and a separate SFPUC decision in 2018 regarding RWS water deliveries after 2018.
- The ability to impose financial penalties is included in the new Water Supply Agreement to limit water sales to an average annual of 265 mgd from the watersheds.

The additional 10 mgd of supplies produced in San Francisco by implementation of the WSIP are considered secure and have been included in this Study. This Study assumes the WSIP local supplies will be in place in the timeframes stated in the SFPUC WSIP, with this assumption total Retail supplies increase to 94.50 mgd in 2015 and remain constant over the 20-year planning horizon. Projects related to these efforts are detailed below.

2.3.2 Local Groundwater Projects

2.3.2.1. San Francisco Groundwater Supply Project

The San Francisco Groundwater Supply Project would provide up to 4 mgd of local groundwater water to improve reliability during drought or maintenance conditions, as well as ensure that a reliable, high-quality source of water is available in the case of an earthquake or other emergency. The project proposes the construction of up to six wells and associated facilities in the western part of San Francisco to extract up to 4 mgd of groundwater water from the Westside Groundwater Basin for distribution in the City. The extracted groundwater, which would be used both for regular and emergency water supply purposes, would be disinfected and blended in small quantities with imported surface water before entering the municipal drinking water system. The environmental review for this project will begin in November 2009.

2.3.2.2. Lake Merced Water Level Restoration Project

The goal of the Lake Merced Water Level Restoration Project is to protect and balance the beneficial uses of Lake Merced by providing a more stable water level regime using groundwater and stormwater, rather than supplies provided through the RWS.

2.3.3 Local Recycled Water Projects

The proposed Westside, Harding Park and Eastside Recycled Water Projects would provide up to 4 mgd of recycled water to a variety of users in San Francisco. Recycled water will primarily be used for landscape irrigation, toilet flushing and industrial purposes. The Harding Park Project has completed environmental review, and the Westside Project will begin environmental review in late 2009 or early 2010.

The proposed Westside Project would bring recycled water from the proposed recycled water treatment facility in Golden Gate Park to the San Francisco Zoo, Golden Gate Park, and Lincoln Park Golf Course. Recycled water would be used for irrigation at all three sites; additionally, it would be used for non-potable uses in Golden Gate Park at the California Academy of Sciences. The proposed Harding Park Recycled Water Project would use available recycled water from the North San Mateo County Sanitation District (NSMCSD) located in Daly City, to irrigate Harding Park and Fleming Park golf courses in San Francisco. The SFPUC has partnered with the NSMCSD for this proposed project.

Currently, the SFPUC is conducting a recycled water demand assessment on the Eastside of San Francisco. The assessment examines the potential uses of recycled water for irrigation, toilet flushing, and commercial applications. The WSIP contains funding for planning, design, and environmental review for the San Francisco Eastside Recycled Water Project.

2.3.4 Local Water Conservation

The SFPUC has also increased its water conservation programs in an effort to achieve new water savings by 2018. The SFPUC's conservation program is based on the Demand Study (Section 1.2) that identified water savings and implementation costs associated with a number of water conservation and efficiency measures. The Demand Study evaluated the costs and benefits of implementing 48 different conservation measures using an end-use model. The results indicated that local conservation programs implemented through 2030 could cumulatively reduce Retail purchases from the SFPUC RWS by 4.5 mgd in year 2030. These new conservation programs include high-efficiency toilet replacement in low-income communities, plumbing retrofits in compliance with the 1992 California plumbing code and water efficient irrigation systems in municipal parks. Through its conservation program, the SFPUC anticipates reducing gross per capita consumption from 91.5 gpcd to 87.4 gpcd by 2018 for an average daily savings of nearly 4.0 mgd.

2.3.5 Summary of Local WSIP Water Supply Programs

As previously discussed, SFPUC anticipates that the expanded groundwater and recycled water production, and increased conservation programs will provide the City with an additional 10 mgd of local water supplies. As quantified in Table 2-1 with implementation of the WSIP, SFPUC expects to have in these local supplies in place by 2015. These programs and projects are reliable in all hydrologic conditions and are not subject to RWSAP reductions or curtailments.

Table 2-1: WSIP Water Supply Sources (mgd)

WSIP Water Supplies	2010	2015	2020	2025	2030
Groundwater	0.0	2.0	2.0	2.0	2.0
Recycled Water	0.0	4.0	4.0	4.0	4.0
Conservation	0.0	4.0	4.0	4.0	4.0
Total WSIP Local Supplies	**0.0**	**10.0**	**10.0**	**10.0**	**10.0**

2.3.6 Total SFPUC Retail Water Supplies

Table 2-2 summarizes SFPUC's total water supplies now and over the 20-year planning period. In 2010, prior to the development of the 10 mgd of local supplies, SFPUC can access an annual average 84.50 mgd from all sources discussed above. Beginning in 2015, when the WSIP water supply sources are readily available, the SFPUC's Retail water supplies increase to 94.5 mgd. These supplies are assumed to be available in the quantities listed in Table 2-2. SFPUC intends to use these supplies to meet its Retail customer demands.

Table 2-2: SFPUC Water Supplies 2010 - 2030

Current Water Supply Sources	2010	2015	2020	2025	2030
SFPUC RWS (Surface water: Tuolumne River, Alameda & Peninsula) (1)	81.0	81.0	81.0	81.0	81.0
Groundwater Sources					
Groundwater (In-City Irrigation Purposes)	2.5(2)	0.5(3)	0.5(3)	0.5(3)	0.5(3)
Groundwater at Castlewood(4)	1.0(4)	1.0(4)	1.0(4)	1.0(4)	1.0(4)
Groundwater: Treated for Potable – Previously used for In-City Irrigation purposes(5)	0.0	2.0	2.0	2.0	2.0
Groundwater Subtotal	**3.5**	**3.5**	**3.5**	**3.5**	**3.5**
Current Water Supply Subtotal	**84.5**	**84.5**	**84.5**	**84.5**	**84.5**
WSIP Water Supply Sources					
Groundwater Development: Potable from SF GWSP (Westside Groundwater Basin)(6)	0.0	2.0	2.0	2.0	2.0
Recycled Water Expansion Irrigation(7)	0.0	4.0	4.0	4.0	4.0
Supply Conservation Program	0.0	4.0	4.0	4.0	4.0
WSIP Supply Subtotal	**0.0**	**10.0**	**10.0**	**10.0**	**10.0**
Total Retail Supply (Current and WSIP Supplies)	**84.5**	**94.5**	**94.5**	**94.5**	**94.5**

(1) RWS surface water supplies are subject to reductions due to below-normal precipitation. This may affect dry year supplies - model shows supply reduction occurs in year 2 of multiple dry year event. (Source: SFPUC 2008 WSIP Phase Variant Supply limitation)

(2) Groundwater serves irrigation to Golden Gate Park, SF Zoo, and Great Highway Median. (Source: 2005 SFPUC UWMP Table 8B page 43)

(3) A Groundwater reserve of 0.5 mgd for irrigation purposes will remain as part of SFPUC's non-potable groundwater supply. (Source: SFPUC 2008 WSIP Phase Variant)

(4) Castlewood current and projected use remains unchanged over 20 year planning horizon. (Source: 2005 SFPUC UWMP Table 8B page 43)

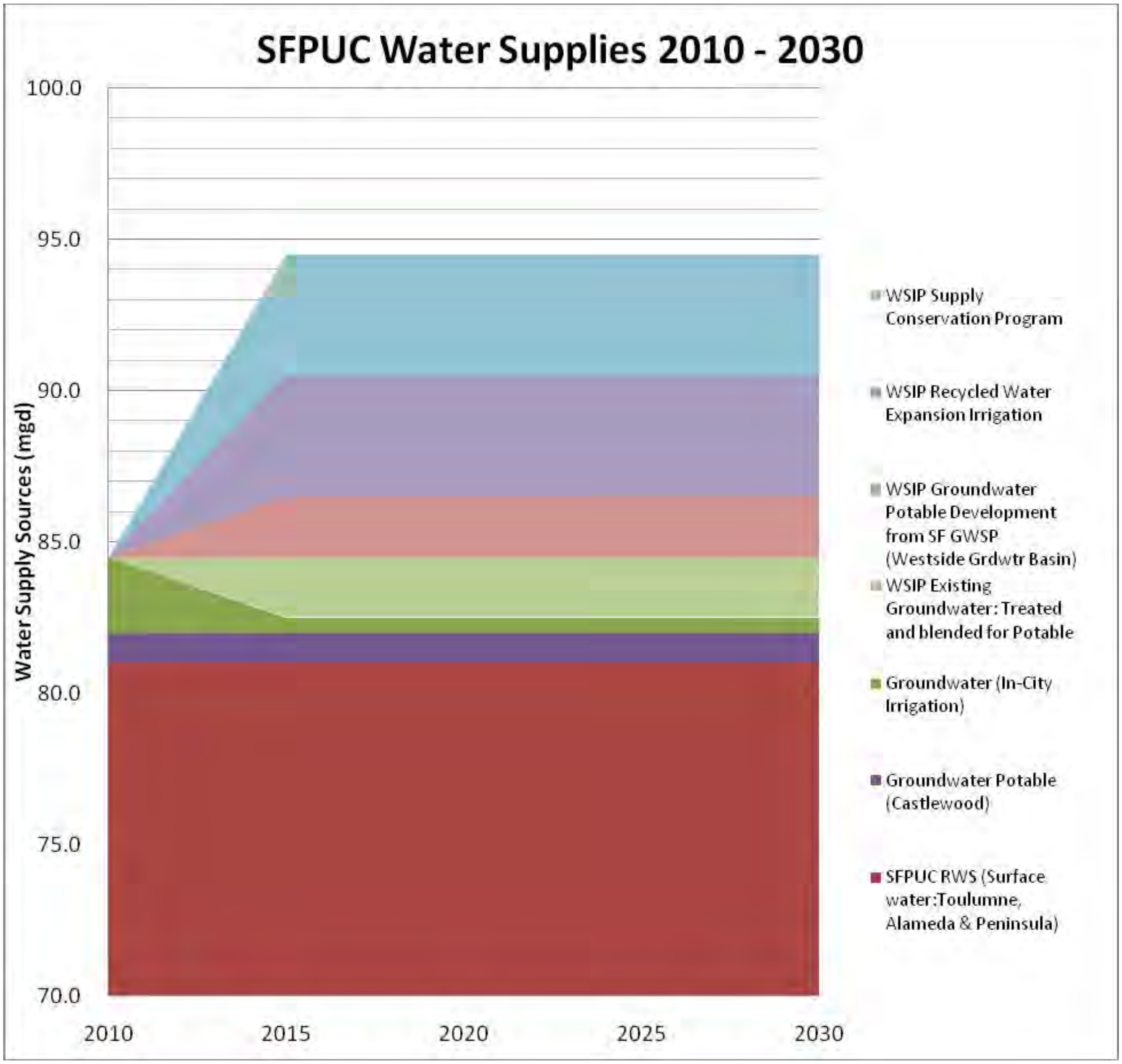
(5) 2.0 mgd of groundwater treated and blended for Potable water supply purposes. (Source: 2005 SFPUC UWMP Table 8B page 43)

(6) 2.0 mgd of new groundwater developed as part of the new local supply target. (Source: SFPUC 2008 WSIP Phase Variant Supply Target)

(7) 2.0 mgd of Recycled used for irrigation at Golden Gate Park, SF Zoo, Great Highway Median, and 2.0 mgd for other non-potable purposes. (Source: SFPUC 2008 WSIP Phase Variant Supply Target)

Figure 2-1 is a graphical representation of the SFPUC's current supply sources and the WSIP local supply sources. As shown in Figure 2-2, the supplies grow from 84.5 mgd in 2010 to 94.5 mgd as the WSIP local supplies are brought into the SFPUC Retail supply system. The figure shows the total supplies increasing in 2015 and holding constant over the 20-year planning horizon.

Figure 2-2: SFPUC Water Supplies



2.3.7 Dry Year Water Supply Projects

The WSIP water supply program includes development of dry-year supplies for the RWS. The PEIR included an analysis of dry-year water supply transfers from the senior water rights holders on the Tuolumne River (MID and TID); a groundwater conjunctive use project; and a regional desalination project. The latter two projects are described below. The SFPUC is investigating the possibility of a dry-year water transfer with MID and TID for 2 mgd in 2018. The WSIP provides funding for the Groundwater Storage and Recovery Project.

2.3.7.1. Groundwater Storage and Recovery Project

The proposed Regional Groundwater Storage and Recovery Project would balance the use of both groundwater and surface water to increase water supply reliability during dry years or in emergencies. The proposed project is located in San Mateo County and is sponsored by the SFPUC in coordination with its partner agencies, the California Water Service Company, City of Daly City and City of San Bruno. The partner agencies currently purchase wholesale surface water from the SFPUC and also independently operate groundwater production wells for drinking water and irrigation.

The proposed Regional Groundwater Storage and Recovery Project would extract groundwater from the South Westside Basin groundwater aquifer in San Mateo County. The project would consist of installing up to sixteen new recovery well facilities in northern San Mateo County to pump stored groundwater during a drought. During years of normal or heavy precipitation, the proposed project would provide surface water to the partner agencies in order to reduce the amount of groundwater pumped. Over time, the reduced pumping would result in the storage of approximately 61,000 acre-feet of water (more than the supply contained in the Crystal Springs Reservoir on the SFPUC Peninsula Watershed.) This would allow recovery of this stored water at a rate of up to 7.2 million gallons per day for a 7.5-year dry period. The water would be in compliance with the California Department of Public Health requirements for drinking water supplies. The proposed project would include construction of well pump stations, disinfection units, and piping. The proposed project is currently undergoing environmental review.

2.3.7.2. Desalination

The SFPUC's investigations of desalination as a water supply source have focused primarily on the potential for regional facilities. The proposed Bay Area Regional Desalination Project is a joint venture between the SFPUC, Contra Costa Water District, East Bay Municipal Utility District, and the Santa Clara Valley Water District.

The regional desalination project would provide an additional source of water during emergencies, provide a supplemental water supply source during extended droughts, allow other major water facilities to be taken out of service for maintenance or repairs, and increase supply reliability by providing water supply from a regional facility. The Bay Area Regional Desalination Project would have an ultimate total capacity of up to 65 mgd.[4]

4 EBMUD, "Desalination Project", http://www.ebmud.com/water_&_environment/water_supply/current_projects/desalination_project/default.htm, accessed July 30, 2009.

3.0 POTENTIAL IMPACT OF CLIMATE CHANGE ON SFPUC SUPPLY AVAILABILITY

The issue of climate change has become an important factor in water resources planning in the State, and it is being considered during planning for the RWS. There is evidence that increasing concentrations of greenhouse gases have caused and will continue to cause a rise in temperatures around the world, which will result in a wide range of changes in climate patterns. Moreover, there is evidence that a warming trend occurred during the latter part of the 20th century and will likely continue through the 21st century. These changes will have a direct effect on water resources in California, and numerous studies on climate change have been conducted to determine the potential impacts water resources. Based on these studies, climate change could result in the following types of water resource impacts, including impacts on the RWS and associated watersheds:

- Reductions in the average annual snowpack due to a rise in the snowline and a shallower snowpack in the low- and medium-elevation zones, such as in the Tuolumne River basin, and a shift in snowmelt runoff to earlier in the year,
- Changes in the timing, intensity, and variability of precipitation, and an increased amount of precipitation falling as rain instead of as snow,
- Long-term changes in watershed vegetation and increased incidence of wildfires that could affect water quality,
- Sea level rise and an increase in saltwater intrusion,
- Increased water temperatures with accompanying adverse effects on some fisheries,
- Increases in evaporation and concomitant increased irrigation need, and
- Changes in urban and agricultural water demand.

However, other than the general trends listed above, there is no clear scientific consensus on exactly how global warming will quantitatively affect State water supplies, and current models of State water systems generally do not reflect the potential effects of global warming.

The SFPUC staff performed an initial evaluation of the effect on the Regional Water System of a 1.5-degree Celsius (°C) temperature rise between 2000 and 2025. The temperature rise of 1.5°C is based on a consensus among many climatologists that current global climate modeling suggests a 3°C rise will occur between 2000 and 2050 and a rise of 6°C will occur by 2100. The evaluation predicts that an increase in temperature of 1.5°C will raise the snowline approximately 500 feet every twenty-five years. The elevation of the watershed draining into Hetch Hetchy Reservoir ranges from 3,800 to 12,000 feet above mean sea level, with about 87 percent of the watershed area above 6,000 feet. In 2000 (a normal hydrologic year in the 82-year period of historical record), the average snowline in this watershed was approximately 6,000 feet during the winter months. Therefore, the SFPUC evaluation indicates that a rise in temperature of 1.5°C between 2000 and 2025 will result in less or no snowpack between 6,000 and 6,500 feet and faster melting of the snowpack above 6,500 feet. Similarly, a temperature rise of 1.5°C between 2025 and 2050 will result in less or no snowpack between 6,500 and 7,000 feet and faster melting of the snowpack above 7,000 feet.

The SFPUC climate change modeling indicates that about 7 percent of the runoff currently draining into Hetch Hetchy Reservoir will shift from the spring and summer seasons to the fall and winter seasons in the Hetch Hetchy basin by 2025. This percentage is within the current interannual variation in runoff and is within the range accounted for during normal runoff forecasting and existing reservoir management practices. The additional change between 2025 and 2030 is not expected to be detectible. The predicted shift in runoff timing is similar to the results found by other researchers modeling water resource impacts in the Sierra Nevada due to warming trends associated with climate change.

Based on these preliminary studies and the results of literature reviews, the potential impacts of global warming on the RWS are not expected to affect the water system operations through 2030. SFPUC hydrologists are involved in ongoing monitoring and research regarding climate change trends and will continue to monitor the changes and predictions, particularly as these changes relate to water system operations and management of the RWS. The SFPUC has developed a workplan to further advance its research on the effects of climate change on the RWS.

4.0 DROUGHT PLANNING AND WATER SUPPLY RELIABILITY

The SFPUC water supply system reliability is expressed in terms of its ability to deliver water during droughts. Reliability is defined by the amount and frequency of water delivery reductions required to balance customer demands with available supplies in droughts. The SFPUC has a reliability goal of meeting dry-year delivery needs while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts.

The total amount of water the SFPUC has available to deliver to its Retail and wholesale customers during a defined period of time is dependent on several factors. These include the amount of water that is available to the SFPUC from natural runoff, the amount of water in reservoir storage, and the amount of water that must be released from the SFPUC's system for commitments to purposes other than customer deliveries, such as releases below Hetch Hetchy reservoir to meet the Raker Act and fishery purposes.

The SFPUC operates its system to optimize the reliability and quality of its water deliveries. Hetch Hetchy Reservoir operations are guided by two principal objectives: collection of Tuolumne River water runoff for diversion to the Bay Area; and fulfillment of the SFPUC's downstream release obligations. To conserve runoff, Hetch Hetchy Project reservoirs are drawn down beginning in early winter, relying on the recurrence and forecast of snow melt to guide drawdown releases. Similarly, the Regional Water System Bay Area reservoirs are operated to conserve watershed runoff. As such, reservoirs are drawn down during the winter period to capture storms and reduce the potential for spilling water out of the reservoirs. In the spring, excess Hetch Hetchy water supply (snowmelt) is transferred to three of the Bay Area reservoirs, capable of receiving the water, to fill any unused reservoir storage.

Prior to the late 1970's, droughts did not seriously affect the ability of the SFPUC to sustain full deliveries to its customers. However, as the 1987-1992 droughts progressed and reservoir storage continued to decline, it became apparent that continued full deliveries could not be sustained without the risk of running out of water before the drought ended.

To provide some level of assurance that water could be delivered continuously throughout a drought (although at reduced levels), the SFPUC adopted a drought planning sequence and associated operating procedures that trigger different levels of water delivery reduction rationing relative to the volume of water actually stored in SFPUC reservoirs. Each year, during the snowmelt period, the SFPUC evaluates the amount of total water storage expected to occur throughout the RWS. If this evaluation finds the projected total water storage to be less than an identified level sufficient to provide sustained deliveries during drought, the SFPUC may impose delivery reductions or rationing.

4.1 Water Shortage Allocation Plan (WSAP)

During a drought, it is expected that the Retail and wholesale customers would experience a reduction in the amount of water received from the RWS. The amount of this reduction has been dictated by existing contractual agreements between the SFPUC and the Wholesale Customers, as detailed in the existing WSAP. The WSAP provides specific allocations of available water between the Retail and wholesale customers collectively associated with different levels of system-wide shortages, as shown in Table 4-1.

Table 4-1: WSAP Allocation

Level of System-Wide Reduction in Water Use Required	Share of Available Water	
	SFPUC Share	Wholesale Customers Share (collectively)
5% or less	35.5%	64.5%
6% through 10%	36.0%	64.0%
11% through 15%	37.0%	63.0%
16% through 20%	37.5%	62.5%

In addition to providing an allocation method, the plan also includes provisions for transfers, banking and excess use charges.

Under the WSAP, SFPUC Retail customers would experience no reduction in deliveries at a 10 percent shortage. However, during a 20 percent system-wide shortage, the Retail customers would experience a 1.9 percent reduction in Retail deliveries. This assumes the full development of the additional 10 mgd of local WSIP supplies in the Retail service area. These 10 mgd of local supplies are not subject to reduction under the WSAP as the WSAP only allocates water supplies from the RWS. Table 4-2 shows SFPUC RWS Retail supply schedule during normal, single dry year, and multiple dry year periods.

The WSAP has been carried forward in the new Water Supply Agreement for system-wide shortages of up to 20 percent. For shortages in excess of this amount, the Water Supply Agreement provides that the SFPUC may allocate water in its discretion.

4.2 Retail Water Shortage Allocation Plan

San Francisco's Retail Water Shortage Allocation Plan (RWSAP) was adopted to formalize a three-stage program of action to be taken in San Francisco to reduce water use during a drought. In accordance with the RWSAP, prior to the initiation of any water delivery reductions in San Francisco, whether it be initial implementation of reduction delivery or increasing the severity of water shortage, the SFPUC would outline a drought response plan that would address the following: the water supply situation; proposed water use reduction objectives; alternatives to water use reductions; methods to calculate water use allocations and adjustments; compliance methodology and enforcement measures; and budget considerations.

Table 4-2: 2005 – 2030 SFPUC Retail Allocations in Normal, Dry and Multiple Dry Years

	Normal Year		Single Dry Year		Multiple Dry Year Event(2) Year 1		Year 2		Year 3	
	mgd	%	mgd	%	mgd	%	mgd	%	mgd	%
2010(1)	81.0	100	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1
2015	81.0	100	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1
2020	81.0	100	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1
2025	81.0	100	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1
2030	81.0	100	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1

(1) In 2010 the Retail allocation of RWS supply is reduced to 81 mgd to reflect the Retail allocation under the 2018 Phased WSIP Variant. 10 mgd of recycled water, groundwater, and conservation will be implemented by 2015 to make up for the loss in RWS supply. The 10 mgd of local supply is not subject to reduction under the WSAP.

(2) Under the WSAP, the SFUPC Retail allocations at a 10 percent shortage are 85.86 mgd. However, due to the Phased WSIP Variant, only 81 mgd of RWS supply is shown. The remaining supply can be transferred from or to the Wholesale Customers under the terms of the Water Supply Agreement.

Source: San Francisco Public Utilities Commission. 2005. Urban Water Management Plan for the City and County of San Francisco. p. 54-57 and discussions with SFPUC staff.

This drought response will be presented at a regularly scheduled SFPUC Commission meeting for public input. The meeting will be advertised in accordance with the requirements of California Water Code Section 6066 of the Government Code, and the public will be invited to comment on the SFPUC's intent to reduce deliveries.

Depending on the level of water demand and the desired objective for water use reduction, one, two or all three stages of the RWSAP may be required.

<u>Stage 1 (Voluntary)</u>

- System-wide demand reductions of 5-10 percent experienced
- Voluntary rationing request of customers
- Customers are alerted to water supply conditions
- Remind customers of existing water use prohibitions
- Education on, and possible acceleration of, incentive programs

<u>Stage 2 (Mandatory)</u>

- System-wide demand reductions of 11-20 percent experienced
- All Stage 1 actions implemented
- All customers receive an "allotment" of water based on the Inside/Outside allocation method (based on base year water usages for each account)
- Water use above the "allocation" level will be subject to excess use of flow restrictor devices and shut-off of water

Stage 3 (Mandatory)

- System-wide demand reductions of 20 percent or greater experienced
- Same actions as in Stage 2 with further reduced allocations

5.0 SAN FRANCISCO GROWTH PROJECTIONS AND WATER DEMAND ANALYSIS

This section shows the calculated water demand projections for San Francisco based on recent housing and employment forecasts.

5.1 Revised City of San Francisco Growth Projections

The SFPUC has recently evaluated projected demands and incorporated the updated San Francisco Planning projections for residential and non-residential growth contained in a memorandum from SF Planning to SFPUC dated July 9, 2009 (Appendix A). This analysis results in a 2030 growth projection that differs from the 2005 UWMP. Table 5-1 compares 2030 growth projections between the 2005 UWMP and the 2009 growth projections developed by the SF Planning department. As shown in Table 5-1 new residential growth is expected to increase by 29,787 units. The 27,400 new residential units proposed in three Projects account for the majority of new residential growth in 2030. In contrast, the 2009 employment projections result in net loss of 47,300 new employment opportunities in 2030.

Table 5-1: 2030 SF Planning Projections for Households and Employment

Residential Units		**2030 Projection**
2005 UWMP(1)		373,513
2009 SF Planning Projections(2)		403,300
	Net Change	**29,787**(3)
Non-Residential Population		**2030 Projection**
2005 UWMP(4)		795,400
2009 SF Planning Projections(5)		748,100
	Net Change	**-47,300**

(1) 2005 Urban Water Management Plan residential projections were based on ABAG Projections 2002 and Citywide Policy Analysis and Planning, San Francisco Planning Department, Land Use Allocations 2002.

(2) 2009 Residential Projections were developed by the San Francisco Planning Department and designed to closely match the recently adopted ABAG Projections 2009 target, but taking into account local knowledge of projects currently in various stages of the entitlement process, commonly referred to as the Development Pipeline. (Appendix A)

(3) Of the new residential units the Projects account for 27,700 units and new incremental growth accounts for 2,387 units.

(4) 2005 Urban Water Management Plan non-residential projections were based on ABAG 2030 employment projections and linearly extrapolated for 2020 and 2030.

(5) Revised 2009 Non-Residential Projections were developed by the San Francisco Planning Department and based on ABAG 2009 Employment projections for 2030. (Appendix A)

5.1.1 2009 Residential Projections

As stated previously, the SF Planning and the San Francisco Redevelopment Agency are currently engaged in planning for various proposed land development projects. These Projects, as well as Incremental Growth throughout San Francisco, account for 29,787 new dwelling units in 2030. As proposed, the Projects would contribute 27,400 new dwelling units to San Francisco's housing inventory. The Incremental Growth throughout the City accounts for the remaining 2,387 new dwelling units (Appendix B).

The updated 2030 City growth projection shown in Table 5-1 reflects an increase in residential households from the 2005 UWMP forecast but an overall decrease in non-residential (employment) population. As shown in Table 5-2, the residential growth at the Projects commences in 2015 with 6,850 new dwelling units and continues to grow to 27,400 in 2030, essentially growing by 6,850 over each five-year period. In addition, this Study also assumes that the incremental growth throughout San Francisco would occur in the same manner. As shown in Table 5-2, the incremental growth commences in 2015 with 597 new dwelling units and continues to grow to 2,387 in 2030, essentially growing by 597 over each five-year period.

Table 5-2: Projects and Incremental Growth within San Francisco

Residential Units	2010	2015	2020	2025	2030
Residential Units [(1)]	344,306	351,608	358,910	366,211	373,513
Residential Units for Projects[(2)]	0	6,850	13,700	20,550	27,400
Residential Units for Incremental Growth[(3)]	0	597	1,194	1,790	2,387
Subtotal (Projects and Incremental Growth)		***7,447***	***14,894***	***22,340***	***29,787***
Total New Residential Units	**344,306**	**359,055**	**373,803**	**388,552**	**403,300**

[(1)] 2005 UWMP residential unit projections shown in Table 5-1. Source: 2005 SFPUC UWMP Table 2, page 7
[(2)] Residential Units of Projects (CP-HPS II 10,500 units); (TI-YBI 8,000 units); (Parkmerced 8,900 total units)
[(3)] Incremental Growth accounts for 2,387 new units.

5.1.2 2009 Employment Projections

The updated 2030 City growth projection shown in Table 5-1 reflects an increase in residential households from the 2005 UWMP forecast but an overall decrease in non-residential (employment) population. These changes mirror the changes in the Association of Bay Area Governments (ABAG) projections. ABAG projections are used for various planning purposes by many of the cities in the nine-county area covered by ABAG. ABAG publishes regional projections and employment and growth every two years. Projections developed after 2002 incorporate a fundamental shift in ABAG's projection methodology. Rather than taking existing local land use policy as a given (as had previously been the case), in the projections following the 2002 projections, ABAG assumes that local policy will be amended in the future to adopt "smart growth" principles. Specifically, the projections assume that higher density growth will be focused in urban core areas, and that more housing will be produced in those areas, compared to that previously assumed. The result of these assumptions is to increase the expected population in already developed areas. Another difference reflected in the later projections is a more current and accurate reflection of the internet industry (dot com era), as well as the effect of the current recession on employment projections.

Table 5-3 shows the progression of growth in employment opportunities forecasted in San Francisco based on SF Planning's 2009 Employment Projections (Appendix B). Beginning in 2015 employment is projected to increase to 719,145 jobs, and then by 2025 employment is expected to grow to 734,050 jobs. As projected, and shown in Table 5-3 employment in San Francisco is expected to reach 748,100 jobs.

Table 5-3: Non-Residential Employment Projections

Non-Residential Employment Projections	2010	2015	2020	2025	2030
SF Planning Employment Total[1] (jobs)	712,145	719,447	726,749	734,050	748,100

[1] Table 5-1 2009 SF Planning Projections based on ABAG 2030 Employment projections

5.2 City of San Francisco Retail Water Demand Analysis

Retail water demands in the 2005 UWMP were based on the findings of the Demand Report. The Demand Report analyzed water demand associated with each Retail customer sector and then forecasted demand over a 25-year planning horizon using data provided by the City, and the SFPUC. The demand projections were developed using a water use model, which initially established a base-year water demand at the end-use level (such as toilets, showerheads, other lavatory hardware and household fixtures), calibrated the model to initial conditions, and forecasted future water demand based on projected demand of existing water service accounts and future population growth.

This Study updates the 2005 UWMP water demand forecasts in 2010 through 2030 to reflect San Francisco's three major development Projects (CP-HPS II, TI-YBI, and Parkmerced) and incremental growth projected to occur throughout the City, and the 2009 San Francisco non-residential planning projections (based on ABAG 2009 Employment Projections) for 2030. Tables 5-4 and 5-5 show the results of the demand forecasts at the Project sites; anticipated incremental growth expected to occur throughout the City and growth in demand generated through employment opportunities (jobs).

5.2.1 Water Demand of Projects and Incremental Growth

The Projects are proposed as mixed-use residential redevelopment projects within San Francisco. Each project sponsor provided land use plans or reports to the City that include residential unit counts, commercial spaces, and public facilities. These same plans and reports estimated potable water demand along with other land use information. Residential water demands for the Projects were provided to the City by the Project developers, and were developed using an end use model on a per-unit or per-employee basis. The Project demands were independently reviewed by PBS&J and the SFPUC as part of this Study, and appear consistent with the SFPUC demand estimates. See Appendix B for the methodology used in the Project demand estimates.

Upon buildout in 2030, these Projects represent the majority of new growth in San Francisco above the 2030 growth projected in the 2005 UWMP. As shown in Table 5-4, overall water demand at each of the Project sites is estimated at 1.99 mgd (CP-HPS II); 1.70 mgd (TI-YBI) and 0.98 mgd at Parkmerced. The CP-HPS II includes a number of different development scenarios, the estimated water demands of the three main CP-HPS II development scenarios are also shown in Table 5-2.

The Demand Report (see Section 1.2) analyzed water demands associated with each Retail customer sector and established per unit-use rates. As such, between 2010 and 2030, SFPUC used a per-unit use rate average of 98.7 gpd per household for multi-family residential demands. As shown in Table 5-4, the 98.7 gpd per household rate was applied to the incremental growth of 2,387 new dwelling units throughout the City resulting in a demand of 0.24 mgd in 2030.

Table 5-4: 2030 Water Demand of the Projects and Incremental Growth within SF City and County (mgd)

Projects and Incremental Growth[1]	Water Demand (mgd)					
	Stadium		R&D Variant		Housing Variant	
	Project Water Demand	Non-Residential Adjustment (1.18)[7]	Project Water Demand	Non-Residential Adjustment (1.40)[7]	Project Water Demand	Non-Residential Adjustment (1.15)[7]
CP-HPS II[2]	1.67	1.04	1.99	1.05	1.66	1.04
TI – YBI[3]	1.70	1.17	1.70	1.17	1.70	1.17
Parkmerced[4]	0.98	0.94	0.98	0.94	0.98	0.94
Projects Subtotal	**4.38**	**3.16**	**4.67**	**3.16**	**4.34**	**3.16**
Existing Demand at Project Sites[5]	-1.51	-1.51	-1.51	-1.51	-1.51	-1.51
Net Development Subtotal	**2.87**	1.64	**3.16**	1.65	**2.83**	1.64
Other Growth in SF (City and County)[6]	0.24	0.24	0.24	0.24	0.24	0.24
Net Change in Water Demand with Non-Residential Adjustment[7]		**1.88**[7]		**1.89**[7]		**1.88**[7]

(1) Average annual demands. Residential water demands for the proposed projects were provided to the City by project developer. They were also developed using an end use model on a per unit or per employee basis. The developer demands were independently reviewed by PBS&J and the SFPUC as part of this Study, and appear consistent with the SFPUC demand estimates. (Appendix B)
(2) CP-HPS Phase II Arup – Winzler & Kelly Water Demand Memo September 25, 2009 Appendix B
(3) Treasure Island Technical Memo Section 7 August 2009. Appendix B
(4) Parkmerced Water Demand Spreadsheet from August 2009 Appendix B
(5) Existing demand provided by SFPUC from current billing records
(6) Derived by SFPUC staff based on approximately 2,387 dwelling units at 98.7 gpd. August 2009 Appendix X
(7) To avoid double-counting the water demand associated with the 2009 SF Planning Non-Residential Employment Projections and the non-residential demand calculated in the developer estimates at each of the Project sites, the total water demand at each of the developments was adjusted to remove the non-residential demands. This study assumes all non-residential demand is accounted for in the 2009 SF Planning Non-Residential Employment Projections.

For conservative water supply planning purposes, this Study uses the highest total water demand adjusted for non-residential uses[5] of 1.89 mgd associated with the R&D Variant at CP-HPS II. The net change in demand accounts for existing uses at the project site and a non-residential demand adjustment.

5.2.2 Water Demand of Non-Residential Employment Projections

As shown above in Table 5-1, the SF Planning and ABAG projected new job growth in the San Francisco based on the employment changes in the San Francisco Bay Area as described in Section 5.1.1 above.

Demand projections for overall City growth were based on 2010-2030 average per-unit use factors of the Demand Report. The Demand Report analyzed water demands associated with each Retail customer sector and established per unit-use rates. As such, between 2010 and 2030, SFPUC used an average of 42.42 gallons per day (gpd) per employee for non-residential water demands. In an effort to represent the employment opportunities over the 20-year planning horizon this Study assumes that the non-residential employment sector would grow at a linear rate over the same planning period without accounting for market force influences and changes in local economics. As shown in Table 5-5, the 42.42 gpd per employee water demand rate was applied to the growth in jobs over the 20-year planning horizon. In 2015, demand is expected to be 30.52 mgd and by 2030, water demand generated through employment is expected to reach 31.73 mgd.

Table 5-5: Water Demand for Non-Residential Employment Projections

Employment Projections and Non-Residential Demand	2010	2015	2020	2025	2030
SF Planning Employment Total[(1)] (jobs)	712,145	719,447	726,749	734,050	748,100
Non-Residential - Business/Industrial Demand[(2)] (mgd)	30.21	30.52	30.83	31.14	31.73

(1) Table 5-1 2009 SF Planning Projections
(2) Average of 42.42 gallons per day (gpd) per employee for non-residential water demands.

5.2.3 SFPUC Total Retail System Demand

The SFPUC incorporated the 2009 SF Planning projections for residential and non-residential growth in San Francisco into this Study to assess the results of the SF Planning projections and its effects on the City's water demand. The previous tables (5-3 and 5-4) along with demand data from the 2005 UWMP is incorporated in the City's total Retail demand. The results of these 2009 demand forecasts are shown in Table 5-6. The table represents the anticipated growth in demand commencing in 2010 and extending over the 20-year planning horizon to 2030.

5 To avoid double-counting the water demand associated with the 2009 Non-Residential Planning Projections and the non-residential demand calculated in the developer estimates at each of the Project sites, the total water demand at each of the developments was adjusted to remove the non-residential demands. This study assumes all non-residential demand is accounted for in the 2009 Non-Residential SF Planning Projections. Table 5-2 shows the net change in water demand at the Project sites and the adjusted change in water demand without non-residential demand.

As shown in Table 5-6, incremental residential growth demand and demand at the Project sites commences in 2015 at 0.47 mgd and progresses to 1.89 mgd in 2030. In 2015, demand drops slightly due to a reduction in total residential demand. The non-residential demand commences in 2010 at 30.21 mgd, increases to 30.83 mgd and culminates at 31.73 in 2030.

Table 5-6 shows total Retail demands for SFPUC beginning in 2010 at 91.81, and then drops slightly in 2015 because of a drop in residential demand and then increases to 91.87 mgd in 2020. By 2030, Retail demand will be approximately 93.42 mgd.

Table 5-6: SFPUC Retail Demand (mgd)

Users, Facilities and Entities	**Projected Water Demand (mgd)**				
	2010	**2015**	**2020**	**2025**	**2030**
Residential Demand (Single & Multiple Family)[(1)]	44.70	43.80	43.20	42.90	42.90
New Residential Demand generated by Projects and Incremental Growth[(2)(4)]	-	0.47	0.95	1.42	1.89
Subtotal	44.70	44.27	44.15	44.32	44.79
Non-Residential - Business/Industrial Demands[(3,4)]	30.21	30.52	30.83	31.14	31.73
Subtotal	**74.91**	**74.79**	**74.97**	**75.46**	**76.52**
Unaccounted-for System Losses	7.30	7.30	7.30	7.30	7.30
Subtotal	**82.21**	**82.09**	**82.27**	**82.76**	**83.82**
Other Retail Demands[(5)]	4.90	4.90	4.90	4.90	4.90
Lawrence Livermore Laboratory; Groveland CSD[(6)]	1.20	1.20	1.20	1.20	1.20
City Irrigation Demand[(7)]	2.5	2.5	2.5	2.5	2.5
Castlewood Community Demand[(8)]	1.0	1.0	1.0	1.0	1.0
Total Retail Demand	**91.81**	**91.69**	**91.87**	**92.36**	**93.42**

(1) Residential Demands (Source: 2005 SFPUC UWMP Table 8B, page 43)

(2) See Table 5-4. Multiple Family – [In 2030 Incremental Growth of 0.24 mgd + (CP-HPS II 10,500 DU) 1.04 mgd + (TI-YBI 8,000 DU) 1.17 mgd + (Parkmerced 8,900 total DU) 0.94 mgd = 3.40 mgd] Existing Demand is 1.51 mgd at all sites. [3.40 mgd – 1.51 = 1.89 mgd] as shown in Table 4-2 (Sources: ARUP Water Demand Memo for CP-HPS Phase II September 25, 2009; Parkmerced Water Demand Spreadsheet June 30, 2009; Treasure Island Water Technical Report December 2008 Updated August 2009)

(3) See Table 5-5. Agriculture, Mining, Construction, Manufacturing, Transportation, Wholesale & Retail Trade, F.I.R.E., Services, Gov't including Builders – Contractors and Docks – Shipping. (Source: Adapted from 2009 ABAG Employment Projections in conjunction with SF Planning, July 2009) As developed in the Demand Study, SFPUC derived the employment water demands by taking the ABAG employment projections and multiplying by 42.42 gallons per employee per day and is consistent with SFPUC's demand projection methodology.

(4) See Table 5-5. Non-residential (jobs/employment) demands at major project sites were assumed to be contained in the 2009 ABAG Employment projections. Growth in demand is incrementally increased to reflect the growth in jobs over the 20-year planning horizon. To avoid double-counting the water demand associated with the 2009 SF Planning Non-Residential Employment Projections and the non-residential demand calculated in the developer estimates at each of the Project sites, the total water demand at each of the developments was adjusted to remove the non-residential demands. This study assumes all non-residential demand is accounted for in the 2009 SF Planning Non-Residential Employment Projections. Table 5-4 shows the net change in water demand at the Project sites and the adjusted change in water demand without non-residential demand. Adapted by PBS&J and SFPUC September 2009 from ARUP Water Demand Memo for CP-HPS Phase II September 25, 2009; Parkmerced Water Demand Spreadsheet June 30, 2009; Treasure Island Water Technical Report December 2008 Updated August 2009

(5) US Navy, SF International Airport, and other suburban/municipal accounts. (Source: 2005 SFPUC UWMP Table 8B, page 43)

(6) Lawrence Livermore Laboratories (0.8 mgd); Groveland CSD (0.4 mgd) (Source: 2005 SFPUC UWMP Table 8B, page 43)

(7) City Irrigation at Golden Gate Park, Great Highway Median and SF Zoo. (Source: 2005 SFPUC UWMP Table 8B, page 43)

(8) Castlewood Community demand served by wells in the Pleasanton well field. (Source: 2005 SFPUC UWMP Table 8B, page 43)

5.2.4 Potential Recycle Water Demand of the Projects

In addition to providing estimated potable water demands, each of the Projects also provided the City with estimated recycled water demands. Each of the Projects anticipates developing new recycled water projects to help offset potable demand. As shown in Table 5-7, the Projects may produce up to 1.49 or 1.5 mgd of recycled water.

Table 5-7: Potential Recycled Water Demand of the Projects (mgd)

Development	**Recycled Water Demand[1] (mgd)**
CP-HPS II	0.89
TI-YBI	0.38
Parkmerced	0.22
Total	**1.49**

Notes: Average annual recycled water demand.
(1) Sources: ARUP Water Demand Memo for CP-HPS Phase II September 25, 2009; Parkmerced Water Demand Spreadsheet June 30, 2009; Treasure Island Water Technical Report December 2008 Updated August 2009. Appendix B

The recycled water potential shown in Table 5-7 is considered additional recycled water sources and have not been included as part of SFPUC's local WSIP supplies. In the event that recycled water is produced at the Project sites, recycled water could offset as much as 1.5 mgd in total City potable demand. This Study provides a conservative analysis of SFPUC's Retail supplies and demands and, as such, evaluates the City's demands to include the proposed projects without recycled water.

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6.0 SUPPLY AND DEMAND COMPARISON

This section compares the SFPUC's Retail water supplies and demands through year 2030.

6.1 Supply and Demand Comparison

Table 6-1 compares SFPUC Retail supplies and demand during normal, single dry year, and multiple dry year periods. Section 2.3.6 discusses SFPUC's total water supplies now and over the 20-year planning period. In 2010, prior to the development of the 10 mgd of local supplies, SFPUC can access an annual average 84.50 mgd from all water supply sources. Beginning in 2015, when the WSIP water supply sources are readily available, the SFPUC's Retail water supplies increase to 94.5 mgd. These supplies are assumed to be available in the quantities listed in Table 6-1. SFPUC intends to use these supplies to meet its Retail customer demands.

The demand estimates in this Study show that the 2009 SF Planning projections result in an increase in City Retail demand. As stated previously, by 2030 Retail demand is estimated at 93.42 mgd. This increase, however, does not change the findings in the 2005 UWMP, which estimated demand at 93.4 mgd in 2030.[6] As shown in Table 6-1, the SFPUC can meet the current and future demands of its Retail customers in normal years, single dry-years and nearly all multiple dry-year events with the exception of years 2 and 3 in 2030.

As modeled in Table 6-1, the deficit shown in 2010 is the result of reducing the RWS supply to 81 mgd as per the Phased WSIP Variant, without full development of the additional 10 mgd of new WSIP supplies. It is expected that 10 mgd of new sources will be developed and available for use in San Francisco by 2015. However, Retail demand is currently lower than the 2010 projected demand (Fiscal Year 2007-2008 use was 83.9 mgd). If Retail demand exceeds the available RWS supply of 81.0 mgd between 2010 and 2015, and total RWS deliveries exceed 265 mgd between 2010 and 2015, the Water Supply Agreement allows the SFPUC to purchase additional water with the payment of an Environmental Surcharge. Notably, total RWS deliveries in Fiscal Year 2007-2008 were 256.7 mgd, which is 8.3 mgd below the 265 mgd watershed delivery goal.

As shown in Table 6-1, during a multiple dry-year event[7] commencing in 2030, it is possible that the SFPUC will not be able to meet 100 percent of Retail demand in 2030. As modeled, a supply shortfall of 0.42 mgd is anticipated to occur in the second and third year of a multiple dry-year event. To overcome the potential 0.42 mgd supply deficit during multiple dry-years in 2030, the SFPUC will implement their adopted drought planning sequence and associated operating procedures that trigger different levels of water delivery reduction rationing relative to the volume of water actually stored in SFPUC reservoirs. If the SFPUC determines the projected total water storage to be less than an identified level sufficient to provide sustained deliveries during drought, the SFPUC may impose delivery reductions or rationing. The WSAP and RWSAP allow the SFPUC to reduce water deliveries to customers during periods of water shortage to

6 SFPUC 2005 Urban Water Management Plan Table 8B, page 43.

7 Multiple dry-year events are defined as a three-year event per UWMP requirements. SFPUC determined that a multiple dry-year event is years 2-4 of SFPUC's 8.5 year design drought. SFPUC can meet 100 percent of deliveries in the first year of such an event.

achieve a positive balance of supplies and demands. Under WSAP, the RWS supply curtailment in multiple dry years of 1.5 mgd to 79.5 mgd, results in a 1.9 percent reduction as shown in Table 4-2. The SFPUC, as part of the WSIP, adopted a water reliability objective of no greater than 20 percent rationing in any one year of a drought.

Table 6-1: Projected Supply and Demand Comparison - Normal, Dry, and Multiple Dry Years (mgd)

				Multiple Dry Year Event		
	Retail Supply and Demand	Normal Year	Single Dry Year	Year 1	Year 2	Year 3
2010	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater Supply(2)	3.50	3.50	3.50	3.50	3.50
	Total Retail Supply(3)	84.50	84.50	84.50	83.00	83.00
	Total Retail Demand(4)	91.81	91.81	91.81	91.81	91.81
	Surplus/(Deficit)(5)	-7.31	-7.31	-7.31	-8.81	-8.81
2015	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater(6)	3.50	3.50	3.50	3.50	3.50
	WSIP Supply Sources(7)	10.00	10.00	10.00	10.00	10.00
	Total City Supply(3)	94.50	94.50	94.50	93.00	93.00
	Total Retail Demand(4)	91.69	91.69	91.69	91.69	91.69
	Surplus/(Deficit)	2.81	2.81	2.81	1.31	1.31
2020	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater(6)	3.50	3.50	3.50	3.50	3.50
	WSIP Supply Sources(7)	10.00	10.00	10.00	10.00	10.00
	Total City Supply(3)	94.50	94.50	94.50	93.00	93.00
	Total Retail Demand(4)	91.87	91.87	91.87	91.87	91.87
	Surplus/(Deficit)	2.63	2.63	2.63	1.13	1.13
2025	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater(6)	3.50	3.50	3.50	3.50	3.50
	WSIP Supply Sources(7)	10.00	10.00	10.00	10.00	10.00
	Total City Supply(3)	94.50	94.50	94.50	93.00	93.00
	Total Retail Demand(4)	92.36	92.36	92.36	92.36	92.36
	Surplus/(Deficit)	2.14	2.14	2.14	0.64	0.64
2030	RWS Supply(1)	81.00	81.00	81.00	79.50	79.50
	Groundwater(6)	3.50	3.50	3.50	3.50	3.50
	WSIP Supply Sources(7)	10.00	10.00	10.00	10.00	10.00
	Total City Supply(3)	94.50	94.50	94.50	93.00	93.00
	Total Retail Demand(4)	93.42	93.42	93.42	93.42	93.42
	Surplus/(Deficit)	1.08	1.08	1.08	-0.42(8)	-0.42(8)

(1) RWS Supply (SFPUC Water Supplies Table 2-2)
(2) Groundwater Uses for In-City Irrigation and Castlewood (SFPUC Water Supplies - Table 2-2)
(3) Total Retail Supply (SFPUC Water Supplies Table 2-2)
(4) SFPUC Retail Demand (SFPUC Retail Demand Table 5-6)
(5) The deficit shown in 2010 is the result of reducing the RWS supply to 81 mgd per the Phased WSIP Variant, without full development of the additional 10 mgd of new WSIP supplies. 10 mgd of new sources will be developed and available for use in San Francisco by 2015. However, Retail demand is currently lower than the 2010 projected demand (FY 07/08 use was 83.9 mgd). If Retail demand exceeds the available supply of 84.5 mgd between 2010 and 2015, the Water Supply Agreement allows the SFPUC to purchase additional water from the RWS. If combined Retail and Wholesale RWS deliveries exceed 265 mgd, the SFPUC Retail customers would be required to pay an Environmental Surcharge for RWS deliveries over 81 mgd (Total RWS deliveries in FY07/08 were 256.7 mgd).
(6) Groundwater Supplies at Castlewood and In-City Irrigation (SFPUC Water Supplies Table 2-2)
(7) WSIP Supply Sources (Recycled Water (4.0 mgd; Groundwater (2.0 mgd Existing and 2.0 from NWGWP, and WSIP Water Efficiency and Conservation (4.0 mgd) (see SFPUC Water Supplies Table 2-2)
(8) Deficit occurs in year 2 and 3 of multiple dry year event, SFPUC implements its Drought Year Water Shortage Contingency Plans - RWSAP and WSAP to balance supply and demand under this projected shortfall as described in Section 4.0

6.2 Conclusion and Findings

The updated 2009 SF Planning projections results in a Retail demand in 2030 of 93.42 mgd, which is only slightly greater than the 2030 demand projections estimated in the 2005 UWMP. This increase, however, does not change the results of the 2005 UWMP. In years with normal or above-normal precipitation, the City has sufficient supplies to serve their Retail customers.[8] The ability to meet the demands of the Retail customers is in large part due to the development of 10 mgd of local WSIP supplies in the Retail service area. These new sources of groundwater, recycled water, and water conservation are essential to provide the City with adequate supply in dry year periods, as well as improving supply reliability during years with normal precipitation. Although the 2005 UWMP considered the 10 mgd of new WSIP sources in terms of system-wide drought-planning, the WSIP supplies were not assigned to either the Retail or Wholesale Customers directly as it was not known how the resources would be used. As presented in this Study, with the adoption of the Phased WSIP Variant, the WSIP supplies can now be applied to meet Retail demands. In addition, due to the nature and development of the local supplies, these WSIP supply sources are not subject to reduction under the WSAP.

During a multiple dry-year event, however, it is possible that the SFPUC will not be able to meet 100 percent of demand from its Retail customers in 2030, and will therefore have to impose reductions on its Retail supplies. Under the WSAP, SFPUC Retail customers would experience no reduction in deliveries at a 10 percent RWS shortage. However, during a 20 percent system-wide shortage, the Retail customers would experience a 1.9 percent reduction in Retail deliveries. Table 6-1 compared SFPUC Retail supplies during normal, single dry year, and multiple dry year periods. The main difference between 2010 and subsequent planning years (2015–2030) is due to the development of the additional 10 mgd of local WSIP supplies in the Retail service area. These WSIP local supplies are not subject to a reduction under the WSAP, as the WSAP only allocates water from the RWS, which is subject to reductions.

The Projects anticipate developing new recycled water projects to help offset potable demand. These new projects may produce up to 1.5 mgd of recycled water. By reducing their potable water demands through the use of recycled water, these projects have the ability to eliminate the City's overall water shortage during multiple dry year periods.

8 The deficit shown in 2010 is the result of reducing the RWS supply to 81 mgd per the Phased WSIP Variant, without full development of the additional 10 mgd of new WSIP supplies. 10 mgd of new sources will be developed and available for use in San Francisco by 2015. However, Retail demand is currently lower than the 2010 projected demand (FY 07/08 use was 83.9 mgd). If Retail demand exceeds the available supply of 84.5 mgd between 2010 and 2015, the Water Supply Agreement allows the SFPUC to purchase additional water from the RWS. If combined Retail and Wholesale RWS deliveries exceed 265 mgd, the SFPUC Retail customers would be required to pay an Environmental Surcharge for RWS deliveries over 81 mgd (Total RWS deliveries in FY07/08 were 256.7 mgd).

Regarding the availability of water supplies to serve the City, beginning in 2015 the SFPUC finds as follows:

- In years of average and above-average precipitation and including development of SFPUC's local WSIP water supply sources the SFPUC has adequate supplies to serve 100 percent of normal, single dry and multiple dry year demand up to 2030.[9]
- In multiple-dry-year events after 2030, when the SFPUC imposes reductions in its supply, the SFPUC has in place the WSAP and RWSAP to balance supply and demand.
- If recycled water is implemented as proposed at each of the major development project sites, then it is assumed that potable water demands for the City can decrease by up to 1.5 mgd; thereby, eliminating potential multiple dry-year deficit after 2030.
- With the WSAP and RWSAP in place, and the addition of local WSIP supplies, the SFPUC finds it has sufficient water supplies available to serve its existing Retail customers and planned future uses.

9 The deficit shown in 2010 is the result of reducing the RWS supply to 81 mgd per the Phased WSIP Variant, without full development of the additional 10 mgd of new WSIP supplies. 10 mgd of new sources will be developed and available for use in San Francisco by 2015. However, Retail demand is currently lower than the 2010 projected demand (FY 07/08 use was 83.9 mgd). If Retail demand exceeds the available supply of 84.5 mgd between 2010 and 2015, the Water Supply Agreement allows the SFPUC to purchase additional water from the RWS. If combined Retail and Wholesale RWS deliveries exceed 265 mgd, the SFPUC Retail customers would be required to pay an Environmental Surcharge for RWS deliveries over 81 mgd (Total RWS deliveries in FY07/08 were 256.7 mgd).

7.0 REFERENCES

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APPENDICES

APPENDIX A

Growth Projections Letter from San Francisco Planning Department

SAN FRANCISCO
PLANNING DEPARTMENT

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Suite 400
San Francisco,
CA 94103-2479

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July 9, 2009

Michael P. Carlin
Deputy General Manager, SFPUC
1155 Market St, 11th Floor
San Francisco, CA 94103

Subject: Projections of growth by 2030

Dear Michael:

Thank you for your letter dated March 11, 2009 requesting the Planning Department's projections of growth by 2030 in order to satisfy your mandates in connection with assessing water supply and demand in the years to come, and more specifically for preparing water supply assessments for individual projects moving forward.

The Planning Department routinely prepares projections for the purposes of analyzing impacts of plans and projects undergoing the environmental review process. While the assumptions of these sets may vary depending on the circumstances surrounding a specific project, the Department recently completed a citywide projection capturing citywide growth expectations by 2030 designed to closely match the recently adopted ABAG Projections 2009 target, but taking into account local knowledge of projects currently in various stages of the entitlement process, commonly referred to as the development pipeline. Table 1 shows the projections for 2030.

Table 1 Development Projections

	2000	2005	2030	Growth 2000-2030	Growth 2005-2030
Households	329,700	341,478	403,292	73,592	61,814
HH Population	756,976	783,441	916,800	159,824	133,359
Jobs	642,500	553,090	748,100	105,600	195,010

Source: ABAG, San Francisco Planning Department

As the question may arise whether particular projects were included, the Planning Department for the purposes of these numbers assumed full buildout over the course of the forecast period of three large development programs currently undergoing environmental review, namely Treasure Island, Bayview Waterfront, and Park Merced projects.

More generally, we included entitled pipeline projects, and projects larger than 500 units, or large commercial projects per criteria set forth in California Water Code §10912(a) as these are the projects for which individual water supply assessments would otherwise need to be made in the near future.

We are looking forward to continuing the larger regional growth dialogue with PUC and other regional stakeholders.

Sincerely,

John Rahaim
Director of Planning

CC: Aksel Olsen
Teresa Ojeda
File

APPENDIX B

Major Projects Water Demand Estimates from Project Sponsors

[Candlestick Point/Hunter's Point Shipyard; Parkmerced; Treasure Island-Yerba Buena Island]

To	Lennar -	Reference number 131878/RRJ	
cc		File reference	
From	Rowan Roderick-Jones/Manish Dalia x 27222 (San Francisco)	Date October 15, 2009	
Subject	**Candlestick Point / Hunters Point Shipyard Phase II** **Water Demand Memorandum** **Revision # 16**		

1 Purpose

This Water Demand Memorandum (Memo) presents a summary approach, references, assumptions, and results of calculations undertaken by Arup to estimate a range of potential water demands and sanitary sewer flows for the Candlestick Point/Hunters Point Shipyard (CP/HPS) Development including the Proposed Project as well as the R&D and Housing Variants.

The Memo establishes a historical baseline condition and makes adjustments to account for current California building code requirements as well as the San Francisco Green Building Ordinance. The basis for these analyses and the results are presented herein.

Arup worked in conjunction with Winzler & Kelly to develop water demand and sanitary sewer flow values appropriate for use in engineering design.

2 Approach

To develop reasonable water demand estimates for the CP/HPS development the following steps were taken.

1) The Proposed Project was divided into land uses as identified in Table 1. Two project variants exclude the stadium. The R&D Variant also includes an additional 2,500,000 square feet of research and development space, as shown in Table 2. The Housing Variant does not include any additional program but shifts 1,350 housing units from Candlestick Point to Hunters Point, as shown in Table 4. The methodology for developing water demands was the same for the Proposed Project and Project Variants.
2) A **Historical Benchmark** demand was estimated for each land use based on a series of assumptions and references. Key references used were:
    a. The Urban Water Management Plan for the City of San Francisco
    b. The SFPUC Wholesale Customer Demand Projections Technical Report (URS, 2004)
    c. The City of Los Angeles CEQA Threshold Guide, 2006
    d. The EPA, Onsite Wastewater Treatment Systems Manual, 2002

A number of other references were also used and these are provided at the end of this memorandum. Arup collected information from a number of sources and selected a method of estimating demands that we believed to be appropriate and reasonable for the area. Assumptions and references are provided in Section 4.

3) The demands were then distributed between indoor and outdoor end uses which were estimated based on published data in the SFPUC Wholesale Customer Demand Projections Report (URS 2004). End use distributions for the stadium and performance venues were assumed rather than taken directly from the SFPUC's projections. The distribution ratios are provided in Table 23 and Table 25.

4) Next, the Historical Benchmark was adjusted to an **Adjusted to California Codes** scenario using new fixture flow rates from California and Federal Buildings standards as well as the International Plumbing Code.

5) The Adjusted to California Codes demand estimate does not include the requirements of the **San Francisco Green Building Ordinance (SFGBO)**. The SFGBO is based on LEED for New Construction (LEED NC) and requires a 50% reduction in landscape irrigation demands. The SFGBO does not specify what code is to be used as the baseline for irrigation demands. Therefore the current code was assumed to be equivalent to the irrigation amount allowed under the California Water Efficient Landscape Ordinance. This rule was assumed to be applicable to both private and public landscape irrigation. In addition, the SFGBO requires a 30% reduction in potable water demand. The SFGBO does not provide specific language as to which portions of demand are to be included in the 30% reduction. However, the intention of the similar LEED NC credit (Water Efficiency Credit 3) is to reduce building water demand by 30%. The total 30% reduction in building water efficiency may be achieved by any number of means including improved fixture efficiency, mechanical building efficiency, or by providing an alternative water supply. The demand estimates, when adjusted for the SFGBO represent the final demands for the Proposed Project and Project Variants.

   The SFGBO demand was developed by using the California code as a baseline and using a trajectory or possible means of water saving strategies and/or alternative water supplies to achieve the SFGBO. The assumptions and references used to make these adjustments are provided in Table 27.

6) Potential reclaimed water demands as well as sewage generation were determined based on end use distributions.

The results of the study are presented at the beginning of this report. References and Assumptions used for making the demand estimations are provided after the results in Section 3.

Table 1: CP/HPS Land Use Program (Proposed Project)

		Hunters Point Shipyard	Candlestick Point	Project Total
Land Use				
Residential				
	Density, 15-75 units per acre (units)	680	750	1,430
	Density, 50-125 units per acre (units)	1,415	3,215	4,630
	Density, 100-175 units per acre (units)	265	2,445	2,710
	Density, 175-285 units per acre (units)	290	1,440	1,730
	Total Project (units)	**2,650**	**7,850**	**10,500**
Retail				
	Regional Retail (sqft))	0	635,000	635,000
	Neighborhood Retail (sqft)	125,000	125,000	250,000
	Total (sqft)	**125,000**	**760,000**	**885,000**
Office (sqft)		0	150,000	150,000
Community Uses (sqft)		50,000	50,000	100,000
Research & Development (sqft)		2,500,000	0	2,500,000
Hotel (sqft)		0	150,000	150,000
Artist's Studios				
	1:1 Studio Renovation & Replacement (sqft)	225,000	0	225,000
	New Artist Center (sqft)	30,000	0	30,000
	Total (sqft)	**255,000**	**0**	**255,000**
Parks & Open Space				
	New City Parks (acres)	140	8.1	148.1
	New Sports Fields & Active Recreation (acres)	91.6	0	91.6
	New Open Space and Restored State Parkland (acres)	0	96.7	96.7
	Total (acres)	**231.6**	**104.8**	**336.4**
Football Stadium (seats)		69,000	0	69,000
Performance Venue (seats)		0	10,000	10,000
Source: Lennar, 2009				

Table 2: CP/HPS Land Use Program (R&D Variant)

		Hunters Point Shipyard	Candlestick Point	Project Total
Land Use				
Residential				
	Density, 15-75 units per acre (units)	680	750	1,430
	Density, 50-125 units per acre (units)	1,415	3,215	4,630
	Density, 100-175 units per acre (units)	265	2,445	2,710
	Density, 175-285 units per acre (units)	290	1,440	1,730
	Total Project (units)	**2,650**	**7,850**	**10,500**
Retail				
	Regional Retail (sqft))	0	635,000	635,000
	Neighborhood Retail (sqft)	125,000	125,000	250,000
	Total (sqft)	**125,000**	**760,000**	**885,000**
Office (sqft)		0	150,000	150,000
Community Uses (sqft)		50,000	50,000	100,000
Research & Development (sqft)		5,000,000	0	5,000,000
Hotel (sqft)		0	150,000	150,000
Artist's Studios				
	1:1 Studio Renovation & Replacement (sqft)	225,000	0	225,000
	New Artist Center (sqft)	30,000	0	30,000
	Total (sqft)	**255,000**	**0**	**255,000**
Parks & Open Space				
	New City Parks (acres)	152.4	8.1	160.5
	New Sports Fields & Active Recreation (acres)	69.8	0	69.8
	New Open Space and Restored State Parkland (acres)	0	96.7	96.7
	Total (acres)	**222.2**	**104.8**	**327**
Football Stadium (seats)		0	0	0
Performance Venue (seats)		0	10,000	10,000
Source: Lennar, 2009				

.

Table 4: CP/HPS Land Use Program (Housing Variant)

		Hunters Point Shipyard	Candlestick Point	Project Total
Land Use				
Residential				
	Density, 15-75 units per acre (units)	1,540	970	2,510
	Density, 50-125 units per acre (units)	1,905	3,670	5,575
	Density, 100-175 units per acre (units)	265	1,220	1,485
	Density, 175-285 units per acre (units)	290	640	930
	Total Project (units)	**4,000**	**6,500**	**10,500**
Retail				
	Regional Retail (sqft))	0	635,000	635,000
	Neighborhood Retail (sqft)	125,000	125,000	250,000
	Total (sqft)	**125,000**	**760,000**	**885,000**
Office (sqft)		0	150,000	150,000
Community Uses (sqft)		50,000	50,000	100,000
Research & Development (sqft)		2,500,000	0	2,500,000
Hotel (sqft)		0	150,000	150,000
Artist's Studios				
	1:1 Studio Renovation & Replacement (sqft)	225,000	0	225,000
	New Artist Center (sqft)	30,000	0	30,000
	Total (sqft)	**255,000**	**0**	**255,000**
Parks & Open Space				
	New City Parks (acres)	149.9	8.1	158
	New Sports Fields & Active Recreation (acres)	94.7	0	94.7
	New Open Space and Restored State Parkland (acres)	0	96.7	96.7
	Total (acres)	**244.6**	**104.8**	**349.4**
Football Stadium (seats)		69,000	0	69,000
Performance Venue (seats)		0	10,000	10,000
Source: Lennar, 2009				

3 Results

This section provides the results of the water demand assessment. The results are provided by land use as well as by end use (fixture type). The overall results for the proposed project are summarized by Figure 1. Similar summaries for the two project variants are provided in Figure 3and Figure 5.

Table 4: Potable water demands for Proposed Project and Project Variants.

	Proposed Project Demand (MGD)	R&D Variant Demand (MGD)	Housing Variant Demand (MGD)
Historical Baseline	2.95	3.47	2.92
Adjusted to California Codes	2.46	2.92	2.44
Adjusted to San Francisco Green Building Ordinance	1.67	1.99	1.66

The above table indicates that the R&D Variant will have the highest potable water demands under the requirements of the SFGBO of 1.99 MGD.

Figures 1 through 3 provide the Proposed Project and Project Variant demands for the Historical Benchmark, the Adjusted to California Codes and the San Francisco Green Building Ordinance cases. They also illustrate the Sustainable Case trajectory defined by the step down line. The first five steps in the “sustainable Case” step-down graph are demand reduction strategies while the later five steps are achieved by utilizing alternative water supplies. Additional demand breakdowns by land use and end use are provided in Table 5 through Table 14 for the Proposed Project and Project Variants. Reclaimed water demands and sanitary flows by end use for the Proposed Project are provided in Table 16 through Table 22.

Please note that in all reported annual water demand and sanitary flow data in Table 5 through Table 22 are in million gallons per day (MGD) and are rounded to the nearest 0.01 millionth gallon. When reporting the calculations within the tables slight rounding errors on the order of 0.01 MGD may occur.

Figure 1: Water demand results summary step down graph- Proposed Project

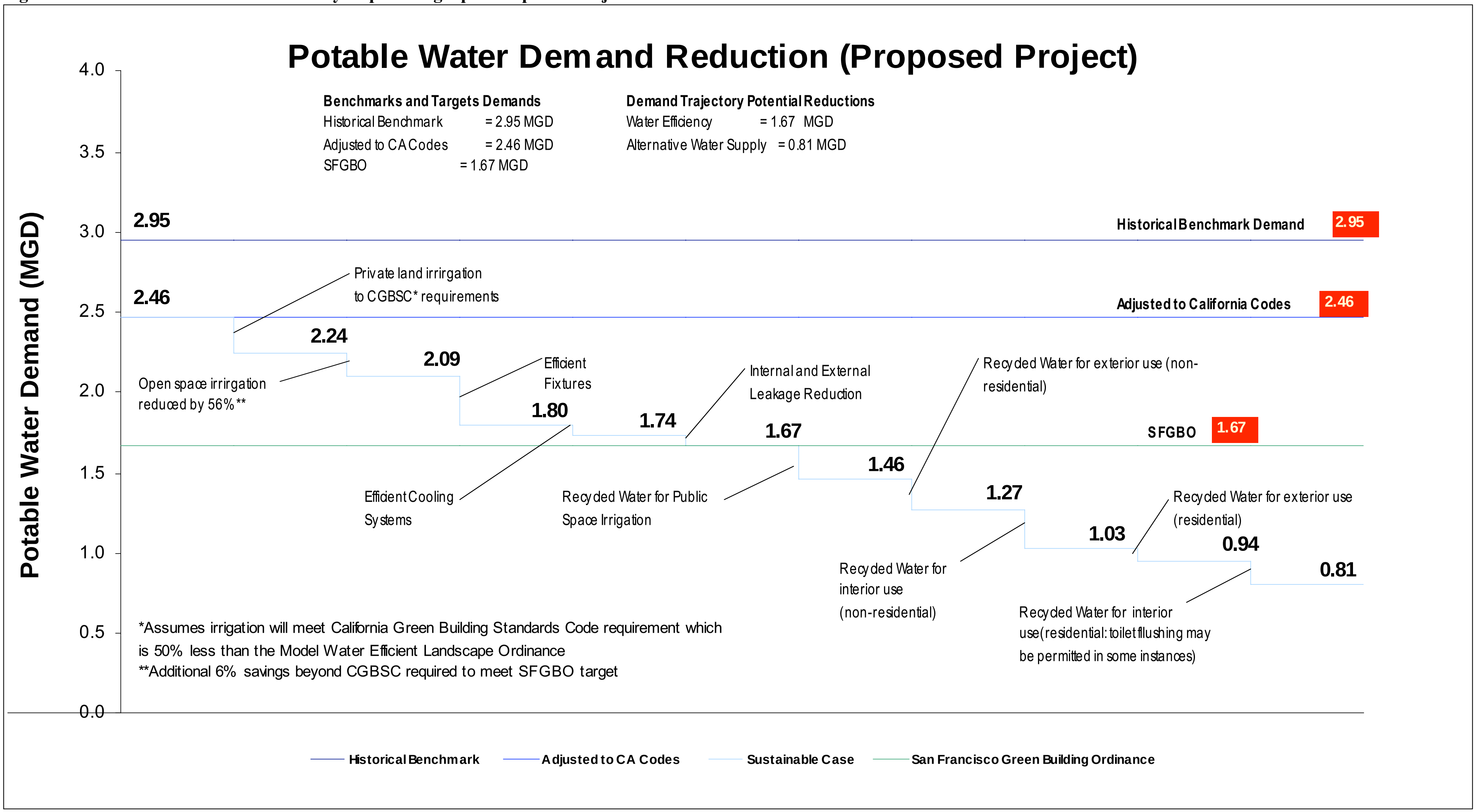

Figure 3: Water demand results summary (R&D Variant)

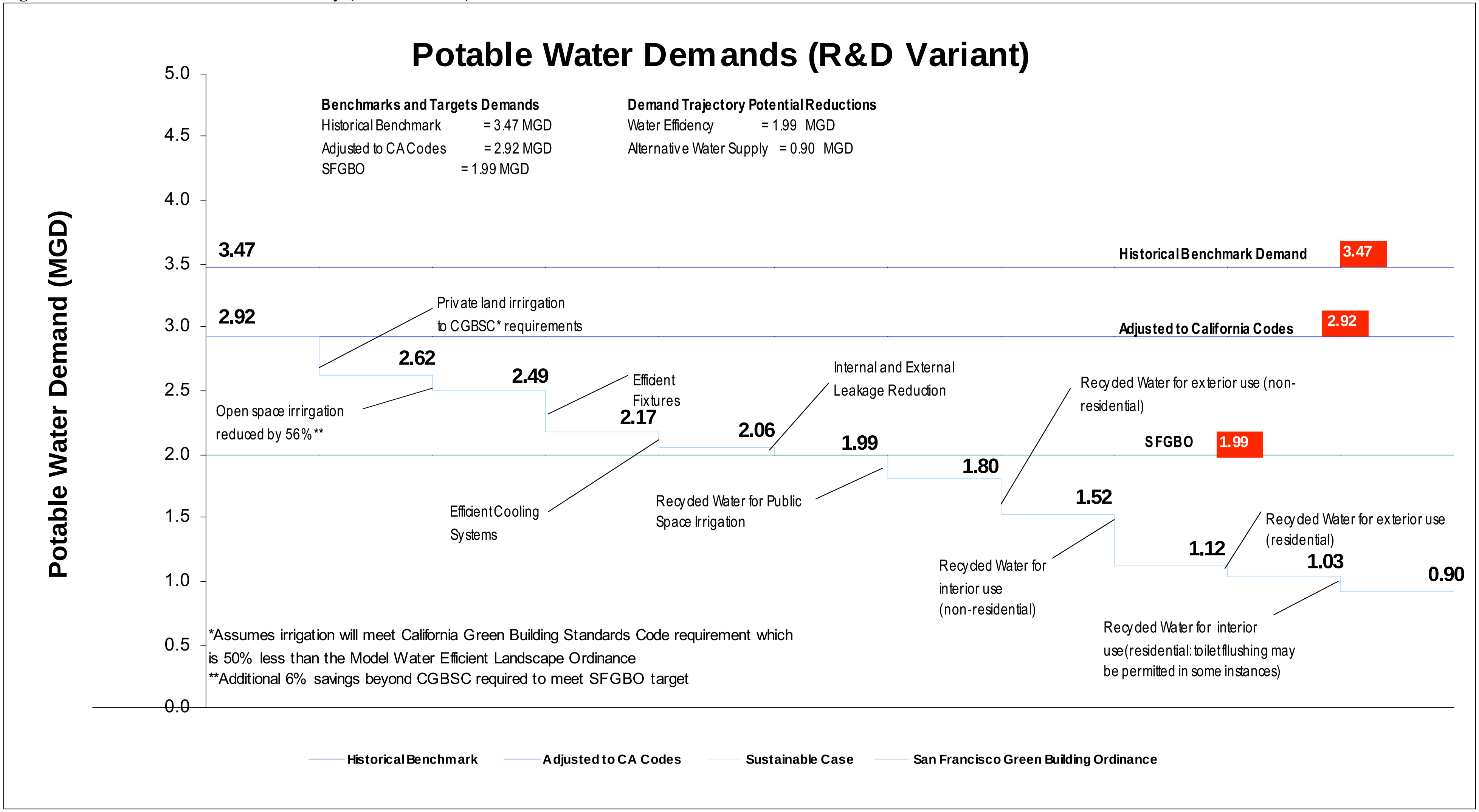

Figure 5: Water demand results summary (Housing Variant)

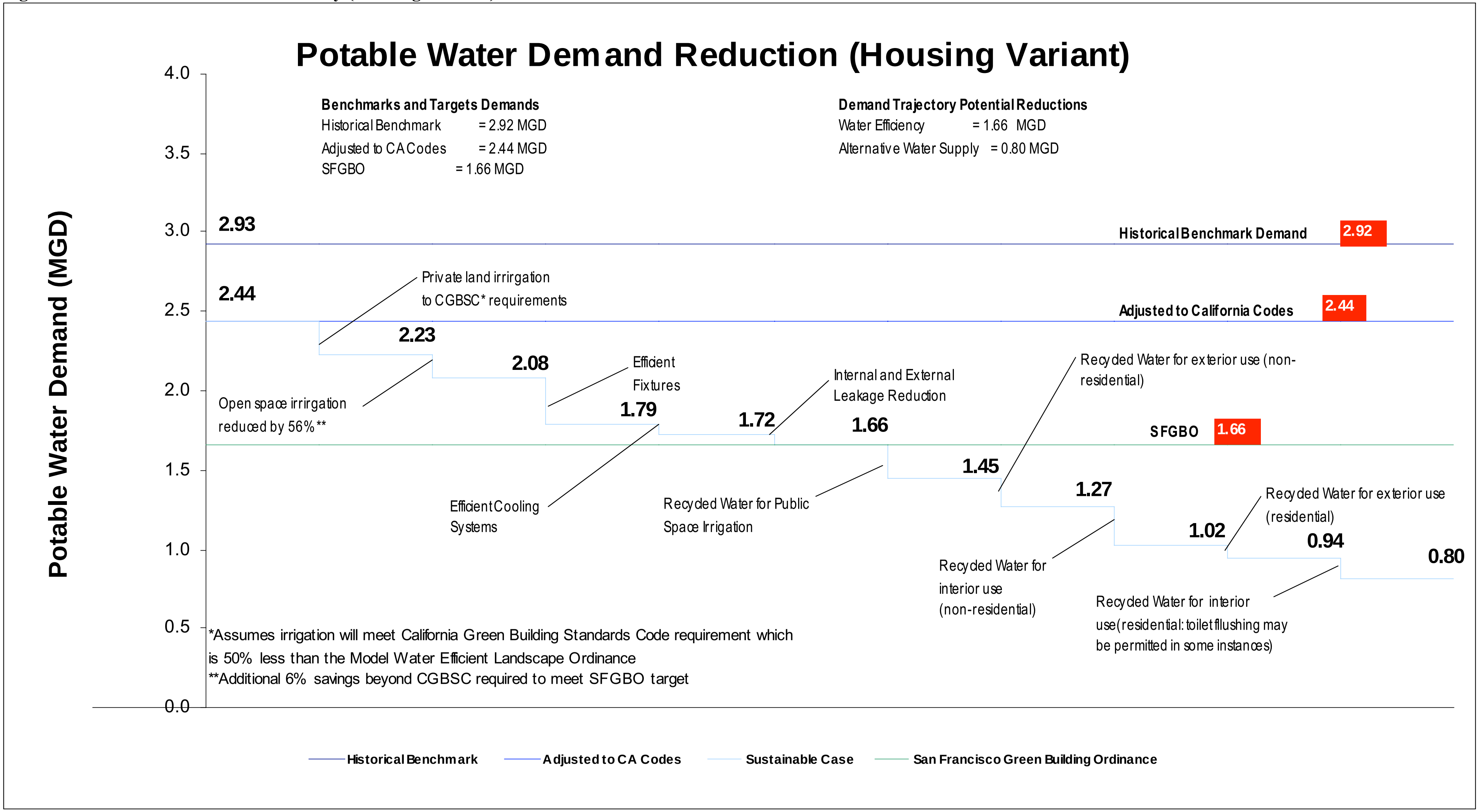

Table 5: Historical Benchmark demand by land use and end use – Proposed Project

Land Use	Historical Benchmark Demand (MGD) Candlestick Point	Hunters Point	Total Development
Residential	1.13	0.38	1.52
Hotel	0.08	0.00	0.08
Office	0.07	0.01	0.08
Artist Studios	0.00	0.03	0.03
Research and Development	0.00	0.61	0.61
Neighborhood Retail	0.03	0.03	0.06
Regional Retail	0.13	0.00	0.13
Community Uses	0.02	0.02	0.03
Football Stadium	0.00	0.05	0.05
Performance Venue	0.03	0.00	0.03
Total demand excluding Parks and Open Space	**1.49**	**1.11**	**2.60**
Parks and Open Space	0.10	0.25	0.35
Total Demand	**1.59**	**1.36**	**2.95**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.03	0.01	0.04
Toilets (med-high density Residential)	0.25	0.08	0.32
Toilets (all other uses)	0.05	0.10	0.15
Urinals	0.01	0.02	0.02
Laundry (low density residential)	0.02	0.01	0.03
Laundry (medium and high density residential)	0.20	0.06	0.26
Laundry (all other uses)	0.02	0.03	0.04
Shower	0.19	0.08	0.27
Bath	0.02	0.01	0.02
Faucets	0.19	0.10	0.29
Process Water	0.05	0.13	0.18
Dishwashers	0.03	0.03	0.06
Internal Leakage	0.16	0.09	0.25
Other domestic	0.03	0.01	0.04
Subtotal	**1.24**	**0.76**	**2.00**
Outdoor Uses			
Irrigation and landscaping	0.18	0.27	0.45
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.02	0.05	0.07
External Leakage	0.01	0.02	0.03
Subtotal	**0.24**	**0.36**	**0.60**
Total excluding Parks and Open Space	**1.49**	**1.11**	**2.60**
Parks and Open Space	0.10	0.25	0.35
Total Demand	**1.59**	**1.36**	**2.95**

*Note: Rounding errors may occur.

Table 6: Adjusted to CA Codes demand by land use and end use- Proposed Project

Land Use	Adjusted to CA Codes Demand (MGD) Candlestick Point	Hunters Point	Total Development
Residential	0.87	0.29	1.16
Hotel	0.07	0.00	0.07
Office	0.06	0.01	0.07
Artist Studios	0.00	0.02	0.02
Research and Development	0.00	0.54	0.54
Neighborhood Retail	0.02	0.02	0.05
Regional Retail	0.12	0.00	0.12
Community Uses	0.01	0.01	0.03
Football Stadium	0.00	0.04	0.04
Performance Venue	0.02	0.00	0.02
Total demand excluding Parks and Open Space	**1.18**	**0.94**	**2.11**
Parks and Open Space	0.10	0.25	0.35
Total Demand	**1.28**	**1.19**	**2.46**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.11	0.04	0.15
Toilets (all other uses)	0.02	0.05	0.07
Urinals	0.00	0.01	0.01
Laundry (low density residential)	0.02	0.01	0.02
Laundry (medium and high density residential)	0.14	0.05	0.19
Laundry (all other uses)	0.01	0.02	0.03
Shower	0.15	0.06	0.21
Bath	0.02	0.01	0.02
Faucets	0.16	0.09	0.25
Process Water	0.05	0.13	0.18
Dishwashers	0.03	0.03	0.06
Internal Leakage	0.16	0.09	0.25
Other domestic	0.03	0.01	0.04
Subtotal	**0.93**	**0.58**	**1.51**
Outdoor Uses			
Irrigation and landscaping	0.18	0.27	0.45
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.02	0.05	0.07
External Leakage	0.01	0.02	0.03
Subtotal	**0.24**	**0.36**	**0.60**
Total excluding Parks and Open Space	**1.18**	**0.94**	**2.11**
Parks and Open Space	0.10	0.25	0.35
Total Demand	**1.28**	**1.19**	**2.46**

*Note: Rounding errors may occur.

Table 7: SFGBO demands by land use and end use – Proposed Project

Land Use	SFGBO Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.61	0.22	0.83
Hotel	0.05	0.00	0.05
Office	0.04	0.00	0.04
Artist Studios	0.00	0.01	0.01
Research and Development	0.00	0.36	0.36
Neighborhood Retail	0.02	0.02	0.03
Regional Retail	0.08	0.00	0.08
Community Uses	0.01	0.01	0.02
Football Stadium	0.00	0.02	0.02
Performance Venue	0.01	0.00	0.01
Total demand excluding Parks and Open Space	**0.82**	**0.64**	**1.47**
Parks and Open Space	0.06	0.15	0.21
Total Demand	**0.88**	**0.79**	**1.67**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.09	0.03	0.12
Toilets (all other uses)	0.02	0.04	0.06
Urinals	0.00	0.00	0.00
Laundry (low density residential)	0.01	0.01	0.02
Laundry (medium and high density residential)	0.10	0.03	0.13
Laundry (all other uses)	0.01	0.01	0.02
Shower	0.10	0.04	0.15
Bath	0.02	0.01	0.02
Faucets	0.11	0.06	0.18
Process Water	0.04	0.10	0.14
Dishwashers	0.02	0.02	0.04
Internal Leakage	0.12	0.07	0.19
Other domestic	0.02	0.01	0.03
Subtotal	**0.68**	**0.42**	**1.11**
Outdoor Uses			
Irrigation and landscaping	0.09	0.14	0.24
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.01	0.04	0.05
External Leakage	0.01	0.01	0.02
Subtotal	**0.14**	**0.22**	**0.36**
Total excluding Parks and Open Space	**0.82**	**0.64**	**1.47**
Parks and Open Space	0.06	0.15	0.21
Total Demand	**0.88**	**0.79**	**1.67**

*Note: Rounding errors may occur.

Table 8: Historical Benchmark demand by land use and end use – R&D Variant

Land Use	Historical Benchmark Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	1.13	0.38	1.52
Hotel	0.08	0.00	0.08
Office	0.07	0.01	0.08
Artist Studios	0.00	0.03	0.03
Research and Development	0.00	1.21	1.21
Neighborhood Retail	0.03	0.03	0.06
Regional Retail	0.13	0.00	0.13
Community Uses	0.02	0.02	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.04	0.00	0.04
Total demand excluding Parks and Open Space	**1.49**	**1.67**	**3.16**
Parks and Open Space	0.09	0.22	0.31
Total Demand	**1.58**	**1.89**	**3.47**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.03	0.01	0.04
Toilets (med-high density Residential)	0.25	0.08	0.32
Toilets (all other uses)	0.05	0.18	0.23
Urinals	0.01	0.02	0.03
Laundry (low density residential)	0.02	0.01	0.03
Laundry (medium and high density residential)	0.20	0.06	0.26
Laundry (all other uses)	0.02	0.05	0.07
Shower	0.19	0.09	0.28
Bath	0.02	0.01	0.02
Faucets	0.19	0.14	0.33
Process Water	0.05	0.24	0.29
Dishwashers	0.03	0.06	0.09
Internal Leakage	0.16	0.12	0.28
Other domestic	0.03	0.01	0.04
Subtotal	**1.25**	**1.08**	**2.33**
Outdoor Uses			
Irrigation and landscaping	0.18	0.43	0.61
Pools and Fountains	0.01	0.02	0.03
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.02	0.10	0.12
External Leakage	0.01	0.03	0.04
Subtotal	**0.24**	**0.59**	**0.83**
Total excluding Parks and Open Space	**1.49**	**1.67**	**3.16**
Parks and Open Space	0.09	0.22	0.31
Total Demand	**1.58**	**1.89**	**3.47**

*Note: Rounding errors may occur.

Table 9: Adjusted to CA Codes demand by land use and end use- R&D Variant

Land Use	Adjusted to Codes BAU Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.87	0.29	1.16
Hotel	0.07	0.00	0.07
Office	0.06	0.01	0.07
Artist Studios	0.00	0.02	0.02
Research and Development	0.00	1.08	1.08
Neighborhood Retail	0.02	0.02	0.05
Regional Retail	0.12	0.00	0.12
Community Uses	0.01	0.01	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.02	0.00	0.02
Total demand excluding Parks and Open Space	**1.18**	**1.43**	**2.61**
Parks and Open Space	0.09	0.22	0.31
Total Demand	**1.27**	**1.66**	**2.92**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.11	0.04	0.15
Toilets (all other uses)	0.02	0.08	0.11
Urinals	0.01	0.01	0.01
Laundry (low density residential)	0.02	0.01	0.02
Laundry (medium and high density residential)	0.14	0.05	0.19
Laundry (all other uses)	0.01	0.04	0.05
Shower	0.15	0.08	0.23
Bath	0.02	0.01	0.02
Faucets	0.17	0.12	0.29
Process Water	0.05	0.24	0.29
Dishwashers	0.03	0.05	0.08
Internal Leakage	0.16	0.12	0.28
Other domestic	0.03	0.01	0.04
Subtotal	**0.93**	**0.84**	**1.78**
Outdoor Uses			
Irrigation and landscaping	0.18	0.43	0.61
Pools and Fountains	0.01	0.02	0.03
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.02	0.10	0.12
External Leakage	0.01	0.03	0.04
Subtotal	**0.24**	**0.59**	**0.83**
Total excluding Parks and Open Space	**1.18**	**1.43**	**2.61**
Parks and Open Space	0.09	0.22	0.31
Total Demand	**1.27**	**1.66**	**2.92**

*Note: Rounding errors may occur.

Table 10: SFGBO demands by land use and end use – R&D Variant

Land Use	SFGBO (MGD) Candlestick Point	Hunters Point	Total Development
Residential	0.62	0.21	0.83
Hotel	0.05	0.00	0.05
Office	0.04	0.00	0.04
Artist Studios	0.00	0.01	0.01
Research and Development	0.00	0.71	0.71
Neighborhood Retail	0.02	0.02	0.03
Regional Retail	0.08	0.00	0.08
Community Uses	0.01	0.01	0.02
Football Stadium	0.00	0.00	0.00
Performance Venue	0.01	0.00	0.01
Total demand excluding Parks and Open Space	**0.83**	**0.96**	**1.80**
Parks and Open Space	0.05	0.14	0.19
Total Demand	**0.89**	**1.11**	**1.99**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.09	0.03	0.12
Toilets (all other uses)	0.02	0.07	0.09
Urinals	0.00	0.00	0.00
Laundry (low density residential)	0.01	0.01	0.02
Laundry (medium and high density residential)	0.10	0.03	0.13
Laundry (all other uses)	0.01	0.03	0.03
Shower	0.10	0.05	0.16
Bath	0.02	0.01	0.02
Faucets	0.11	0.08	0.20
Process Water	0.04	0.18	0.22
Dishwashers	0.02	0.03	0.05
Internal Leakage	0.12	0.09	0.21
Other domestic	0.02	0.01	0.03
Subtotal	**0.68**	**0.62**	**1.31**
Outdoor Uses			
Irrigation and landscaping	0.09	0.22	0.32
Pools and Fountains	0.01	0.02	0.03
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.01	0.08	0.09
External Leakage	0.01	0.02	0.03
Subtotal	**0.14**	**0.36**	**0.50**
Total excluding Parks and Open Space	**0.83**	**0.96**	**1.80**
Parks and Open Space	0.05	0.14	0.19
Total Demand	**0.89**	**1.11**	**1.99**

*Note: Rounding errors may occur.

Table 11: Historical Benchmark demand by land use and end use – Housing Variant

Land Use	Historical Benchmark Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.94	0.58	1.52
Hotel	0.08	0.00	0.08
Office	0.07	0.01	0.08
Artist Studios	0.00	0.03	0.03
Research and Development	0.00	0.61	0.61
Neighborhood Retail	0.03	0.03	0.06
Regional Retail	0.13	0.00	0.13
Community Uses	0.02	0.02	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.04	0.00	0.04
Total demand excluding Parks and Open Space	**1.29**	**1.26**	**2.56**
Parks and Open Space	0.11	0.25	0.36
Total Demand	**1.40**	**1.51**	**2.92**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.05	0.05	0.10
Toilets (med-high density Residential)	0.18	0.09	0.26
Toilets (all other uses)	0.05	0.10	0.15
Urinals	0.01	0.01	0.02
Laundry (low density residential)	0.04	0.04	0.08
Laundry (medium and high density residential)	0.14	0.07	0.21
Laundry (all other uses)	0.02	0.03	0.04
Shower	0.16	0.11	0.26
Bath	0.01	0.01	0.02
Faucets	0.16	0.13	0.29
Process Water	0.05	0.13	0.18
Dishwashers	0.03	0.03	0.06
Internal Leakage	0.14	0.11	0.25
Other domestic	0.03	0.01	0.04
Subtotal	**1.07**	**0.91**	**1.98**
Outdoor Uses			
Irrigation and landscaping	0.17	0.26	0.43
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.02	0.05	0.07
External Leakage	0.01	0.02	0.03
Subtotal	**0.22**	**0.35**	**0.57**
Total excluding Parks and Open Space	**1.29**	**1.26**	**2.56**
Parks and Open Space	0.11	0.25	0.36
Total Demand	**1.40**	**1.51**	**2.92**

*Note: Rounding errors may occur.

Table 12: Adjusted to CA Codes demand by land use and end use- Housing Variant

Land Use	Adjusted to Codes BAU Demand (MGD) Candlestick Point	Hunters Point	Total Development
Residential	0.72	0.44	1.16
Hotel	0.07	0.00	0.07
Office	0.06	0.01	0.07
Artist Studios	0.00	0.02	0.02
Research and Development	0.00	0.54	0.54
Neighborhood Retail	0.02	0.02	0.05
Regional Retail	0.12	0.00	0.12
Community Uses	0.01	0.01	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.02	0.00	0.02
Total demand excluding Parks and Open Space	**1.03**	**1.05**	**2.08**
Parks and Open Space	0.11	0.25	0.36
Total Demand	**1.14**	**1.30**	**2.44**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.02	0.02	0.05
Toilets (med-high density Residential)	0.08	0.04	0.12
Toilets (all other uses)	0.02	0.04	0.07
Urinals	0.01	0.00	0.01
Laundry (low density residential)	0.03	0.03	0.06
Laundry (medium and high density residential)	0.10	0.05	0.15
Laundry (all other uses)	0.01	0.02	0.03
Shower	0.13	0.09	0.21
Bath	0.01	0.01	0.02
Faucets	0.14	0.11	0.25
Process Water	0.05	0.13	0.18
Dishwashers	0.03	0.03	0.06
Internal Leakage	0.14	0.11	0.25
Other domestic	0.03	0.01	0.04
Subtotal	**0.80**	**0.70**	**1.50**
Outdoor Uses			
Irrigation and landscaping	0.17	0.26	0.43
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.02	0.05	0.07
External Leakage	0.01	0.02	0.03
Subtotal	**0.22**	**0.35**	**0.57**
Total excluding Parks and Open Space	**1.03**	**1.05**	**2.08**
Parks and Open Space	0.11	0.25	0.36
Total Demand	**1.14**	**1.31**	**2.44**

*Note: Rounding errors may occur.

Table 14: SFGBO demands by land use and end use – Housing Variant

Land Use	SFGBO (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.51	0.33	0.83
Hotel	0.05	0.00	0.05
Office	0.04	0.00	0.04
Artist Studios	0.00	0.01	0.01
Research and Development	0.00	0.36	0.36
Neighborhood Retail	0.02	0.02	0.03
Regional Retail	0.08	0.00	0.08
Community Uses	0.01	0.01	0.02
Football Stadium	0.00	0.00	0.00
Performance Venue	0.01	0.00	0.01
Total demand excluding Parks and Open Space	**0.72**	**0.73**	**1.45**
Parks and Open Space	0.06	0.15	0.22
Total Demand	**0.78**	**0.88**	**1.66**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
	Indoor Uses		
Toilets (low density residential)	0.02	0.02	0.04
Toilets (med-high density Residential)	0.06	0.03	0.10
Toilets (all other uses)	0.02	0.03	0.05
Urinals	0.00	0.00	0.00
Laundry (low density residential)	0.02	0.02	0.04
Laundry (medium and high density residential)	0.07	0.03	0.11
Laundry (all other uses)	0.01	0.01	0.02
Shower	0.09	0.06	0.15
Bath	0.01	0.01	0.02
Faucets	0.10	0.08	0.18
Process Water	0.04	0.10	0.14
Dishwashers	0.02	0.02	0.04
Internal Leakage	0.10	0.08	0.19
Other domestic	0.02	0.01	0.03
Subtotal	**0.58**	**0.51**	**1.10**
	Outdoor Uses		
Irrigation and landscaping	0.08	0.14	0.22
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.01	0.04	0.05
External Leakage	0.01	0.01	0.02
Subtotal	**0.13**	**0.22**	**0.34**
Total excluding Parks and Open Space	**0.72**	**0.73**	**1.45**
Parks and Open Space	0.06	0.15	0.22
Total Demand	**0.78**	**0.88**	**1.66**

*Note: Rounding errors may occur.

Potential reclaimed water demands and sanitary flows by end use were estimated for the Proposed Project and Project Variants. These are provided below in Table 16 through Table 22.

Table 16: Reclaimed water demands by end use – Proposed Project

End Use	Reclaimed Water Demands by End Use (MGD)		
	Historical Benchmark	Adjusted to CA Codes	SFGBO
Toilets (residential)	0.36	0.17	0.14
Toilets (non-residential))	0.15	0.07	0.06
Urinals	0.02	0.01	0.00
Process Water (non-residential)	0.18	0.18	0.14
Irrigation and landscaping (residential)	0.12	0.12	0.06
Irrigation and Landscaping (non-residential)	0.33	0.33	0.16
Pools and Fountains (residential)	0.01	0.01	0.01
Pools and Fountains (non-residential)	0.01	0.01	0.01
Wash down (residential)	0.01	0.01	0.01
Wash down (non-residential)	0.01	0.01	0.01
Car Washing (residential)	0.01	0.01	0.01
Car Washing (non-residential)	0.00	0.00	0.00
Cooling (non-residential)	0.07	0.07	0.05
Total flow excluding Parks and Open Space	**1.30**	**1.00**	**0.66**
Parks and Open Space	0.35	0.35	0.21
Total Demand	**1.65**	**1.35**	**0.87**

*Note: Rounding errors may occur.

Table 15: Sanitary flows by end use – Proposed Project

End Use	Sanitary Flows by End Use (MGD)		
	Historical Benchmark	Adjusted to CA Codes	SFGBO
Toilets	0.52	0.24	0.19
Urinals	0.02	0.01	0.00
Laundry	0.34	0.24	0.17
Shower	0.27	0.21	0.15
Bath	0.02	0.02	0.02
Faucets	0.29	0.25	0.18
Process Water	0.18	0.18	0.14
Dishwashers	0.06	0.06	0.04
Other domestic	0.04	0.04	0.03
Cooling	0.07	0.07	0.05
Total	**1.82**	**1.33**	**0.98**

*Note: Rounding errors may occur.

Table 16: Reclaimed water demands by end use – R&D Variant

End Use	Reclaimed Water Demands by End Use (MGD)		
	Historical Benchmark	Adjusted to Codes BAU	SFGBO
Toilets (residential)	0.36	0.17	0.14
Toilets (non-residential))	0.23	0.11	0.09
Urinals	0.03	0.01	0.00
Process Water (non-residential)	0.29	0.29	0.22
Irrigation and landscaping (residential)	0.12	0.12	0.06
Irrigation and Landscaping (non-residential)	0.49	0.49	0.25
Pools and Fountains (residential)	0.01	0.01	0.01
Pools and Fountains (non-residential)	0.02	0.02	0.02
Wash down (residential)	0.01	0.01	0.01
Wash down (non-residential)	0.02	0.02	0.02
Car Washing (residential)	0.01	0.01	0.01
Car Washing (non-residential)	0.00	0.00	0.00
Cooling (non-residential)	0.12	0.12	0.09
Total flow excluding Parks and Open Space	**1.71**	**1.37**	**0.90**
Parks and Open Space	0.31	0.31	0.19
Total Demand	**2.02**	**1.69**	**1.09**

*Note: Rounding errors may occur.

Table 17: Sanitary flows by end use – R&D Variant

End Use	Sanitary Flows by End Use (MGD)		
	Historical Benchmark	Adjusted to CA Codes	SFGBO
Toilets	0.60	0.27	0.22
Urinals	0.03	0.01	0.00
Laundry	0.36	0.26	0.18
Shower	0.28	0.23	0.16
Bath	0.02	0.02	0.02
Faucets	0.33	0.29	0.20
Process Water	0.29	0.29	0.22
Dishwashers	0.09	0.08	0.05
Other domestic	0.04	0.04	0.03
Cooling	0.12	0.12	0.09
Total	**2.16**	**1.61**	**1.18**

*Note: Rounding errors may occur.

Table 18: Reclaimed water demands by end use – Housing Variant

End Use	Reclaimed Water Demands by End Use (MGD)		
	Historical Benchmark	Adjusted to Codes BAU	SFGBO
Toilets (residential)	0.36	0.17	0.14
Toilets (non-residential))	0.15	0.07	0.05
Urinals	0.02	0.01	0.00
Process Water (non-residential)	0.18	0.18	0.14
Irrigation and landscaping (residential)	0.12	0.12	0.06
Irrigation and Landscaping (non-residential)	0.30	0.30	0.15
Pools and Fountains (residential)	0.01	0.01	0.01
Pools and Fountains (non-residential)	0.01	0.01	0.01
Wash down (residential)	0.01	0.01	0.01
Wash down (non-residential)	0.01	0.01	0.01
Car Washing (residential)	0.01	0.01	0.01
Car Washing (non-residential)	0.00	0.00	0.00
Cooling (non-residential)	0.07	0.07	0.05
Total flow excluding Parks and Open Space	**1.26**	**0.97**	**0.64**
Parks and Open Space	0.37	0.37	0.22
Total Demand	**1.63**	**1.34**	**0.86**

*Note: Rounding errors may occur.

Table 22: Sanitary flows by end use – Housing Variant

End Use	Sanitary Flows by End Use (MGD)		
	Historical Benchmark	Adjusted to CA Codes	SFGBO
Toilets	0.51	0.23	0.19
Urinals	0.02	0.01	0.00
Laundry	0.34	0.24	0.17
Shower	0.26	0.21	0.15
Bath	0.02	0.02	0.02
Faucets	0.29	0.25	0.18
Process Water	0.18	0.18	0.14
Dishwashers	0.06	0.06	0.04
Other domestic	0.04	0.04	0.03
Cooling (50% flow to sewer)	0.07	0.07	0.05
Total	**1.80**	**1.32**	**0.97**

*Note: Rounding errors may occur.

4 Assumptions and References

This section describes assumptions used to:

1) Estimate historical baseline demands;
2) Distribute the historical baseline demands to specific end uses such as toilets, showers, irrigation etc…;
3) Adjust the historical baseline demands to current California code; and
4) Adjust the to-code demands to a sustainable case wherein efficiency measures such as efficient fixturesare applied. The efficiency measures applied in the Sustainable Case have been tailored to meet the demand reduction requirements of the SFGBO.

Table 20: Assumptions for estimating water demands by land use for the Historical Benchmark case .

Assumptions Summary for Historical Benchmark Demand Estimation						
Land use	**ID#**	**Description**	**Value**	**Unit**	**Reference or Assumption**	**Notes**
Residential						
	1	No. of residents per unit - low density	2.33	residents	Mundie & Associates, 2009	
	2	No. of residents per unit - medium density	2.33	residents	Mundie & Associates, 2009	
	3	No. of residents per unit - high density	2.33	residents	Mundie & Associates, 2009	
	4	Average consumption per capita	62	gallons per day (gp)	SFPUC, 2005	
	5	Average outdoor water use for single family residences	10	%	SFPUC, 2005	Note reference states that average demand is less than 10%
Regional Retail						
	1	Regional Retail jobs creation	350	Square feet (sqft)/job	Economic and Planning Systems, 2009.	
	2	Area of retail space per customer	22	sqft/customer	British Standards Institution. 2006	
	3	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	4	Sewage generation per visitor	2	gpd	EPA, 2002	EPA sites 2 gpd / parking spot. Sewage generation is only a fraction of overall consumption
	5	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	
	6	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer

Neighborhood Retail						
	1	Neighborhood retail jobs creation	270	sqft/job	Economic and Planning Systems, 2009.	
	2	Area of retail space per customer	22	sqft/customer	British Standards Institution. 2006	
	3	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	4	Water generation per visitor	2	gpd	EPA, 2002	EPA sites 2 gpd / parking spot. Sewage generation is only a fraction of overall consumption
	5	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	6	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Office						
	1	Office job creation	276	sqft/job	Economic and Planning Systems, 2009.	
	2	Residential jobs creation	25	Units/job	Economic and Planning Systems, 2009.	
	3	Water consumption per employee	85	gpd	URS, 2004.	
	4	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	
	5	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Community Uses						

	1	Community use job creation	276	sqft/job	Assumed similar to office	Actual Community uses are not finalized therefore community use water demands have been estimated in a similar manner as office land use.
	2	Water consumption per employee	85	gpd	Assumed similar to office	
	3	Average outdoor water use for non-residential customers	43	percent	Assumed similar to office	
	4	Ratio of sewage generation to total water consumed on site	57	percent	Assumed similar to office	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Research and Development						
	1	R&D jobs creation (office)	267	sqft/job	Economic and Planning Systems, 2009.	
	2	Sewage generation per employee for office R&D space	85	gpd	URS, 2004.	Sewage generation is only a fraction of overall consumption
	3	Average outdoor water use for non-residential customers for all R&D	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	4	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Assumption is conservative in that some water consumed indoors would not go to sanitary sewer
	5	Type of R&D Spaces	1/3,1/3, and 1/3	Fraction	Email from Lennar	From email correspondence with Lennar it has been assumed that 1/3 of the R&D space will be office, 1/3 will be wet laboratory, and the remaining 1/3 will be light production which is similar to industrial.
	6	Water Usage for Wet Laboratory R&D Space	0.547	gpsfd	2020 UC Berkeley LRDP Draft EIR (http://www.cp.berkeley.edu/LRDP_2020 draft.htm) - Table 4.13-1	Source provided by Winzler & Kelly. The report states that 0.32 is for sustainable lab case with efficient fixtures built in, and calculations were worked backwards to calculate the BAU.
	7	Water usage profile for	Varies	%	URS, 2004	The water usage profile for wet lab

		Wet Lab Space				space has been assumed to be the average of the commercial and industrial usage profile.
	8	Water Usage for Light Projection R&D Space	0.1	gpsfd	City of Los Angeles, L.A. CEQA Threshold Guide, 2006, Exhibit M.2. - 12 Sewage Generation Factors	
Hotel						
	1	Hotel job creation	700	sqft/job	Economic and Planning Systems, 2009	
	2	Average guest room size	600	sqft	Assumed	This includes the space for reception, kitchens and conference facilities
	3	Average guests / room	1.9	guests	Assumed	
	4	Sewage generation per guest	50	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	5	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	6	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	7	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Artist Studios						
	1	# of artists	252	people	Lennar, 2009	
	2	Consumption per artist	85	gpd	URS, 2004.	
Parks and Open Space						
	1	Total irrigation demand from landscape architect	350,180	gpd	Per landscape irrigation prepared by RHAA 7/31/08	
Football Stadium						
	1	Football games / year	10	Home games	Economic and Planning Systems, 2009.	
	2	Attendance at football games	69000	people	Economic and Planning Systems, 2009.	

	3	Other venues per year	20	Other venues	Economic and Planning Systems, 2009.	
	4	Attendance at other venues	37500	people	Lennar, 2009	
	5	Employees (football day)	3625	people	Stadium Staffing Numbers from SF 49ers, (Lennar, 2009)	Includes 2900 employees and 725 media personnel
	6	Employees (event day)	1,922	people	Pro-rated using football day attendance and employees on football days	
	7	Employee (nonevent days)	48	people	Stadium Staffing Numbers from SF 49ers, (Lennar, 2009)	
	8	No. of players/performers (event day)	200	people	Assumed	100 people per team for players and staff. Assumed same number for other event days
	9	Stadium average daily irrigation	23979	gpd	Marty Laporte, 2009	
	10	Sewage generation per seat and employee on game days	4	gpd	EPA, 2002.	EPA value is for "auditorium" Sewage generation is only a fraction of overall consumption
	11	Ratio of sewage generation to indoor water consumption	95	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
	12	Water consumption per permanent employee per day	85	gpd	URS, 2004.	
Performance Venue						
	1	Performance venue job creation	40	seats/job	Economic and Planning Systems, 2009.	
	2	Performance events per year	250	events	Economic and Planning Systems, 2009.	
	3	Employees - typical day	7	people	Assumed	Prorated to be similar to stadium
	4	Visitors per performance	10,000	people	Per CP/HPS development program, 2009	

	6	Water consumption per permanent employee per day	85	gpd	URS, 2004.	
	7	Sewage generation per seat and employee on event days	4	gpd	EPA, 2002.	EPA value is for "auditorium". Sewage generation is only a fraction of overall consumption
	12	Ratio of sewage generation to indoor water consumption	95	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Sanitary Sewer						
	1	Percent of indoor consumption to sanitary sewer	100%	Percent	Assumed per URS 2004 and conversations with W&K	
	2	Cooling demands assumed to contribute to sanitary sewer. (Non Res)			Assumed per conversations with W&K	Though some losses may occur, 100% of cooling demand is assumed to go to sanitary sewer

Table 23: End use demand distributions by land use (URS 2004)

Table 3-3
End-Use Data - Initial Percentage Assumptions

End Use	Initial Percentages by Customer-Billing Category				
	Single-Family Residential	Multi-Family Residential	Commercial	Industrial	Institutional
Indoor Usage					
Toilets (indoor)	26.7%	26.7%	25%	23%	20%
Urinals (indoor)	NA	NA	0%	7%	0%
Laundry (indoor)	21.7%	21.7%	8%	5%	10%
Showers (indoor)	16.8%	16.8%	5%	5%	16%
Bath (indoor)	1.7%	1.7%	NA	NA	NA
Faucets (indoor)	15.7%	15.7%	10%	15%	19%
Process (indoor)	NA	NA	34%	30%	5%
Dishwashers (indoor)	1.4%	1.4%	8%	5%	15%
Internal Leakage (indoor)	13.7%	13.7%	10%	10%	15%
Other Domestic (indoor)	2.2%	2.2%	NA	NA	NA
Outdoor Usage					
Irrigation and Landscaping (outdoor)	80%	80%	75%	65%	70%
Pools and Fountains (outdoor)	5%	5%	2%	5%	5%
Wash-down of house/facilities (outdoor)	5%	5%	3%	0%	5%
Car Washing (outdoor)	5%	5%	0%	0%	0%
Cooling (outdoor)	0%	0%	15%	25%	15%
External Leakage (outdoor)	5%	5%	5%	5%	5%

NA – Not Applicable

Sources: AWWARF, Konen (1986), Behling et al. (1992)

Table 25: Assumed end use distributions for the stadium and performance venue

Indoor Usage	%	95%
Outdoor Usage	%	5%
Indoor Uses		
Toilets	%	30%
Urinals	%	30%
Laundry	%	0%
Shower	%	5%
Bath	%	0%
Faucets	%	15%
Process Water	%	10%
Dishwashers	%	0%
Internal Leakage	%	10%
Other domestic	%	0%
Outdoor Uses		
Irrigation and landscaping	%	20%
Pools and Fountains	%	0%
Wash down of houses and facilities	%	20%
Car Washing	%	0%
Cooling	%	50%
External Leakage	%	10%

Table 27: Assumptions used to adjust between water demand scenarios

	Historical Benchmark		Adjusted to CA Code		SFGBO		
	Max Flow or Quantity	Note / Reference	Max Flow or Quantity	Note / Reference	Max Flow or Quantity	Note/Reference	Unit
Plumbing Fixture							
Lavatory faucet, private	2.5		2.2	2007 California Plumbing Code	1.5	EPA WaterSense	gpm at 60 psi
Lavatory faucet, public, (metering)	0.25		0.25	2006 International Plumbing Code	0.2	CA Green Building Standard 2008	gallon per metering cycle
(not metering)	0.6		0.5	IPC	0.5	n.a.	gpm at 60 psi
Shower head	3.125	URS 2004*	2.5	2007 California Plumbing Code	1.75	EPA WaterSense	gpm at 80 psi
Sink faucet	2.5		2.2	Plumbing Code	1.5	EPA WaterSense	gpm at 60 psi
Urinal	2	URS 2004*	1	2007 California Plumbing Code	0.125	EPA Water Sense	gallon per flushing cycle
Water closet	3.5	URS 2004*	1.6	2007 California Plumbing Code	1.28	EPA Water Sense and CA Green Building Standard 2008	gallon per flushing cycle
Other Appliances							
Dishwasher (Residential)	7		6	US Department of Energy 2007	4	Energy Star	gallons/cy capacity
Dishwasher (Commercial)	1.75		1.46	Energy Star	0.92	Energy Star	gallons per rack
Laundry	36.4	URS 2004	26	(US Federal Standard by 2011)	18	n.a. (calc)	gal/load
Laundry	13.2		8.5	CA Green Building Standard 2008	6	EPA Water Sense	gal/load-cf (Water Factor)
Irrigation							
Private Lands		Based on water demand distribution		California Water Efficient Landscape Ordinance (CWELO)	50%	CA Green Building Standard 2008	Fractional reduction compared to CWELO
Public Open Space		Per Landscape Architect Estimates		Per Landscape Architect Estimates - Note that this is less than CWELO	50%	CA Green Building Standard 2008	Fractional reduction compared to CWELO

Table 24: Other assumptions used to adjust the CA code demand to the SFGBO

Improved Cooling Efficiency		
Total fraction demand reductiont due to building envelope improvement measures and improved cooling technologies	0.25	
Reduced Losses		
Fractional demand reduction due to new piping and metering	0.25	

5 References

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FUTURE DEMANDS

Residential (Indoor) New Unit

# of persons per new unit	2.3
# of new units	7248
leaks	5%

	gal/person/day	gal/unit/day	Annual Demand (MG/yr)	Annual Demand (mgd)	Peak Month Demand (mgd)
Toilet Flushing	6.46	14.87	39.3	0.108	0.108
Laundry	6.29	14.47	38.3	0.105	0.105
Shower	10.13	23.29	61.6	0.169	0.169
Bathtub	4.0	9.20	24.3	0.067	0.067
Dishwashing	0.96	2.21	5.8	0.016	0.016
Bath Faucet	1.95	4.49	11.9	0.033	0.033
Kitchen Faucet	9.90	22.77	60.2	0.165	0.165
Leaks		4.56	12.1	0.033	0.033
Subtotal Residential New Tower	39.7	95.85	254	0.69	0.69

Residential (Indoor) Existing Tower Unit

# of persons per ex tower unit	2.3
# of ex tower units	1638
leaks	10%

	gal/person/day	gal/unit/day	Annual Demand (MG/yr)	Annual Demand (mgd)	Peak Month Demand (mgd)
Toilet Flushing	8.08	18.58	11.1	0.030	0.030
Laundry	5.85	13.46	8.0	0.022	0.022
Shower	8.00	18.39	11.0	0.030	0.030
Bathtub	4.0	9.20	5.5	0.015	0.015
Bath Faucet	1.95	4.49	2.7	0.007	0.007
Kitchen Faucet	11.30	25.98	15.5	0.043	0.043
Leaks		9.01	5.4	0.015	0.015
Subtotal Residential Ex. Tower	39.2	99.10	59	0.16	0.16

Non-Residential

	square feet	g/sf/yr	Annual Demand (MG/yr)	Annual Demand (mgd)	Peak Month Demand (mgd)
Retail	203,900	15	3.059	0.008	0.008
Office	120,100	8	0.961	0.003	0.003
Educational	21,600	10	0.216	0.001	0.001
Maintenance	15,000	20	0.300	0.001	0.001
Fitness Club	54,700	130	7.111	0.019	0.019
Structured Parking	2,917,400	0.1	0.292	0.001	0.001
Subtotal Non-Residential			11.9	0.03	0.033

Irrigation

	acres	Annual Demand (MG/yr)	Annual Demand (mgd)	Peak Month Demand (mgd)
Public Open Space	49	22.72	0.06	0.16
Courtyards	12.3	5.70	0.02	0.04
Farm	3	1.71	0.005	0.011
Playing Fields	1.8	1.13	0.003	0.008
Pond	0.8	0.12	0.0003	0.004
Subtotal Irrigation		31.4	0.09	0.22
TOTAL		297	0.98	1.11

Parkmerced Water Demands September 2009

EXISTING UNITS

Base Case (existing code)

	Shower	Bath Faucet	WC	Bathtub	Kitchen	Dishwasher	Laundry	Total Per Person
gpm/gpf/gpl	2.5	1.5	3.5	40	2.2		40.9	
uses/person/day	0.65	1.5	5.05	0.1	1.0		0.37	
minutes	8.2				7.5			
gallons/day	13.33	2.25	17.68	4.0	16.57		15.13	68.95

Efficient Fixtures

	Shower	Bath Faucet	WC	Bathtub	Kitchen	Dishwasher	Laundry	Total Per Person
gpm/gpf/gpl	1.5	1.3	1.6	40	1.5		15	
uses/person/day	0.65	1.5	5.05	0.1	1.0		0.39	
minutes	8.2				7.5			
gallons/day	8.0	2.0	8.08	4.0	11.30		5.9	39.17

Super Efficient Fixtures

	Shower	Bath Faucet	WC	Bathtub	Kitchen	Dishwasher	Laundry	Total Per Person
gpm/gpf/gpl	1.5	1.0	1.1	40	1.34		15	
uses/person/day	0.65	1.5	5.05	0.1	1.0		0.39	
minutes	8.2				7.5			
gallons/day	8.00	1.50	5.56	4.00	10.09		5.9	34.99

NEW UNITS

Base Case (existing code)

	Shower	Bath Faucet	WC	Bathtub	Kitchen	Dishwasher	Laundry	Total Per Person
gpm/gpf/gpl	1.9	1.5	1.6	40	2.2	12.5	26	
uses/person/day	0.65	1.5	5.05	0.1	1.0	0.10	0.37	
minutes	8.2				6.6			
gallons/day	10.13	2.25	8.08	4.00	14.52	1.25	9.62	49.85

Efficient Fixtures

	Shower	Bath Faucet	WC	Bathtub	Kitchen	Dishwasher	Laundry	Total Per Person
gpm/gpf/gpl	1.9	1.3	1.28	40	1.5	9.6	17	
uses/person/day	0.65	1.5	5.05	0.1	1.0	0.10	0.37	
minutes	8.2				6.6			
gallons/day	10.1	1.95	6.46	4.0	9.9	1.0	6.29	39.69

Super Efficient Fixtures

	Shower	Bath Faucet	WC	Bathtub	Kitchen	Dishwasher	Laundry	Total Per Person
gpm/gpf/gpl	1.5	0.5	1.1	40	1.3	4	9.9	
uses/person/day	0.65	1.5	5.05	0.1	1.0	0.13	0.39	
minutes	8.2				6.6			
gallons/day	8.00	0.75	5.56	4.00	8.6	0.52	3.9	31.26

current retrofit
find cut sheet or reference

model numbers for cut sheets:

bath faucet	2.2 gpm		laundry (private)	26 gpl	US Federal Standard (2011)
	1.5 gpm	EPA WaterSense		17 gpl	SFPUC Conservation Model
	1.3 gpm	SFPUC Conservation Model		9.9 gpl	Asko
	1.0 gpm	*Niagara_ **faucet** _aerator_N3210-SAW*	dishwasher		
	0.5 gpm	Kohler K-15597-P-CP		12.5 gpl	SFPUC Conservation Model
				9.6 gpl	
toilets	1.6 gpf			4 gpl	
	1.28 gpf	Green Building Standard (2008)			
	1.1 gpf	Kohler K-3519	shower	2.5 gpm	CA Plumbing Code (2007)
				1.9 gpm	SFPUC Conservation Model
kitchen faucet	2.2 gpm			1.75 gpm	EPA WaterSense
	1.5 gpm	1.5 *GPM* Niagara Dual-Spray *Kitchen* Aerator		1.5 gpm	
	1.3 gpm	SFPUC Conservation Model			
laundry (commercial)					
	40.9 gpl	SFPUC Conservation Model			
	15 gpl	Maytag MAH21PD			

TOTALS BY UNIT

Existing Units to Remain

# of units	persons per unit	leaks
1638	2.3	10%

	gpcd	gal/unit/day	total (mgd)	total (MG/yr)
code	75.8	174.4	0.286	104.3
efficient	43.09	99.1	0.162	59.2
super efficient	38.49	88.5	0.145	52.9

New Units

# of units	persons per unit	leaks
7248	2.3	5%

	gpcd	gal/unit/day	total (mgd)	total (MG/yr)
code	52.3	120.4	0.873	318.5
efficient	41.68	95.9	0.695	253.6
super efficient	32.82	75.5	0.547	199.7

Weighted Average

	gpcd	gal/unit/day	total (mgd)	total (MG/yr)
code	56.7	130.3	0.945	344.8
efficient	41.9	96.5	0.699	255.2
super efficient	33.9	77.9	0.565	206.1

TOTALS BY SITE

TOTAL RESIDENTIAL

	MGD	MG/YR
code	1.158	422.8
efficient	0.857	312.8
super efficient	0.692	252.7

NON-POTABLE RESIDENTIAL toilet flushing new units, plus all laundry

	MGD	MG/YR
code	0.352	128.5
efficient	0.235	85.6
super efficient	0.179	65.3

POTABLE RESIDENTIAL

	MGD	MG/YR
code	0.806	294.3
efficient	0.622	227.2
super efficient	0.513	187.3

Parkmerced Existing Demand Backup documentation – June 25, 2009
Beth Goldstein, P.E. Hydroconsult Engineers, Inc.

EXISTING:

	POTABLE		NON-POTABLE		TOTAL	
	MG/yr	mgd	MG/yr	mgd	MG/yr	mgd
Residential (Indoor)	202	0.55	-	-	202	0.55
Non-Residential	-	-	-	-	-	-
Irrigation	58	0.16	-	-	0	0.16
	260	0.71	-	-	202	0.71

FULL BUILD-OUT: (previously reported)

	POTABLE		NON-POTABLE		TOTAL	
	MG/yr	mgd	MG/yr	mgd	MG/yr	mgd
Residential (Indoor)	272	0.74	50.1	0.14	322	0.88
Non-Residential	12	0.03	-	-	12	0.03
Irrigation	-	-	31	0.09	31	0.09
	284	0.78	82	0.22	365	1.00

FULL BUILD-OUT: (w/efficient fixtures)

	POTABLE		NON-POTABLE		TOTAL	
	MG/yr	mgd	MG/yr	mgd	MG/yr	mgd
Residential (Indoor)	227	0.62	85.6	0.23	313	0.86
Non-Residential	8	0.02	3.6	0.01	12	0.03
Irrigation	-	-	31	0.09	31	0.09
	236	0.65	121	0.33	356	0.98

Notes: Existing demands calculated from residential billing records 2006-7 and irrigation billing records 2005-2006.

Future non-potable demand includes toilet flushing in new units, all laundry, and all irrigation.

7. WATER SYSTEM

7.1 Existing System

7.1.1 Existing Water Supply

There are two existing sources of water supply serving Treasure Island. The primary supply is provided by the San Francisco Public Utilities Commission (SFPUC) through an existing 10-inch diameter steel pipe attached to the western span of the Bay Bridge. Water is pumped across the bridge by a pumping station located at 475 Spear Street in San Francisco. The station contains four pumps each rated at 900 gpm. The station can run a maximum of two pumps at a time for a maximum station output of 1,800 gpm.

The existing back up supply of water is provided by the East Bay Municipal Utility District (EBMUD) through a 12-inch diameter ductile iron main connected to an EBMUD water meter at Beach Street in Emeryville. From this location, water is delivered to a pump station located at Pier E23 of the existing Bay Bridge in Oakland. Water is then pumped through a 12-inch diameter steel pipe attached to the eastern span of the Bay Bridge. This water supply charges the fire hydrants on the Bridge and is connected to the existing water tanks on YBI for an emergency backup water supply. The maximum flow rate for this system is reported to be 1,500 gpm. There is currently an agreement in place between EBMUD and the Navy that limits the average annual flow 61 gallons per minute to maintain water quality in the line on the bridge. Actual average annual flows are well below that limit, at approximately 35 gpm.

7.1.2 Existing Water Storage

There are currently four existing concrete reservoirs on Yerba Buena Island that service both Yerba Buena Island and Treasure Island. Combined they have a total design capacity of approximately 6.5 million gallons to serve as both the potable and fire protection water supplies for Treasure Island and Yerba Buena Island. However, all of the tanks are in varying states of disrepair and cannot operate to their full design capacity. The actual operating storage capacity is approximately 1.9 million gallons with another 0.5 million gallons dedicated for fire protection. The design capacities, operating capacities, and operating elevations of the existing reservoirs are shown in Table 7.1.

Table 7.1 – Existing Reservoir Data

Reservoir Number	Design Capacity (million gallons)	Current Operating Capacity (million gallons)	Operating Elevation Range (NAVD88)	Primary Service
227	3.0	0.0	252.5 to 255.5	TI
162	2.0	1.3	322.0 to 327.0	YBI
168	0.5	0.5	356.0 to 359.0	Fire Reserve
242	1.0	0.6	247.0 to 251.0	TI/YBI

The elevations of the existing reservoirs provide an operating pressure of approximately 100-115 psi on TI and 80 psi on YBI (pressures at the higher areas of YBI are achieved with booster pumps).

The existing water storage tanks range in age from 60 to 85 years, and studies indicate that they are all in poor condition and will require either major rehabilitation or replacement.

7.1.3 Existing Water Distribution System

The original piping systems for a separate potable water and fire protection system for the Islands was constructed in 1939 out of copper, galvanized steel, and asbestos cement pipe. In 1990, the two systems were combined and the pipe material replaced with PVC pipe. Many of the individual building services and irrigation services originally constructed out of galvanized steel, however, have not been replaced. The relatively new PVC pipe system will be utilized on an interim basis during the initial phases of construction, but will eventually be replaced at the full build out of the project.

7.2 Proposed Domestic Water System

7.2.1 Proposed Water Demand

The estimated water demand for the proposed Land Use Plan is presented on Table 7.2. This estimate includes demand for the new development as well as the existing demand for the Department of Labor and the Coast Guard. The demand factors for the various facilities are indicated in the notes at the bottom of the table. The project will include the use of recycled water for irrigation and appropriate plumbing in the commercial use buildings. The potable demand factors included in Table 7.2 account for the use of water conserving fixtures in all buildings, the use of recycled water for toilet flushing and other non potable water uses in commercial buildings, and the use of recycled water for irrigation uses where appropriate. Recycled water demands are shown in Table 9.1 and 9.2A of Section 9, Recycled Water System.

As shown on Table 7.2, the average daily demand is estimated to be 1.08 millions gallons per day, or 753 gallons per minute (gpm). Because of the size of the proposed development, the relatively homogeneous use, and the use of recycled water for the irrigation needs, the project will use a maximum day demand factor of 1.2 times the average daily demand. Therefore, the maximum daily demand is 1.3 million gallons per day or 904 gpm.

The project will be designed to provide fire flow of 3,500 gallons per minute. This will be adequate to accommodate new construction. The existing Buildings 2 and 3 are designated to remain and will be retrofitted with appropriate supplemental fire protection systems when they are remodeled for commercial use. The fire protection systems designs for these structures will need to consider the building construction, use, and available fire flow.

7.2.2 Proposed Water Supply

7.2.2.1 Primary Water Supply

The existing SFPUC pump station in San Francisco and 10-inch line on the western span of the Bay Bridge is adequate to provide the required water supply to the project at full buildout and will continue to be the primary supply of water to Treasure Island. As with other water systems in the City, the SFPUC will need to monitor the condition of the pump station and supply line and perform routine maintenance and repairs to ensure reliable service to the islands.

7.2.2.2 Secondary Water Supply Source

The proposed secondary water supply to Treasure Island will continue to be from the EBMUD service in Oakland. Caltrans' construction of the new eastern span of the Bay Bridge, the Eastern Span Seismic Safety Project (ESSSP), is requiring modifications to the EBMUD service near the bridge abutment in Oakland and across the bridge. The new improvements will include:

- Relocation of the water main to the new Bay Bridge abutment.
- New pump station near the new bridge abutment in Oakland.
- New stub and shut off valve on YBI near column line XXX of the new bridge structure.

All of these items will be constructed as part of the ESSSP in cooperation with the SFPUC, and are not considered part of this project.

In addition to the secondary water source improvements associated with the new Bay Bridge project, the alignment of the secondary water source on YBI will be revised to as shown on Figure 7.1. The new alignment will follow North Gate Drive and Macalla Road to the new water tank locations.

The EBMUD back-up system will be capable of delivering approximately 1,800 gpm during emergency conditions. The system will continue to operate within the existing limit of 61 gallons per minute in average annual flow. This modest routine use is needed to maintain the water quality in the line across the Bay Bridge.

Table 7.2 Treasure Island Redevelopment Project Water Demand (8,000 Residential Units +100,000 sf office)

DESCRIPTION OF USE			POTABLE WATER DEMAND			RECYCLED WATER DEMAND	TOTAL WATER DEMAND	SEWER DEMAND	NOTES
Land Use	No.	Unit	Average Daily Demand (gpd)	Average Daily Demand (gpm)	Maximum Daily Demand (gpm) (Note 12)	Average Daily Demand (gpd)	Average Daily Demand (gpd)	Average Daily Demand (gpd)	
Residential	8,000	Units	932,000	647	777	30,000	962,000	885,400	1
Hotel	500	Rooms	132,500	92	110	3,500	136,000	129,375	2
Office	100,000	sf	7,000	5	6	3,500	10,500	10,150	3
Retail	140,000	sf	9,800	7	8	4,900	14,700	14,210	3
Adaptive Reuse, General	244,000	sf	17,080	12	14	8,540	25,620	24,766	3
Adaptive Reuse, Retail	67,000	sf	4,690	3	4	2,345	7,035	6,801	3
Open Space	300	ac	30,000	21	25	180,000	210,000	28,500	10
Miscellaneous Structures	75,000	sf	5,625	4	5	1,875	7,500	7,219	4
Marina	400	Slips	20,000	14	17	0	20,000	19,000	14
Treasure Island School	105,000	sf	21,000	15	18	0	21,000	19,950	7
Police/Fire	30,000	sf	4,000	3	3	2,000	6,000	5,800	6
Misc. Small Community Facilities	13,500	sf	945	1	1	473	1,418	1,370	3
Pier 1 Community Center	35,000	sf	2,450	2	2	1,225	3,675	3,553	3
TI Sailing Center	15,000	sf	1,050	1	1	525	1,575	1,523	3
Museum	75,000	sf	5,250	4	4	2,625	7,875	7,613	3
Department of Labor (DOL)	900	Rooms	111,542	77	93	0	111,542	105,965	8
Coast Guard Facility			17,000	12	14	0	17,000	16,150	9
Utility Facilities	14,000	sf	980	1	1	490	1,470	1,421	3
Urban Farm	20	ac	2,000	1	2	60,000	62,000	1,900	11
Totals			**1,324,912**	**920**	**1,104**	**301,998**	**1,626,910**	**1,290,664**	

Notes:

1 50 gallons per capita per day (gpcd), based on water conserving projections for 2030, based on 8000 units at 2.33 residents per dwelling unit. Population per dwelling unit based on City average from Demands Report Includes 30,000 gpd irrigation (CMG 8/7/09 spreadsheet)

2 Potable use based on 265 gpd/room; this includes all uses within the hotel. Recycled use based on 7 gallons recycled water per room per day (toilet flushing). Assumes no grounds for irrigation. Water demand based on AWWA standards.

3 Potable water demand based on 0.07 gpd/sf. Recycled water demand based on 0.375 gpd/sf. Reference : CCSF Retail Demands Rept Nov 2004

4 4 Allowance for misc. open space buildings not included elsewhere, including the YBI Historic Buildings, kiosks, warming hut, etc. Estimated potable use is based on 1 person per 200 SF, 20 gpcd total water use, minus 5 gpcd recycled water for toilets.

6 Potable use based on 400 persons per day at 15 gpcd total water use, minus recycled water use (toilets) at 5 gpcd

7 1 Student per 100 SF, 20 gpd per students

8 Value based on 2007 monthly demand provided by S. Larano, SFPUC.

9 Value provided by S. Larano, SFPUC.

10 Potable demand at 100 gpd/acre. Irrigation demand at 180,000 gpd for TI (CMG 8/7/09 spreadsheet).

11 Potable demand at 100 gpd/acre. Irrigation demand at 60,000 gpd (CMG 8/7/09 spreadsheet).

12 Maximum daily demand 120% of average daily demand

14 Based on 400 slips, day use only (no live aboard). 50 gpd per slip

7.2.3 Proposed Water Storage

The existing water tanks that serve YBI and TI are in poor condition and need major repair or replacement in order to serve the proposed project. To meet current SFPUC requirements, the Project will replace the existing water storage tanks in phases. The new water storage tanks will be sized to serve both the proposed new uses, as well as the existing uses that will remain.

The SFPUC water storage requirements for Treasure Island will be 2 days of maximum daily demand plus 4 hours of fire flow, or approximately 3.4 million gallons of storage.

The redundant water source from EBMUD provides an equal, compatible, and reliable back up water source to Treasure Island. If either SFPUC or EBMUD system is taken off line for maintenance, power interruptions, or damage due to earthquake, the other source will continue to supply 1,800 gpm, sufficient to meet the peak daily demands for the development. In the extremely unlikely event that both water supplies are taken down at the same time, then 2 days of maximum daily demand plus four 4 hours of fire storage should be sufficient to bridge the time for repairs or evacuation of the Island. It should also be noted that in such an event of extreme emergency, the consumption of potable water would likely be much lower than the calculated average demand shown in Table 7.2. Assuming reasonable reductions in retail, hotel, public and cultural uses that would naturally result following events of dire emergency the potable emergency demand would be significantly less than the average demand under normal conditions.

In addition to the normal operational storage requirements described above, the storage design will also need the ability to accommodate the maintenance of storage tanks. During maintenance, one tank, or portions of a tank, will need to taken out of service. During these regularly scheduled maintenance periods the SFPUC requires that the Treasure Island project maintain a minimum storage of 1 day maximum daily demand plus 4 hours of fire storage, or approximately 2.1 million gallons, at all times.

In order to meet the emergency and maintenance storage requirements, the water storage will be provided in two tanks. The existing 1.0 million gallon, circular, steel water storage tank adjacent to Macalla Road will be replaced with a new 1.0 million gallon, above grade, circular, steel water storage tank in the existing location. The remainder of the storage will be in a 2.4 million gallon water storage tank located at a higher elevation on YBI. Two locations are being considered for this tank as shown on Figure 7.2. The final location of this tank will be determined during the Master Planning phase of the project. The 2.4 million gallon tank will be divided into two 1.2 million gallon cells to accommodate maintenance and provide a minimum of 2.2 million gallons of storage at all times during maintenance. Together, the two tanks will provide 3.4 million gallons of storage. The final sizes, configuration and locations of the water storage tanks are described in more detail in the "Treasure Island and Yerba Buena Island Water Service Area Master Plan and Tank Siting Study" (Appendix E)

The upper storage tank (2.4 million gallons) will be supplied by water pumped directly from the 10-inch supply line from San Francisco, and the back up supply from EBMUD during emergencies. Supply to the lower, 1.0 million gallon tank will flow from the 2.4 million gallon tank by gravity. Because of the elevation of the 1.0 million gallon tank, it is likely that there will need to be a pressure reducing valve between the tank and the Treasure Island service area. The 2.4 million gallon tank is not high enough to provide service with adequate pressure to the upper portions of YBI. Fire flow and domestic demands to these YBI areas will be provided by an adjacent booster pump station with multiple pumps and emergency generator.

7.2.4 Proposed Domestic Water Distribution System

Through phased development of YBI and Treasure Island the existing PVC water distribution system will be replaced with a new ductile iron water system installed to SFPUC standards. Based on preliminary calculation, we anticipate that new water mains will range in size from 8 inches at minimum to a maximum size of 24 inches. A conceptual layout of the proposed domestic water distribution system is shown on Figure 7.1.

The California Code of Regulations, Title 22, requires that the water distribution system be capable of delivering the maximum daily demand coincident with the required fire flow. Based on the preliminary demand calculations described above, the proposed water system will be designed to deliver the maximum daily demand of 882 gpm along with the design fire flow of 3,500 gpm with a minimum residual pressure of 20 pounds per square inch to the fire hydrants on the Island.

7.3 Proposed Bay Water Auxiliary Water Supply System (AWSS)

Treasure Island and YBI do not currently have an AWSS system for fire protection. The project proposes to construct a new bay water AWSS system on TI as a backup fire protection system in the unlikely event of an extended total disruption of water supplies to Treasure Island. AWSS is not planned for Yerba Buena Island due to its steep topography, smaller size and development, and proximity to storage tanks and water supply lines on the Bay Bridge. The exact nature of the AWSS system is still being discussed with the San Francisco Fire Department (SFFD). It is expected that TI's AWSS may provide the following:

- A pump station with a salt-water intake pipe
- Two pipe manifolds for connection to fireboats
- Up to twenty-nine fire hydrants
- A main trunk pipe connecting the pump station, manifolds, and fire hydrants
- Three suction hydrants

The proposed bay water AWSS system discussed with TIDA, SFPUC and SFFD is shown on Figure 7.3. A brief description of the main elements of the AWSS system are as follows:

Pump Station and Intake Structure

The AWSS pump station and intake structure will be capable of continually charging the system and delivering 3,500 gpm of bay water at a maximum pressure of 125 psi. The pump station will include a diesel emergency power generator and additional pumps to provide redundancy during emergencies.

The water is drawn through a horizontal, large diameter draft tube (steel or concrete pipe) with a trash rack on the end to prevent uptake of debris. The draft tube connects to the vertical pump pit (precast concrete box or large diameter manhole), in which the pump intake pipe is located. A retractable fish screen may be included at the interface of the draft tube and the pump pit to prevent fish from entering into the pump system. Portions of the pump station will be contained in a pump house, for protection from weather and damage. See Figure 7.3.1.

Distribution Piping

A dedicated underground piping system will distribute the bay water within the developed areas of TI; dedicated bay water AWSS hydrants will be provided along the distribution route.

Fireboat Manifolds

The fireboat manifolds will be located near the ferry quay and near Pier 1. The manifolds will allow the fireboats to connect to the AWSS system and charge the lines in the unlikely event the pump station fails or additional flow/pressure is required in the system. When connected to the pipe manifold, the fireboat will draw salt water via its on-board pumps which may have a minor effect on the natural environment; this is assumed to be inherent to the operation of the fireboat and is beyond the scope of the AWSS.

Suction Hydrants

Three suction hydrants will be located around the perimeter of Treasure Island that will allow fire trucks to draft water directly from the Bay. Suction hydrants, also called Bay Suction connections, allow fire engines to draft water directly from the Bay. The hydrant is similar to typical fire hydrants, however there is no connection to a pressurized, piped water supply – the hydrant is connected to an intake pipe leading into the Bay. To prevent debris from entering the intake pipes, the end of the pipe may be fitted with a screen. See Figure 7.3.1.

Potential Bay Regulatory Issues

Construction and operation of the AWSS may potentially affect the Bay environment. Descriptions of the potential temporary and permanent effects on the environment, as well as ways in which those effects could possibly be reduced, are described below:

1. Temporary Construction Effects:
   Construction of the draft tube and suction hydrant pipes will require temporary shoreline excavation in the vicinity of the intakes, construction of temporary shoring,

and backfill/replacement of existing shoreline revetment. See Figure 7.3.2 – 4 for approximate areas of potential effect. Measures to reduce the possible temporary environmental effects of this work could include:

- Limit the amount of disturbed area below the mean high water mark as much as feasible.
- Prohibit the use of materials that may reduce water quality
- Follow erosion control plans to keep sediment from entering the Bay
- Follow site maintenance plans to eliminate construction debris from entering the Bay

2. Permanent Construction Effects
   The pump station draft tube and suction hydrant intake pipes will permanently extend through the shoreline revetment into the bay (below low water). This will be similar to other pipe penetrations through the shoreline for storm drain outfalls. Measures to reduce the possible permanent effects on the environmental from this work, could include:
   - Limit the amount of permanent improvements below the mean high water mark as much as feasible.
   - Prohibit the use of materials that may reduce water quality

3. AWSS Operational Effects
   The intake structures have the potential to create a vortex at the end of intakes (pump station draft tube and suction hydrant intake pipes) which could constitute a hazard at the water surface if not addressed. To prevent this, the end of the intakes could be enlarged or otherwise designed to prevent vortex formation.

a. There may be potential effects on fish during the regular testing of the AWSS system. The effect will depend largely on the anticipated usage of the AWSS, which will depend on the frequency and duration of scheduled tests of the system. For short-duration tests to verify the operational functionality of the system, measures – such as fish screens – to prevent fish uptake may not be necessary. If fish screens are required, the affect on fish in the Bay will depend on the design of the fish screen in accordance with the following parameters:
   - Size of openings (based on species and size of fish to be protected);
   - Porosity (percent open area of screen face);
   - Approach velocity (perpendicular to screen face);
   - Sweeping velocity (parallel to screen face).

   In the event that the AWSS is operated to suppress actual fires, the system will be used for a longer duration than that used for periodic testing; consequently, the effect on the environment could be greater. However, it is assumed that any effects that occur as a result of an actual emergency will be acceptable as a unique, singular event, and that the emergency needs will govern.

The final designs for the AWSS intake structures will be submitted to the appropriate agencies for review and approval prior to construction. The permitting agencies will include the Bay Conservation and Development Commission (BCDC), Army Corps of Engineers, Regional Water Quality Control Board, California Department of Fish and Game, and United States Fish and Wildlife Service.

7.4 Phases for Water System Construction
The new water infrastructure to support development of the project will be installed in phases to match development of the project. The existing land uses on Treasure Island will continue to utilize the existing water distribution system with temporary connections to the new system and temporary water infrastructure where required to maintain the existing uses until they are demolished or permanent connections can be made. Water storage will be brought on-line as required to support the water demands of the project as it develops.

7.5 Master Utility System Plans and Master Fire Protection Plan
A Water System Master Plan will be prepared in coordination with the SFPUC and the SFFD during the development of the DDA. The Water System Master Plan will include detailed calculation to size pipes, domestic water system layout, proposed water tank locations and project phasing. The Master Plan is not expected to substantially change the supply, storage and distribution of water described here.

7.6 Sustainability Goals
The construction of the secondary water source from EBMUD, combined with the reconstruction of the entire water storage and delivery system on Yerba Buena and Treasure Islands will provide a robust water supply to sustain and protect the island community. This new system combined with water conserving fixtures within the new buildings, and the maximum feasible use of recycled water for the landscape areas and commercial buildings within the core development area (see below) will meet, or exceed, the goals described in the Sustainability Plan.

Appendix Q2 Arup, Amendment to Water Demand Memorandum #16—Variant 2A (Housing/R&D Variant), April 28, 2010

To	Lennar -	Reference number 131878/RRJ	
cc		File reference	
From	Rowan Roderick-Jones/Manish Dalia x 27222 (San Francisco)	Date April 28, 2010	
Subject	**Candlestick Point / Hunters Point Shipyard Phase II** Amendment to Water Demand Memorandum #16—Variant 2A (Housing/R&D Variant)		

1 Purpose

An option to Variant 2 (Housing Variant)—Variant 2A (Housing/R&D Variant)—has been identified that would allow for additional R&D uses on the stadium site, along with housing, in the event the 49ers do not choose to develop a stadium in the HPS Phase II area. This addendum to the Candlestick Point / Hunters Point Shipyard Phase II Water Demand Memorandum Revision #16, October 15, 2009, provides a water demand estimate for Variant 2A, the Housing/R&D Variant.

As compared to the Housing Variant 2, the Housing/R&D Variant (Variant 2A) would relocate 275 residential units from Candlestick Point to HPS Phase II and redistribute 50 residential units within Candlestick Point. The Housing/R&D Variant (Variant 2A) would not develop the uses in the Jamestown District of Candlestick Point that would occur under the Housing Variant (Variant 2).

An additional 500,000 square feet (sf) of R&D land use would be constructed on the stadium site as compared to the Housing Variant (Variant 2), for a total of 3,000,000 sf of R&D uses at the HPS Phase II site. The Draft EIR analyzed a total of 5,000,000 sf of R&D uses under the R&D Variant 1, and 2,500,000 sf under the Housing Variant (Variant 2); therefore, the increased amount of R&D square footage under the Housing/R&D Variant (Variant 2A) (e.g., 3,000,000 sf) would fall within the range of development programs analyzed by the R&D Variant (Variant 1) and the Housing Variant (Variant 2).

The total amount of park acreage with the Housing/R&D Variant (Variant 2A) would be 326.6 acres, which represents a decrease of approximately 10 acres as compared to the Project (which would provide 336.4 acres) and about 22.8 acres less than the Housing Variant (Variant 2) (which would provide 349.4 acres) because of increased development on the stadium site.

2 Approach

To develop reasonable water demand estimates for the CP/HPS development the following steps were taken.

1) The Project Variant was divided into land uses as shown in Table 1.

2) A **Historical Benchmark** demand was estimated for each land use based on a series of assumptions and references. Key references used were:

   a. The Urban Water Management Plan for the City of San Francisco

   b. The SFPUC Wholesale Customer Demand Projections Technical Report (URS, 2004)

c. The City of Los Angeles CEQA Threshold Guide, 2006

d. The EPA, Onsite Wastewater Treatment Systems Manual, 2002

A number of other references were also used and these are provided at the end of this memorandum. Arup collected information from a number of sources and selected a method of estimating demands that we believed to be appropriate and reasonable for the area. Assumptions and references are provided in Section 4.

3) The demands were then distributed between indoor and outdoor end uses which were estimated based on published data in the SFPUC Wholesale Customer Demand Projections Report (URS 2004). End use distributions for the stadium and performance venues were assumed rather than taken directly from the SFPUC's projections. The distribution ratios are provided in Table 8 and Table 9.

4) Next, the Historical Benchmark was adjusted to an **Adjusted to California Codes** scenario using new fixture flow rates from California and Federal Buildings standards as well as the International Plumbing Code.

5) The Adjusted to California Codes demand estimate does not include the requirements of the **San Francisco Green Building Ordinance (SFGBO)**. The SFGBO is based on LEED for New Construction (LEED NC) and requires a 50% reduction in landscape irrigation demands. The SFGBO does not specify what code is to be used as the baseline for irrigation demands. Therefore the current code was assumed to be equivalent to the irrigation amount allowed under the California Water Efficient Landscape Ordinance. This rule was assumed to be applicable to both private and public landscape irrigation. In addition, the SFGBO requires a 30% reduction in potable water demand. The SFGBO does not provide specific language as to which portions of demand are to be included in the 30% reduction. However, the intention of the similar LEED NC credit (Water Efficiency Credit 3) is to reduce building water demand by 30%. The total 30% reduction in building water efficiency may be achieved by any number of means including improved fixture efficiency, mechanical building efficiency, or by providing an alternative water supply. The demand estimates, when adjusted for the SFGBO represent the final demands for the Proposed Project and Project Variants.

   The SFGBO demand was developed by using the California code as a baseline and using a trajectory or possible means of water saving strategies and/or alternative water supplies to achieve the SFGBO. The assumptions and references used to make these adjustments are provided in Table 10.

6) Potential reclaimed water demands as well as sewage generation were determined based on end use distributions.

The results of the study are presented at the beginning of this report. References and Assumptions used for making the demand estimations are provided after the results in Section 3.

Table 1: CP/HPS Land Use Program (Housing/R&D Variant)

		Hunters Point Shipyard	Candlestick Point	Project Total
Land Use				
Residential				
	Density, 15-75 units per acre (units)	1,320	940	2,260
	Density, 50-125 units per acre (units)	2,185	3,855	6,040
	Density, 100-175 units per acre (units)	460	270	730
	Density, 175-285 units per acre (units)	310	1,160	1,470
	Total Project (units)	**4,275**	**6,225**	**10,500**
Retail				
	Regional Retail (sqft))	0	635,000	635,000
	Neighborhood Retail (sqft)	125,000	125,000	250,000
	Total (sqft)	**125,000**	**760,000**	**885,000**
Office (sqft)		0	150,000	150,000
Community Uses (sqft)		50,000	50,000	100,000
Research & Development (sqft)		3,000,000	0	3,000,000
Hotel (sqft)		0	150,000	150,000
Artist's Studios				
	1:1 Studio Renovation & Replacement (sqft)	225,000	0	225,000
	New Artist Center (sqft)	30,000	0	30,000
	Total (sqft)	**255,000**	**0**	**255,000**
Parks & Open Space				
	New City Parks (acres)	150.9	8.1	159
	New Sports Fields & Active Recreation (acres)	70.9	0	70.9
	New Open Space and Restored State Parkland (acres)	0	96.7	96.7
	Total (acres)	**221.8**	**104.8**	**326.6**
Football Stadium (seats)		0	0	0
Performance Venue (seats)		0	10,000	10,000

3 Results

This section provides the results of the water demand assessment. The results are provided by land use as well as by end use (fixture type). The overall results for the proposed project are summarized by Figure 1.

Figure 1 provides the Variant 2A demands for the Historical Benchmark, the Adjusted to California Codes and the San Francisco Green Building Ordinance cases. It also illustrates the Sustainable Case trajectory defined by the step down line. The first five steps in the "Sustainable Case" step-down graph are demand reduction strategies while the later five steps are achieved by utilizing alternative water supplies. Additional demand breakdowns by land use and end use are provided in Table 2 through Table 4. Reclaimed water demands and sanitary flows by end use for the Proposed Project are provided in Table 5 through Table 6.

Figure 1: Water demand results summary (Housing/R&D Variant)

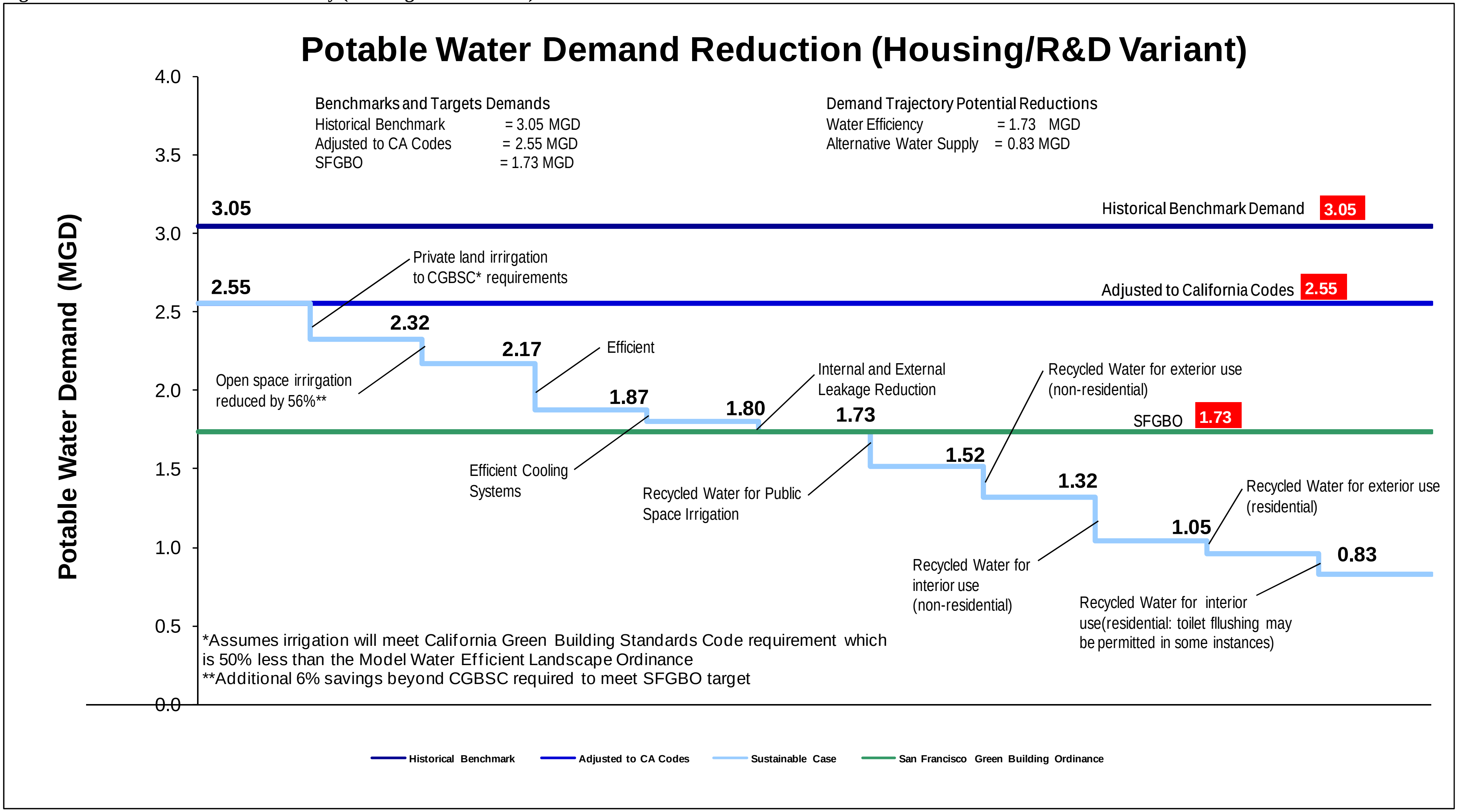

Table 2: Historical Benchmark demand by land use and end use – Housing/R&D Variant

	Historical Benchmark Demand (MGD)		
Land Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Residential	0.90	0.62	1.52
Hotel	0.08	0.00	0.08
Office	0.07	0.01	0.08
Artist Studios	0.00	0.03	0.03
Research and Development	0.00	0.73	0.73
Neighborhood Retail	0.03	0.03	0.06
Regional Retail	0.13	0.00	0.13
Community Uses	0.02	0.02	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.04	0.00	0.04
Total demand excluding Parks and Open Space	**1.25**	**1.42**	**2.68**
Parks and Open Space	0.11	0.25	0.36
Total Demand	**1.36**	**1.67**	**3.04**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.03	0.05	0.08
Toilets (med-high density Residential)	0.19	0.10	0.29
Toilets (all other uses)	0.05	0.11	0.17
Urinals	0.01	0.01	0.02
Laundry (low density residential)	0.02	0.04	0.06
Laundry (medium and high density residential)	0.15	0.08	0.23
Laundry (all other uses)	0.02	0.03	0.05
Shower	0.15	0.12	0.27
Bath	0.01	0.01	0.02
Faucets	0.15	0.14	0.29
Process Water	0.05	0.15	0.20
Dishwashers	0.03	0.04	0.07
Internal Leakage	0.13	0.12	0.26
Other domestic	0.03	0.01	0.04
Subtotal	**1.04**	**1.02**	**2.05**
Outdoor Uses			
Irrigation and landscaping	0.16	0.30	0.46
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.02	0.06	0.08
External Leakage	0.01	0.02	0.03
Subtotal	**0.22**	**0.41**	**0.62**
Total excluding Parks and Open Space	**1.25**	**1.42**	**2.68**
Parks and Open Space	0.11	0.25	0.36
Total Demand	**1.36**	**1.67**	**3.04**

*Note: Rounding errors may occur.

Table 3: Adjusted to CA Codes demand by land use and end use- Housing/R&D Variant

	Adjusted to Codes BAU Demand (MGD)		
Land Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Residential	0.69	0.47	1.16
Hotel	0.07	0.00	0.07
Office	0.06	0.01	0.07
Artist Studios	0.00	0.02	0.02
Research and Development	0.00	0.65	0.65
Neighborhood Retail	0.02	0.02	0.05
Regional Retail	0.12	0.00	0.12
Community Uses	0.01	0.01	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.02	0.00	0.02
Total demand excluding Parks and Open Space	**1.00**	**1.18**	**2.18**
Parks and Open Space	0.11	0.25	0.36
Total Demand	**1.11**	**1.43**	**2.54**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.02	0.03
Toilets (med-high density Residential)	0.08	0.05	0.13
Toilets (all other uses)	0.02	0.05	0.08
Urinals	0.01	0.01	0.01
Laundry (low density residential)	0.02	0.03	0.04
Laundry (medium and high density residential)	0.11	0.06	0.17
Laundry (all other uses)	0.01	0.02	0.03
Shower	0.12	0.09	0.21
Bath	0.01	0.01	0.02
Faucets	0.14	0.12	0.26
Process Water	0.05	0.15	0.20
Dishwashers	0.02	0.03	0.06
Internal Leakage	0.13	0.12	0.26
Other domestic	0.03	0.01	0.04
Subtotal	**0.78**	**0.78**	**1.56**
Outdoor Uses			
Irrigation and landscaping	0.16	0.30	0.46
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.02	0.06	0.08
External Leakage	0.01	0.02	0.03
Subtotal	**0.22**	**0.41**	**0.62**
Total excluding Parks and Open Space	**1.00**	**1.19**	**2.18**
Parks and Open Space	0.11	0.25	0.36
Total Demand	**1.11**	**1.45**	**2.54**

*Note: Rounding errors may occur.

Table 4: SFGBO demands by land use and end use – Housing/R&D Variant

Land Use	SFGBO (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.48	0.35	0.83
Hotel	0.05	0.00	0.05
Office	0.04	0.00	0.04
Artist Studios	0.00	0.01	0.01
Research and Development	0.00	0.43	0.43
Neighborhood Retail	0.02	0.02	0.03
Regional Retail	0.08	0.00	0.08
Community Uses	0.01	0.01	0.02
Football Stadium	0.00	0.00	0.00
Performance Venue	0.01	0.00	0.01
Total demand excluding Parks and Open Space	**0.70**	**0.82**	**1.52**
Parks and Open Space	0.06	0.15	0.22
Total Demand	**0.76**	**0.97**	**1.73**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.02	0.03
Toilets (med-high density Residential)	0.07	0.04	0.11
Toilets (all other uses)	0.02	0.04	0.06
Urinals	0.00	0.00	0.00
Laundry (low density residential)	0.01	0.02	0.03
Laundry (medium and high density residential)	0.08	0.04	0.12
Laundry (all other uses)	0.01	0.02	0.02
Shower	0.08	0.07	0.15
Bath	0.01	0.01	0.02
Faucets	0.09	0.08	0.19
Process Water	0.04	0.11	0.15
Dishwashers	0.02	0.02	0.04
Internal Leakage	0.10	0.09	0.19
Other domestic	0.02	0.01	0.03
Subtotal	**0.56**	**0.57**	**1.10**
Outdoor Uses			
Irrigation and landscaping	0.08	0.16	0.24
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.01	0.05	0.06
External Leakage	0.01	0.02	0.02
Subtotal	**0.13**	**0.25**	**0.37**
Total excluding Parks and Open Space	**0.70**	**0.82**	**1.52**
Parks and Open Space	0.06	0.15	0.22
Total Demand	**0.76**	**0.97**	**1.73**

*Note: Rounding errors may occur.

Potential reclaimed water demands and sanitary flows by end use were estimated for the Proposed Project and Project Variants. These are provided below in Table 5 through Table 6.

Table 5: Reclaimed water demands by end use – Housing/R&D Variant

End Use	Reclaimed Water Demands by End Use (MGD)		
	Historical Benchmark	Adjusted to Codes BAU	SFGBO
Toilets (residential)	0.36	0.17	0.13
Toilets (non-residential))	0.17	0.08	0.06
Urinals	0.02	0.01	0.00
Process Water (non-residential)	0.20	0.20	0.15
Irrigation and landscaping (residential)	0.12	0.12	0.06
Irrigation and Landscaping (non-residential)	0.34	0.34	0.17
Pools and Fountains (residential)	0.01	0.01	0.01
Pools and Fountains (non-residential)	0.01	0.01	0.01
Wash down (residential)	0.01	0.01	0.01
Wash down (non-residential)	0.01	0.01	0.01
Car Washing (residential)	0.01	0.01	0.01
Car Washing (non-residential)	0.00	0.00	0.00
Cooling (non-residential)	0.08	0.08	0.06
Total flow excluding Parks and Open Space	**1.35**	**1.05**	**0.69**
Parks and Open Space	0.37	0.37	0.22
Total Demand	**1.72**	**1.42**	**0.90**

*Note: Rounding errors may occur.

Table 6: Sanitary flows by end use – Housing/R&D Variant

End Use	Sanitary Flows by End Use (MGD)		
	Historical Benchmark	Adjusted to CA Codes	SFGBO
Toilets	0.53	0.24	0.19
Urinals	0.02	0.01	0.00
Laundry	0.34	0.25	0.17
Shower	0.27	0.21	0.15
Bath	0.02	0.02	0.02
Faucets	0.29	0.26	0.19
Process Water	0.20	0.20	0.15
Dishwashers	0.07	0.06	0.04
Other domestic	0.04	0.04	0.03
Cooling (50% flow to sewer)	0.08	0.08	0.06
Total	**1.88**	**1.38**	**1.01**

*Note: Rounding errors may occur.

4 Assumptions and References

This section describes assumptions used to:

1) Estimate historical baseline demands;
2) Distribute the historical baseline demands to specific end uses such as toilets, showers, irrigation etc…;
3) Adjust the historical baseline demands to current California code; and
4) Adjust the to-code demands to a sustainable case wherein efficiency measures such as efficient fixtures are applied. The efficiency measures applied in the Sustainable Case have been tailored to meet the demand reduction requirements of the SFGBO.

Table 7: Assumptions for estimating water demands by land use for the Historical Benchmark case .

Assumptions Summary for Historical Benchmark Demand Estimation						
Land use	**ID#**	**Description**	**Value**	**Unit**	**Reference or Assumption**	**Notes**
Residential						
	1	No. of residents per unit - low density	2.33	residents	Mundie & Associates, 2009	
	2	No. of residents per unit - medium density	2.33	residents	Mundie & Associates, 2009	
	3	No. of residents per unit - high density	2.33	residents	Mundie & Associates, 2009	
	4	Average consumption per capita	62	gallons per day (gp)	SFPUC, 2005	
	5	Average outdoor water use for single family residences	10	%	SFPUC, 2005	Note reference states that average demand is less than 10%
Regional Retail						
	1	Regional Retail jobs creation	350	Square feet (sqft)/job	Economic and Planning Systems, 2009.	
	2	Area of retail space per customer	22	sqft/customer	British Standards Institution. 2006	
	3	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	4	Sewage generation per visitor	2	gpd	EPA, 2002	EPA sites 2 gpd / parking spot. Sewage generation is only a fraction of overall consumption
	5	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	
	6	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer

Neighborhood Retail						
	1	Neighborhood retail jobs creation	270	sqft/job	Economic and Planning Systems, 2009.	
	2	Area of retail space per customer	22	sqft/customer	British Standards Institution. 2006	
	3	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	4	Water generation per visitor	2	gpd	EPA, 2002	EPA sites 2 gpd / parking spot. Sewage generation is only a fraction of overall consumption
	5	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	6	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Office						
	1	Office job creation	276	sqft/job	Economic and Planning Systems, 2009.	
	2	Residential jobs creation	25	Units/job	Economic and Planning Systems, 2009.	
	3	Water consumption per employee	85	gpd	URS, 2004.	
	4	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	
	5	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Community Uses						

	1	Community use job creation	276	sqft/job	Assumed similar to office	Actual Community uses are not finalized therefore community use water demands have been estimated in a similar manner as office land use.
	2	Water consumption per employee	85	gpd	Assumed similar to office	
	3	Average outdoor water use for non-residential customers	43	percent	Assumed similar to office	
	4	Ratio of sewage generation to total water consumed on site	57	percent	Assumed similar to office	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Research and Development						
	1	R&D jobs creation (office)	267	sqft/job	Economic and Planning Systems, 2009.	
	2	Sewage generation per employee for office R&D space	85	gpd	URS, 2004.	Sewage generation is only a fraction of overall consumption
	3	Average outdoor water use for non-residential customers for all R&D	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	4	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Assumption is conservative in that some water consumed indoors would not go to sanitary sewer
	5	Type of R&D Spaces	1/3,1/3, and 1/3	Fraction	Email from Lennar	From email correspondence with Lennar it has been assumed that 1/3 of the R&D space will be office, 1/3 will be wet laboratory, and the remaining 1/3 will be light production which is similar to industrial.
	6	Water Usage for Wet Laboratory R&D Space	0.547	gpsfd	2020 UC Berkeley LRDP Draft EIR (http://www.cp.berkeley.edu/LRDP_2020 draft.htm) - Table 4.13-1	Source provided by Winzler & Kelly. The report states that 0.32 is for sustainable lab case with efficient fixtures built in, and calculations were worked backwards to calculate the BAU.
	7	Water usage profile for	Varies	%	URS, 2004	The water usage profile for wet lab

		Wet Lab Space				space has been assumed to be the average of the commercial and industrial usage profile.
	8	Water Usage for Light Projection R&D Space	0.1	gpsfd	City of Los Angeles, L.A. CEQA Threshold Guide, 2006, Exhibit M.2. - 12 Sewage Generation Factors	
Hotel						
	1	Hotel job creation	700	sqft/job	Economic and Planning Systems, 2009	
	2	Average guest room size	600	sqft	Assumed	This includes the space for reception, kitchens and conference facilities
	3	Average guests / room	1.9	guests	Assumed	
	4	Sewage generation per guest	50	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	5	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	6	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	7	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Artist Studios						
	1	# of artists	252	people	Lennar, 2009	
	2	Consumption per artist	85	gpd	URS, 2004.	
Parks and Open Space						
	1	Total irrigation demand from landscape architect	350,180	gpd	Per landscape irrigation prepared by RHAA 7/31/08	
Football Stadium						
	1	Football games / year	10	Home games	Economic and Planning Systems, 2009.	
	2	Attendance at football games	69000	people	Economic and Planning Systems, 2009.	

	3	Other venues per year	20	Other venues	Economic and Planning Systems, 2009.	
	4	Attendance at other venues	37500	people	Lennar, 2009	
	5	Employees (football day)	3625	people	Stadium Staffing Numbers from SF 49ers, (Lennar, 2009)	Includes 2900 employees and 725 media personnel
	6	Employees (event day)	1,922	people	Pro-rated using football day attendance and employees on football days	
	7	Employee (nonevent days)	48	people	Stadium Staffing Numbers from SF 49ers, (Lennar, 2009)	
	8	No. of players/performers (event day)	200	people	Assumed	100 people per team for players and staff. Assumed same number for other event days
	9	Stadium average daily irrigation	23979	gpd	Marty Laporte, 2009	
	10	Sewage generation per seat and employee on game days	4	gpd	EPA, 2002.	EPA value is for "auditorium" Sewage generation is only a fraction of overall consumption
	11	Ratio of sewage generation to indoor water consumption	95	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
	12	Water consumption per permanent employee per day	85	gpd	URS, 2004.	
Performance Venue						
	1	Performance venue job creation	40	seats/job	Economic and Planning Systems, 2009.	
	2	Performance events per year	250	events	Economic and Planning Systems, 2009.	
	3	Employees - typical day	7	people	Assumed	Prorated to be similar to stadium
	4	Visitors per performance	10,000	people	Per CP/HPS development program, 2009	

	6	Water consumption per permanent employee per day	85	gpd	URS, 2004.	
	7	Sewage generation per seat and employee on event days	4	gpd	EPA, 2002.	EPA value is for "auditorium". Sewage generation is only a fraction of overall consumption
	12	Ratio of sewage generation to indoor water consumption	95	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Sanitary Sewer						
	1	Percent of indoor consumption to sanitary sewer	100%	Percent	Assumed per URS 2004 and conversations with W&K	
	2	Cooling demands assumed to contribute to sanitary sewer. (Non Res)			Assumed per conversations with W&K	Though some losses may occur, 100% of cooling demand is assumed to go to sanitary sewer

Table 8: End use demand distributions by land use (URS 2004)

Table 3-3
End-Use Data - Initial Percentage Assumptions

End Use	Initial Percentages by Customer-Billing Category				
	Single-Family Residential	Multi-Family Residential	Commercial	Industrial	Institutional
Indoor Usage					
Toilets (indoor)	26.7%	26.7%	25%	23%	20%
Urinals (indoor)	NA	NA	0%	7%	0%
Laundry (indoor)	21.7%	21.7%	8%	5%	10%
Showers (indoor)	16.8%	16.8%	5%	5%	16%
Bath (indoor)	1.7%	1.7%	NA	NA	NA
Faucets (indoor)	15.7%	15.7%	10%	15%	19%
Process (indoor)	NA	NA	34%	30%	5%
Dishwashers (indoor)	1.4%	1.4%	8%	5%	15%
Internal Leakage (indoor)	13.7%	13.7%	10%	10%	15%
Other Domestic (indoor)	2.2%	2.2%	NA	NA	NA
Outdoor Usage					
Irrigation and Landscaping (outdoor)	80%	80%	75%	65%	70%
Pools and Fountains (outdoor)	5%	5%	2%	5%	5%
Wash-down of house/facilities (outdoor)	5%	5%	3%	0%	5%
Car Washing (outdoor)	5%	5%	0%	0%	0%
Cooling (outdoor)	0%	0%	15%	25%	15%
External Leakage (outdoor)	5%	5%	5%	5%	5%

NA – Not Applicable

Sources: AWWARF, Konen (1986), Bohling et al. (1992)

Table 9: Assumed end use distributions for the stadium and performance venue

Indoor Usage	%	95%
Outdoor Usage	%	5%
Indoor Uses		
Toilets	%	30%
Urinals	%	30%
Laundry	%	0%
Shower	%	5%
Bath	%	0%
Faucets	%	15%
Process Water	%	10%
Dishwashers	%	0%
Internal Leakage	%	10%
Other domestic	%	0%
Outdoor Uses		
Irrigation and landscaping	%	20%
Pools and Fountains	%	0%
Wash down of houses and facilities	%	20%
Car Washing	%	0%
Cooling	%	50%
External Leakage	%	10%

Table 10: Assumptions used to adjust between water demand scenarios

	Historical Benchmark		Adjusted to CA Code		SFGBO		
	Max Flow or Quantity	Note / Reference	Max Flow or Quantity	Note / Reference	Max Flow or Quantity	Note/Reference	Unit
Plumbing Fixture							
Lavatory faucet, private	2.5		2.2	2007 California Plumbing Code	1.5	EPA WaterSense	gpm at 60 psi
Lavatory faucet, public, (metering)	0.25		0.25	2006 International Plumbing Code	0.2	CA Green Building Standard 2008	gallon per metering cycle
(not metering)	0.6		0.5	IPC	0.5	n.a.	gpm at 60 psi
Shower head	3.125	URS 2004*	2.5	2007 California Plumbing Code	1.75	EPA WaterSense	gpm at 80 psi
Sink faucet	2.5		2.2	Plumbing Code	1.5	EPA WaterSense	gpm at 60 psi
Urinal	2	URS 2004*	1	2007 California Plumbing Code	0.125	EPA Water Sense	gallon per flushing cycle
Water closet	3.5	URS 2004*	1.6	2007 California Plumbing Code	1.28	EPA Water Sense and CA Green Building Standard 2008	gallon per flushing cycle
Other Appliances							
Dishwasher (Residential)	7		6	US Department of Energy 2007	4	Energy Star	gallons/cy capacity
Dishwasher (Commercial)	1.75		1.46	Energy Star	0.92	Energy Star	gallons per rack
Laundry	36.4	URS 2004	26	(US Federal Standard by 2011)	18	n.a. (calc)	gal/load
Laundry	13.2		8.5	CA Green Building Standard 2008	6	EPA Water Sense	gal/load-cf (Water Factor)
Irrigation							
Private Lands		Based on water demand distribution		California Water Efficient Landscape Ordinance (CWELO)	50%	CA Green Building Standard 2008	Fractional reduction compared to CWELO
Public Open Space		Per Landscape Architect Estimates		Per Landscape Architect Estimates - Note that this is less than CWELO	50%	CA Green Building Standard 2008	Fractional reduction compared to CWELO

Table 11: Other assumptions used to adjust the CA code demand to the SFGBO

Improved Cooling Efficiency		
Total fraction demand reductiont due to building envelope improvement measures and improved cooling technologies	0.25	
Reduced Losses		
Fractional demand reduction due to new piping and metering	0.25	

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Appendix Q3 Hydroconsult Engineers Hydrologic Modeling to Determine Potential Water Quality Impacts, October 19, 2009

Subject:	**Hydrologic Modeling to Determine Potential Water Quality Impacts**
Phase:	Preliminary Results
Prepared By:	Chris Phanartzis, P.E., Beth Goldstein, P.E., LEED AP®
Reviewed By:	Brent Johnson, P.E., LEED AP®
Date:	October 19, 2009
Reference:	090014

1 Introduction

This report contains a brief description of potential water quality impacts resulting from changes in frequency, duration or volume of combined sewer overflows (CSOs) from the City's combined sewer system (CSS). Potential changes in CSOs were reviewed in response to predicted changes in the sanitary flow and storm runoff from the proposed redevelopment of Candlestick Point (CP) and Hunters Point Shipyard (HPS). This Technical Memorandum (TM) summarizes the results of a hydrologic modeling analysis and presents a comparison between the base case and with-project scenarios.

2 Base Case Scenario

The Base Case scenario for comparison represents the existing Bayside system including development at Hunters Point through Phase I, Mission Bay at full build-out, and construction of the Sunnydale Tunnel. It does not include additional reasonable foreseeable future developments.

3 With-Project Scenario

The hydrologic analysis was premised on a number of assumptions including type and extent of proposed uses, stormwater and sanitary flow discharge destinations and other pertinent information as outlined in Tables 1 and 2. Contributing areas were determined based on Figure 1—CP/HPS Project Area, and are organized into two main subareas as described below.

Figure 1. CP/HPS Project Area

Source: Lennar Urban

3.1 Candlestick Point Subarea

Currently, all of the Alice Griffith Housing Development, portions of the State Park, and portions of the Stadium site contribute storm runoff to the City's CSS. With the proposed project, these flows will be removed from the City system, and all future stormwater flows will be discharged to the Bay with a portion of the flow receiving treatment prior to discharge (Lennar Urban, "LID Stormwater Opportunities Study", June, 2009).

Currently, the CP site contributes sanitary sewage to the CSS via gravity sewers from three locations: the stadium, the Alice Griffith housing development, and the RV Park on State Park grounds. The existing sanitary flows from these three sources are as follows:

- The existing annual average sanitary flow from the stadium is assumed as 23,285 gpd (ARUP, "Candlestick Point/ Hunters Point Shipyard Phase II Water Demand Memorandum Revision # 15, September 25, 2009).
- The existing sanitary flow from the housing development is calculated based on 256 units at a rate of 101.9 gpd/unit (SFPUC Multi-Family Residential estimates for 2010, "householdcons.xls").

- The existing sanitary flow from the State Park RV Park is based on average monthly meter data for the period January, 2007 through September, 2009 provided by SFPUC (via email from Hayden Kam, September 30, 2009).

3.2 Hunters Point Shipyard Subarea

Currently, no stormwater flows (other than infiltration and inflow to the sanitary system) from HPS are directed to the City CSS. The proposed project and both variants maintain separation of stormwater flows from the City CSS. All sanitary flows from HPS are currently pumped to the City system via force main on Crisp Road discharging just upstream of the Hunters Point Tunnel. For the purpose of this analysis, the existing sanitary flows from HPS are assumed to be 0.154 mgd on average based on SFPUC meter data for the period July 1, 2001, through June 30, 2002 (SFPUC, "Annual Metered Sewage Discharge.xls").

Table 1. Hydrologic Model Dry Weather Inputs—Sanitary Flows to the City CSS

	Future[1] (mgd)	Base Case[2] (mgd)	Net increase (mgd)
Proposed Project			
Candlestick Park	0.57	0.0517	0.518
Hunters Point	0.39	0.154	0.236
R & D Variant			
Candlestick Park	0.57	0.0517	0.518
Hunters Point	0.61	0.154	0.456
Housing Variant			
Candlestick Park	0.49	0.0517	0.438
Hunters Point	0.48	0.154	0.326

Sources:

1. *Future sanitary flows from ARUP, "Candlestick Point/ Hunters Point Shipyard Phase II Water Demand Memorandum Revision # 15, September 25, 2009.*
2. *Existing sanitary flows from ARUP, 2009, data provided by SFPUC, and calculation.*

Table 2. Hydrologic Model Wet Weather Inputs--Area Contributing Runoff to the City CSS

Subarea	Total Area[1] (acres)	Base Case[2] (acres)	Future[3] (acres)
Candlestick Point	281	108	0
Hunters Point Shipyard	421	0	0

Sources:

1. *Total Area from Lennar Urban (see Figure 1)*
2. *Existing areas from SF Planning Department, "Preliminary Draft Candlestick Point Stadium and Retail/Entertainment Center Environmental Impact Report", February 17, 1998*
3. *Future areas from Lennar Urban, "LID Stormwater Opportunities Study", June, 2009*

4 Analysis and Results

The proposed redevelopment scenario described above was analyzed with the aid of the Bayside Planning computer model. Model results of primary importance to this project include the frequency, volume and duration of combined sewage overflow (CSO) from the Yosemite Basin, and the total CSO volume for the entire Bayside. Other Bayside basins are not impacted by the proposed redevelopment. The results of the computer analysis are summarized in Table 3.

Table 3. Hydrologic Model Results

	Yosemite CSO			Bayside CSO
	MG/yr	#/year	hours/yr	MG/yr
Base Case	5.3	1	2	890
Proposed Project	3.1	0.64	1.17	877
R & D Variant	3.1	0.64	1.18	878
Housing Variant	3.1	0.64	1.17	877

The model results indicate a predicted decrease in CSO volume, frequency, and duration of CSO in the Yosemite Basin, and a decrease in overall CSO volume for the entire Bayside, for the proposed project and both variants. While the total dry weather (sanitary) flows are expected to increase, the CSO frequency, duration, and volume are all expected to decrease. The proposed diversion of wet weather flows away from the combined system offset the increase in dry weather flows. This may not be the case during the construction period if enough new units are constructed (increasing the sanitary flows) before the separated stormwater management system is complete. Through the course of interim development, a balance will need to be kept between the increase in sanitary flows and the decrease in stormwater runoff.

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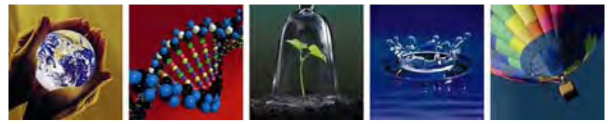
Appendix R There is no appendix associated with Section III.R

Appendix S ENVIRON Climate Change Technical Report Candlestick Point Hunters Point Shipyard Phase II, October 22, 2009



Climate Change Technical Report

Candlestick Point-Hunter's Point Shipyard Phase II Development Plan

Prepared for:
PBS&J
San Francisco, California

Prepared by:
ENVIRON International Corporation
San Francisco, California

Date:
October 22, 2009

Project Number:
03-22804A

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Acronyms

AB 1493	Assembly Bill No. 1493
AB 32	California Global Warming Solutions Act of 2006
ACM	Alternative Compliance Method
AF	acre feet
ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
C	carbon
CAFÉ	corporate average fuel economy
CAPCOA	California Air Pollution Control Officers Association
CAT	climate action team
CCAR	California Climate Action Registry
ccf/yr	hundred cubic feet per year
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CF_4	tetrafluoromethane
CFC	chlorinated fluorocarbons
CH_4	methane
CHP	combined heat and power
CO_2	carbon dioxide
CO_2e	CO_2 equivalents
CP	Candlestick Point
CP-HPS Plan	Candlestick Point-Hunter's Point Shipyard Phase II Development Plan
CPUC	California Public Utilities Commission
DHW	domestic hot water
DOT	Department of Transportation
EIA	United States Energy Information Administration
EIR	Environmental Impact Report
EMFAC	emissions estimation software programs
ENVIRON	ENVIRON International Corporation
GDP	gross domestic product
GHGs	greenhouse gases
GRP	General Reporting Protocol
GWP	global warming potential
H_2O	water
HFC	hydrofluorocarbons
HPS	Hunter's Point Shipyard
IPCC	Intergovernmental Panel on Climate Change
ISD	Climate Change Internal Services Department
kW	kilowatt
kW-hr/yr	kilowatt hours/year
lbs	pounds
LCA	Life Cycle Assessment
LDA	light-duty auto
LDT	light-duty truck
LEED	Leadership in Energy and Environmental Design
LEV	Low-Emission Vehicle
LID	Low Impact Development
MA	Massachusetts
MAC	Market Advisory Committee
$MMTCO_2e$	million metric tonnes of CO_2 equivalent
MN	Minnesota

MND	Mitigated Negative Declaration
MW	megawatts
NAT	No Action Taken
N_2O	nitrous oxide
O_2	oxygen
OPR	Office of Planning and Research
PC	passenger car
PFC	perfluorocarbon
PG&E	Pacific Gas and Electric Company
ppb	parts per billion
ppm	parts per million
RCx	Facility Retrocommissioning
RECS	Residential Energy Consumption Survey
SB 97	Senate Bill 97
SCAQMD	South Coast Air Quality Management District
SF_6	sulfur hexafluoride
sf	square feet
TBD	to be determined
TDV	Time Dependent Valuation
tonnes	Metric tonnes; 1,000 kilograms
UNEP	United Nations Environment Programme
URBEMIS	Urban Emissions Model
US	United States
USEPA	United States Environmental Protection Agency
VMT	vehicle miles traveled
WMO	World Meteorological Organization

Executive Summary

The Candlestick Point-Hunter's Point Shipyard Phase II Development Plan (CP-HPS Plan) is a proposed mixed use community to be built in the western area of San Francisco County. The CP-HPS Plan consists of two project areas: Candlestick Point (CP) and Hunter's Point Shipyard (HPS). The site is part of a redevelopment of the previous uses at the site. CP-HPS Plan will result in approximately 10,500 residences at full build out with 256 existing residences being replaced for a total of 10,244 net new residences. The development will also include commercial (i.e., office and retail uses) space. The CP-HPS Plan includes demolition of Candlestick Park. The Project includes having the Stadium rebuilt in the HPS project area. Two different project variants are considered if no Stadium is rebuilt. Project Variant 1 will place additional research and development space at HPS. Project Variant 2 will change the distribution of residences between CP and HPS but will keep the overall total number of residences the same as the Project. This development will result in both one-time and annual direct and indirect emissions of greenhouse gases (GHGs). The term, "direct emissions of GHGs" refers to GHGs that are emitted directly as a result of CP-HPS Plan and include land use change and construction emissions. Indirect emissions are those emissions that CP-HPS Plan entitlement will enable, but that are not controlled by CP-HPS Plan proponent. This report discusses the scientific developments surrounding global climate change and provides an inventory surveying the emissions that would result from approving CP-HPS Plan.

There is a general scientific consensus that most current global warming is the result of human activity on the planet. This man-made, or anthropogenic, warming is primarily caused by increased emissions of GHGs that keep the earth's surface warm. This is called "the greenhouse effect" and contributes to global climate change.

Residents and the employees and patrons of commercial and municipal buildings and services use electricity, heating, and are transported by motor vehicles. These activities directly or indirectly emit GHGs. The most significant GHG emissions resulting from such residential and commercial developments are emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). GHG emissions are typically measured in terms of tonnes of CO_2 equivalents (CO_2e), calculated as the product of the mass emitted of a given GHG and its specific global warming potential (GWP).

The emissions inventory presented in this report is consistent with the methodologies established by the California Climate Action Registry (CCAR), where possible. The CP-HPS Plan emissions inventory considers nine categories of direct and indirect GHG emissions: emissions due to vegetation changes, emissions from construction activities, residential building emissions, non-residential building emissions, mobile source emissions, municipal emissions, area sources, solid waste, and transit services. The emissions from construction and vegetation change are one-time emissions events. The other emissions occur annually throughout the life of CP-HPS Plan. The electrical power for the CP-HPS Plan development will be supplied by Pacific Gas and Electric Company (PG&E). Accordingly, indirect GHG emissions from electricity usage are calculated using the PG&E carbon-intensity factor.

A variety of methods are employed to develop a complete GHG emissions inventory. In addition to well-established emission factors for certain activities and emission estimates based on similar activities in other representative communities; several emissions estimation software programs are used. These include EMFAC, OFFROAD, and Urban Emissions Model (URBEMIS).

Emissions from the various aspects of CP-HPS Plan are presented in Table ES-1. Both the one-time emissions and emissions that are expected to occur each year after build-out of the CP-HPS Plan development are presented. There are 98,587 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to 154,639 tonnes CO_2e/year. Of the annual emissions, slightly more than 68% result from vehicular emissions associated with residential activities, and 29% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately 2,465 tonnes, or 2% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 157,104 tonnes/year.

Emissions from the various aspects of Variant 1 are presented in Table ES-2. Both the one-time emissions and emissions that are expected to occur each year after build-out of the CP-HPS Plan development are presented. There are 98,587 tonnes of CO_2e one-time emissions. This is the same for all project scenarios since there were not different estimates of construction equipment. The annual emissions from the use of the development amount to 178,651 tonnes CO_2e/year. Of the annual emissions, slightly more than 67% result from vehicular emissions associated with residential activities, and 29% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately 2,465 tonnes, or 2% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 181,115 tonnes/year.

Emissions from the various aspects of Variant 2 are presented in Table ES-3. Both the one-time emissions and emissions that are expected to occur each year after build-out of the CP-HPS Plan development are presented. There are 98,587 tonnes of CO_2e one-time emissions. This is the same for all project scenarios since there were not different estimates of construction equipment. The annual emissions from the use of the development amount to 157,509 tonnes CO_2e/year. Of the annual emissions, slightly more than 70% result from vehicular emissions associated with residential activities, and 26% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately 2,465 tonnes, or 2% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 159,974 tonnes/year.

This inventory was prepared as a worst-case analysis. For example, it assumes that all emissions from CP-HPS Plan are "new," in the sense that, absent the development of CP-HPS Plan, these emissions would not occur except for the 256 replacement residences and associated emissions and traffic associated with the stadium. Given the global nature of GHG emissions, “new” global GHG emissions are those caused by economic growth and population growth (births); local development projects accommodate such growth.

As an example of why these are worst-case emissions, these emissions are estimated assuming that the carbon intensity of the electricity supply system and transportation system do not change in the future beyond the changes anticipated from the 20% Renewable Portfolio Standard in 2010 and Pavley vehicle emission standards. This assumption is clearly an over-simplification, as the measures incorporated into California Global Warming Solutions Act of 2006 (AB 32) mandate change in both areas and would reduce future GHG emissions from the development.

Table ES-1
Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan Project
San Francisco, California

Source	**GHG Emissions**				**Percentage of Annual CO_2e Emissions (%)**		
		HPS	**CP**	**CP-HPS Plan**	**HP**	**CP**	**CP-HPS Plan**
Vegetation[1]	tonnes CO_2e	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]		46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)		**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	6,642	19,035	25,677	13%	19%	17%
Non-Residential[4]		13,766	4,263	18,028	26%	4%	12%
Mobile[5]		30,371	75,149	105,520	57%	74%	68%
Municipal[6]		766	1,793	2,559	2%	2%	2%
Area		56	161	217	0%	0%	0%
Waste		375	532	907	1%	1%	1%
Transit Area		865	865	1,730	2%	1%	1%
Total (annual emissions)		**52,842**	**101,798**	**154,639**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**53,906**	**103,198**	**157,104**	**NA**	**NA**	**NA**

Table ES-2
Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 1
San Francisco, California

Source	GHG Emissions				Percentage of Annual CO_2e Emissions (%)		
		HPS	CP	CP-HPS Plan	HP	CP	CP-HPS Plan
Vegetation[1]	tonnes CO_2e total	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]		46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)		**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	6,642	19,035	25,677	9%	18%	14%
Non-Residential[4]		23,155	4,263	27,418	31%	4%	15%
Mobile[5]		42,332	77,586	119,918	57%	74%	67%
Municipal[6]		860	1,793	2,653	1%	2%	2%
Area		56	161	217	0%	0%	0%
Waste		506	532	1,038	1%	1%	1%
Transit Area		865	865	1,730	1%	1%	2%
Total (annual emissions)		**74,416**	**104,234**	**178,651**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**75,480**	**105,635**	**181,115**	**NA**	**NA**	**NA**

Table ES-3
Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 2
San Francisco, California

Source	**GHG Emissions**				**Percentage of Annual CO_2e Emissions (%)**		
		HPS	**CP**	**Variant 2**	**HP**	**CP**	**Variant 2**
Vegetation[1]	tonnes CO_2e total	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]		46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)		**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	10,026	15,651	25,677	17%	16%	16%
Non-Residential[4]		11,963	4,263	16,226	20%	4%	10%
Mobile[5]		34,888	75,180	110,068	58%	77%	70%
Municipal[6]		1,488	1,066	2,553	2%	1%	2%
Area		85	132	217	0%	0%	0%
Waste		587	451	1,038	1%	1%	2%
Transit Area		865	865	1,730	1%	1%	3%
Total (annual emissions)		**59,901**	**97,608**	**157,509**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**60,965**	**99,009**	**159,974**	**NA**	**NA**	**NA**

1 Introduction

The Candlestick Point-Hunter's Point Shipyard Phase II Development Plan (CP-HPS Plan) will result in one-time and annual (direct and indirect) emissions of GHGs. Direct emissions of GHGs refers to GHGs that are emitted directly as a result of CP-HPS Plan and include land use change and construction emissions. Indirect emissions are those emissions that CP-HPS Plan entitlement will enable, but that are not controlled by CP-HPS Plan proponent. This report discusses the scientific developments surrounding global climate change and provides an estimate of an emissions inventory that would result from entitling CP-HPS Plan. This report also places the emissions inventory from CP-HPS Plan into context.

Residents, employees, and patrons of commercial and municipal buildings use electricity, heat their homes and water (typically with natural gas), and are transported in motor vehicles, all of which directly or indirectly emit GHGs. The principal green house gases resulting from such developments are emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). CO_2 is considered the most important GHG, due primarily to the large emissions produced by fossil fuel combustion, especially for the generation of electricity and powering of motor vehicles. CH_4 and N_2O are also emitted by fossil fuel combustion, though their emissions are much less significant than CO_2. CH_4 is also emitted from the transmission, storage, and incomplete combustion of natural gas.

The effect that each of these gases can have on global warming is a combination of the mass of their emissions and their global warming potential (GWP). GWP indicates, on a pound for pound basis, how much a gas is predicted to contribute to global warming relative to how much warming would be predicted to be caused by the same mass of CO_2. CH_4 and N_2O are substantially more potent GHGs than CO_2, with GWPs of 21 and 310, respectively.[1] In emissions inventories, GHG emissions are typically reported in terms of pounds (lbs) or tonnes[2] of CO_2 equivalents (CO_2e). CO_2e are calculated as the product of the mass emitted of a given GHG and its specific GWP. While CH_4 and N_2O have much higher GWPs than CO_2, CO_2 is emitted in such vastly higher quantities that it accounts for the majority of GHG emissions in CO_2e, both from residential developments and human activity in general.

The CP-HPS Plan is located within the Bay Area Air Quality Management District (BAAQMD) jurisdiction. However, as BAAQMD guidelines for the preparation of GHG inventories have not yet been developed, this inventory has been developed consistent with the methodologies established by the California Climate Action Registry (CCAR) where possible[3]. When guidance from the CCAR is lacking, methodologies established by the Intergovernmental Panel on Climate Change (IPCC)[4] and best available science are used. Legislation and rules regarding

[1] GWP values from IPCC's Second Assessment Report (SAR, 1996) are still used by international convention and are used in this protocol, even though more recent (and slightly different) GWP values were developed in the IPCC's Third Assessment Report (TAR, 2001)

[2] In this report, "tonnes" will be used to refer to metric tonnes (1,000 kilograms). "Tons" will be used to refer to short tons (2,000 pounds).

[3] BAAQMD released Draft Air Quality Guidelines in September 2009 that includes some guidance for the preparation of GHG inventories. The methods described in the draft guidelines are similar to the methodologies used in the CP-HPS Plan GHG Inventory.

[4] The WMO and the UNEP established the IPCC in 1988; it is open to all members of the United Nations and WMO.

climate change, as well as scientific understanding of the extent to which different activities emit GHGs, continue to evolve; as such, the inventory in this report is a reflection of the guidance and knowledge currently available.

At the entitlement stage of a development, while the number of homes, the approximate size of commercial areas and the locations of both are known, the exact designs of the homes, businesses and facilities are not. Even so, the types of buildings and the types of facilities at the future CP-HPS Plan site can be used for developing an estimate of CP-HPS Plan's anticipated GHG emissions. Energy used in a building depends in part on the built environment; however, actual future emissions from the site will depend heavily upon the future homeowners' and business owners' habits. Because the actual future occupants and their habits are not yet known, average current behavior is assumed. Given the current regulatory environment and the media focus on global climate change, it is likely that the actual future occupants will be more sensitive to the GHG emissions caused by their activities and, therefore, their activities will result in lower GHG emissions than average current behavior shows.

1.1 Emissions Inventory

The CP-HPS Plan emissions inventory considers the following categories of GHG emissions:

- emissions due to land use (vegetation) changes,
- emissions from construction activities,
- residential building operations emissions,
- non-residential building operations emissions,
- mobile source operations emissions,
- municipal operations emissions,
- area sources (fireplaces and lawn maintenance) emissions,
- solid waste disposal, and
- transit services.

In addition, an estimate of "life-cycle" GHG emissions from building materials is presented. Life cycle emissions include all of the emissions caused by the existence of a product or project, for example, GHG emissions from the processes used to manufacture and transport materials used in the buildings and infrastructure. This estimate is to be used for comparison purposes only and is not included in the final inventory as these emissions would be accounted for under California Global Warming Solutions Act of 2006 (AB 32) in other industry sectors. In addition, life-cycle analyses inherently involve many uncertainties. For example, in a life-cycle analysis for building materials, somewhat arbitrary boundaries must be drawn to define the processes considered in the life-cycle analysis.[5] Although life-cycle emission estimates can provide a broader view of a project's emissions, life cycle analyses often double count emissions that might be attributable to other sectors in a comprehensive analysis. The applicability of information to a specific

5 For instance, in the case of building materials, the boundary could include the energy to make the materials, the energy used to make the machine that made the materials, and the energy used to make the machine that made the machine that made the materials.

geographic location, climatic zone and building type can influence the life-cycle GHG emissions. Further uncertainty of life-cycle analyses come from some basic choices, such as the useful life of a building or road which can substantially change the outcome of the life-cycle analysis.

The inventory does not consider whether the emissions from CP-HPS Plan are "new" in the sense that, absent the development of CP-HPS Plan, these emissions may not occur. However, emissions from electricity use and construction worker commuting are included.

The timeframe over which GHGs are emitted varies from category to category, which is taken into consideration in the emissions inventory. For most of the categories, GHGs will be emitted every year that the development is inhabited. For these categories (residential buildings, non-residential buildings, mobile sources, municipal services, area sources, solid waste disposal, and transit service), the inventory includes estimates of annual GHG emissions from ongoing development operations. GHG emissions from two of the categories, construction and changes in vegetation, are one-time events that will not be part of the development's ongoing activity. These one-time emissions can be divided by the estimated lifetime of CP-HPS Plan to allow direct comparison of these two emissions classes. The inventory presents estimates of these one-time emissions, converts them to annualized estimates, and integrates them into an annual inventory.

It is worth noting that the GHG emissions estimates assume there are no reductions in GHG-generating activities over time. This is clearly unlikely, and presents a conservative analysis, given the expected reductions in GHG emissions from most activities that will take place over the years due to future regulations, greater public awareness and the likely increasing costs of energy. For example, the emissions estimated for electricity consumption assumes that there will not be an increase in energy production from renewables beyond the existing 20% Renewable Portfolio Standard (RPS) in 2010 or non-GHG producing sources; this is not realistic, given the mandates of AB 32, and other regulatory development, as discussed later in this report.

A variety of methods are employed to develop a complete GHG emissions inventory. In addition to well established emission factors for certain activities and emission estimates based on similar activities in other representative communities; several emissions estimation software programs are used. These include EMFAC, OFFROAD, and Urban Emissions Model (URBEMIS). Later sections of the report describe these models and other estimation methods. The major emissions sources that exist in residential developments are described later in this report.

1.2 Comparison of GHG Emissions

Because, to date, the BAAQMD and ARB has not established significance thresholds for GHG emissions under the California Environmental Quality Act (CEQA), the proposed GHG emissions from CP-HPS Plan are compared to other inventories to gain perspective on the impact these emissions may have[6]. To evaluate CP-HPS Plan's GHG emissions, the CP-HPS

[6] Both BAAQMD and ARB have recently released proposed significance thresholds, but these have not been finalized at this time.

Plan inventory is compared with ARB Scoping Plan No Action Taken (NAT) scenario. The CP-HPS Plan inventory is also compared with emissions thresholds associated with regulations being developed by the California Air Resources Board (ARB) pursuant to AB 32 to determine if the development is likely to be consistent with rules propagated for California to meet its 2020 emissions reduction goal. In addition to absolute emissions, emissions per capita are compared with the current average per capita emissions of California residents. Finally, to understand the large-scale significance of CP-HPS Plan's GHG emissions, the inventory is compared to state, national and global inventories.

1.3 Report Description

This report contains six sections. Following this introduction, Sections 2 details the state of climate change science. Section 3 presents the results of the CP-HPS Plan GHG Inventory. Section 4 compares these results to various benchmarks to gain perspective on what impact the CP-HPS Plan development will have on overall GHG emissions. Section 5 analyzes the impact of regulatory developments on CP-HPS Plan's GHG emissions. Finally, the main findings from the report are summarized in the conclusion which is Section 6.

2 State of Science

This section summarizes the scientific issues surrounding climate change and global warming. It also provides a discussion of the actions and phenomena that contribute to climate change and puts into context global, national, and state emissions of GHGs.

2.1 Global Climate Change

Global warming and *global climate change* are both terms that describe changes in the earth's climate. *Global climate change* is a broad term used to describe any worldwide, long-term change in the earth's climate. This change could be, for example, an increase or decrease in temperatures, the start or end of an ice age, or a shift in precipitation patterns. The term *global warming* is more specific than *global climate change* and refers to a general increase in temperatures across the earth. Though global warming is characterized by rising temperatures, it can cause other climatic changes, such as a shift in the frequency and intensity of rainfall or hurricanes. Global warming does not necessarily imply that all locations will be warmer. Some specific, unique locations may be cooler even though the world, on average, is warmer. All of these changes fit under the umbrella of global climate change.[7]

While global warming can be caused by natural processes, there is a general scientific consensus that most current global warming is the result of human activity on the planet.[8] This man-made, or anthropogenic, warming is primarily caused by increased emissions of "GHGs" that keep the earth's surface warm. This is called "the greenhouse effect." The greenhouse effect and the role GHGs play in it are described below.

2.2 The Greenhouse Effect

Greenhouses allow sunlight to enter and then capture some of the heat generated by the sunlight's impact on the earth's surface. The earth's atmosphere acts like a greenhouse by allowing sunlight in, but trapping some of the heat that reaches the earth's surface. When solar radiation from the sun reaches the earth, much of it penetrates the atmosphere to ultimately reach the earth's surface; this solar radiation is absorbed by the earth's surface and then re-emitted as heat in the form of infrared radiation.[9] Whereas the GHGs in the atmosphere let solar radiation through, the infrared radiation is trapped by greenhouses gases, resulting in the warming of the earth's surface.[10] This phenomenon is referred to as the "greenhouse effect".

The earth's greenhouse effect has existed far longer than humans have and has played a key role in the development of life. Concentrations of major GHGs, such as CO_2, CH_4, N_2O, and water vapor have been naturally present for millennia at relatively stable levels in the

[7] Other definitions of "Greenhouse Effect" and "Global Warming" can be found on Merriam-Webster online: http://www.m-w.com/. A definition for "Climate Change" can be found on dictionary.com which uses Webster's New Millennium™ Dictionary of English, Preview Edition (v 0.9.6).

[8] From the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers." Available online at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

[9] All light, be it visible, ultraviolet, or infrared, carries energy.

[10] Infrared radiation is characterized by longer wavelengths than solar radiation. Greenhouse gases reflect radiation with longer wavelengths. As a result, instead of escaping back into space, greenhouse gases reflect much infrared radiation (i.e., heat) back to Earth.

atmosphere, adequate to keep temperatures on Earth hospitable. Without these GHGs, the earth's temperature would be too cold for life to exist.

As human industrial activity has increased, atmospheric concentrations of certain GHGs have grown dramatically. Figure 2-1 shows the increase in concentrations of CO_2 and CH_4 over time. In the absence of major industrial human activity, natural processes have maintained atmospheric concentrations of GHGs, and, therefore, global temperatures at constant levels over the last several centuries.[11] As the concentrations of GHGs increase due to human activity, more infrared radiation is trapped, and the earth is heated to higher temperatures. This is the process that is described as human-induced global warming.

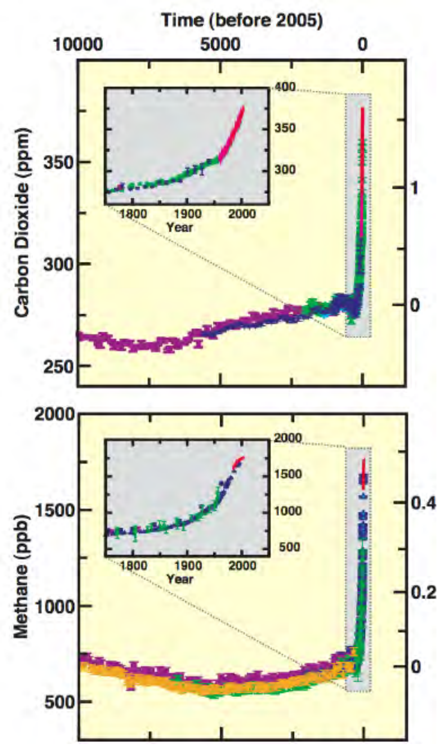

Figure 2-1. Carbon dioxide and methane concentrations have increased dramatically since the industrial revolution.[12]

In 2007, the IPCC began releasing components of its Fourth Assessment Report on climate change. In February 2007, the IPCC provided a comprehensive assessment of climate change science in its Working Group I Report.[13] It states that there is a scientific consensus that the global increases in GHGs since 1750 are mainly due to human activities such as fossil fuel use, land use change (e.g., deforestation), and agriculture. In addition, the report states that it is likely that these changes in greenhouse gas concentrations have contributed to global warming.

[11] Examples of natural processes include the addition of GHGs to the atmosphere from respiration, fires, and decomposition of organic matter. The removal of greenhouse gases is mainly from plant and algae growth and absorption by the ocean.

[12] Adapted from figure SPM-1 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers." Available online at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf

[13] Available online at: http://www.ipcc.ch/ipccreports/ar4-wg1.htm

Confidence levels of claims in this report have increased since 2001 due to the large number of simulations run and the broad range of available climate models.

2.3 Greenhouse Gases and Sources of Their Emissions

The term "GHGs" includes gases that contribute to the natural greenhouse effect, such as CO_2, CH_4, N_2O, and water, as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs), chlorinated fluorocarbons (CFCs), and sulfurhexafluoride (SF_6). These last three families of gases, while not naturally present in the atmosphere, have properties that also cause them to trap infrared radiation when they are present in the atmosphere, thus making them GHGs. These six gases comprise the major GHGs that are recognized by the Kyoto Accords (water is not included).[14] There are other GHGs that are not recognized by the Kyoto Accords, due either to the smaller role that they play in climate change or the uncertainties surrounding their effects. Atmospheric water vapor is not recognized by the Kyoto Accords because there is not an obvious correlation between water concentrations and specific human activities. Water appears to act in a positive feedback manner; higher temperatures lead to higher water concentrations, which in turn cause more global warming.[15]

The effect each of these gases has on global warming is a combination of the volume of their emissions and their GWP. GWP indicates, on a pound for pound basis, how much a gas will contribute to global warming relative to how much warming would be caused by the same mass of CO_2. CH_4 and N_2O are substantially more potent than CO_2, with GWPs of 21 and 310, respectively. However, these natural GHGs are nowhere near as potent as SF_6 and fluoromethane, which have GWPs of up to 23,900 and 6,500 respectively.[16] GHG emissions are typically measured in terms of mass of CO_2e. CO_2e are calculated as the product of the mass of a given GHG and its specific GWP.

The most important greenhouse gas in human-induced global warming is CO_2. While many gases have much higher GWPs than the naturally occurring GHGs, CO_2 is emitted in such vastly higher quantities that it accounts for 85% of the GWP of all GHGs emitted by the United States.[17] Fossil fuel combustion, especially for the generation of electricity and powering of motor vehicles, has led to substantial increases in CO_2 emissions and thus substantial increases in atmospheric CO_2 concentrations. In 2005, atmospheric CO_2 concentrations were about 379 parts per million (ppm), over 35 percent higher than the pre-industrial concentrations of about 280 ppm.[18] In addition to the sheer increase in the volume of its emissions, CO_2 is a major factor in human-induced global warming because of its lifespan in the atmosphere of 50 to 200 years.

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[14] This Kyoto Protocol sets legally binding targets and timetables for cutting the greenhouse-gas emissions of industrialized countries. The US has not approved the Kyoto treaty.

[15] From the IPCC Third Assessment Report: http://www.grida.no/climate/ipcc_tar/wg1/143.htm and http://www.grida.no/climate/ipcc_tar/wg1/268.htm

[16] California Climate Action Registry General Reporting Protocol - Reporting Entity-Wide Greenhouse Gas Emissions. Version 3.1 SAR values, Appendix B. Table C.1. http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

[17] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, U.S. Environmental Protection Agency. Available online at: http://epa.gov/climatechange/emissions/downloads/08_CR.pdf

[18] Page 2 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers."

Concentrations of the second most prominent GHG, CH_4, have also increased due to human activities such as rice production, degradation of waste in landfills, cattle farming, and natural gas mining. In 2005, atmospheric levels of CH_4 were more than double pre-industrial levels, up to 1774 parts per billion (ppb) as compared to 715 ppb.[19] CH_4 has a relatively short atmospheric lifespan of only 12 years, but has a higher GWP than CO_2.

Nitrous oxide concentrations have increased from about 270 ppb in pre-industrial times to about 319 ppb by 2005.[20] Most of this increase can be attributed to agricultural practices (such as soil and manure management), as well as fossil-fuel combustion and the production of some acids. Nitrous oxide's 120-year atmospheric lifespan increases its role in global warming.

Besides CO_2, CH_4, and N_2O; there are several gases and categories of gases that were not present in the atmosphere in pre-industrial times but now exist and contribute to warming. These include CFCs, used often as refrigerants, and their more stratospheric-ozone-friendly replacements, HFCs. Fully fluorinated species, such as SF_6 and tetrafluoromethane (CF_4), are present in the atmosphere in relatively small concentrations, but have extremely long life spans of 50,000 and 3,200 years each, making them potent GHGs.

2.4 Current and Projected Climatic Impacts of Global Warming

A strong indication that global warming is currently taking place is the fact that the top seven warmest years since the 1890s occurred after 1997. Furthermore, a warming of about 0.2°C per decade is projected by currently accepted models.

There is a scientific consensus that global climate change will increase the frequency of heat extremes, heat waves, and heavy precipitation events. Other likely direct effects include an increase in the areas affected by drought and by floods, an increase in tropical cyclone activity, a rise in sea level, and recession of polar ice caps. The impacts of global warming have already been demonstrated by substantial ice loss in the Arctic.[21] Figure 2-2 shows the rise of global temperatures, the global rise of sea level, and the loss of snow cover from 1850 to the present.

[19] Page 4 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers."
[20] Page 4 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers."
[21] Statistics from IPCC Working Group I and II Reports.

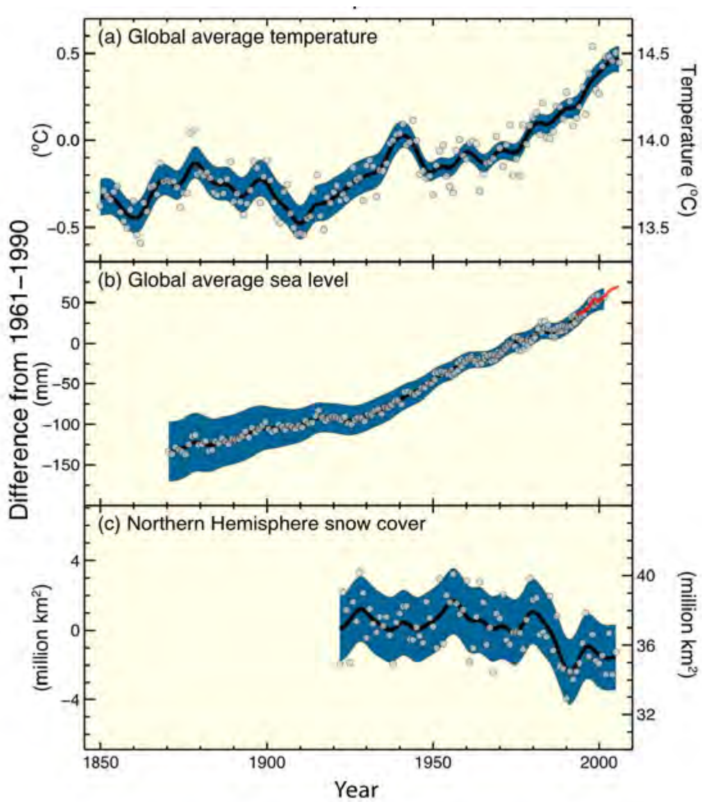

Figure 2-2. Global warming trends and associated sea level rise and snow cover decrease.[22]

2.5 Socioeconomic Impacts of Global Warming

Global temperature increases may have significant negative impacts on ecosystems, natural resources, and human health. Ecosystem structure and biodiversity will be compromised by temperature increases and associated climatic and hydrological disturbances.[23] The availability and quality of potable water resources may be compromised by increased salinisation of ground water due to sea-level rises, decreased supply in semi-arid and arid locations, and poorer water quality arising from increased water temperatures and more frequent floods and droughts.[24] These impacts on freshwater systems, in addition to the effects of increased drought and flood frequencies, can reduce crop productivity and food supply.

In addition to compromising food and water resources, there are other means through which climatic changes associated with global warming can affect human health and welfare. Warmer temperatures can cause more ground-level ozone, a pollutant that causes eye irritation and respiratory problems. Ranges of infectious diseases will likely increase and some areas will face greater incidences of illness and mortality associated with increased flooding and drought events.

[22] Figure SPM-3 of the IPCC "Climate Change 2007: The Physical Science Basis, Summary for Policymakers."
[23] From the IPCC Working Group II Report.
[24] From the IPCC Technical Paper VI: "Climate Change and Water". Available online at: http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf

In its April 2007 Working Group II Report, the IPCC provided an assessment of the "current scientific understanding of impacts of climate change on natural, managed and human systems, the capacity of these systems to adapt and their vulnerability".[25] Here, the IPCC states that although some people will gain and some will lose because of global climate change, the overall change will be one of social and economic losses. California in particular is an area that could be negatively impacted by global warming. Global warming could alter the seasonal pattern of snow accumulation and snowmelt, which serve as primary sources for California's drinking water and irrigation water supplies. The scientific community projects extensions in the periods of high forest fire risk. Climatic changes would also affect agriculture, a major California industry, which could result in economic losses. For example, the heat wave in July 2006 is estimated to have cost the California dairy industry in excess of one billion dollars.[26]

IPCC Fourth Assessment Report

It is important to recognize that the climatic conditions experienced by the Project over its designed lifetime are likely to be substantially different from those observed over the past century. Consequently, it is useful to consider the implications of changing climatic conditions for Project performance. Scenarios[27] for 2100 modeled in the IPCC Fourth Assessment Report (FAR) include:

Temperature Increase

- Low Emissions Scenario: 1.8°C (best estimate), with a range of 1.1°C to 2.9°C
- High Emissions Scenario: 4.0°C (best estimate), with a range of 2.4°C to 6.4°C

Sea Level Rise

- Low Emissions Scenario: 0.18 to 0.38 meters (range)
- High Emissions Scenario: 0.26 to 0.59 meters (range)

Potential implications for the Project include:

Sea level: Rising sea levels could directly impact the proposed Project due to its close proximity to the coast and relative elevation.

Temperature: Rising temperatures could have a variety of impacts, including stress on sensitive populations (e.g., sick and elderly), additional burden on building systems (e.g., demand for

[25] Available online at: http://www.ipcc-wg2.org/index.html
[26] Office of the Governor.
[27] Future GHG emissions are the product of very complex dynamic systems, determined by driving forces such as demographic development, socio-economic development, and technological change. Their future evolution is highly uncertain. Scenarios are alternative images of how the future might unfold and are an appropriate tool with which to analyze how driving forces may influence future emission outcomes and to assess the associated uncertainties. They assist in climate change analysis, including climate modeling and the assessment of impacts, adaptation, and mitigation. The possibility that any single emissions path will occur as described in scenarios is highly uncertain. More information on the IPCC's selection of scenarios is available at http://www.ipcc.ch/ipccreports/sres/emission/index.htm.

conditioning), and, indirectly, increasing emissions of greenhouse gases and criteria pollutants associated with energy generation. It is not possible to reliably quantify these risks at this time.

Precipitation: Climate change is expected to alter seasonal and inter-annual patterns of precipitation. These changes continue to be one of the most uncertain aspects of future scenarios. For this Project, the most relevant direct impacts are likely to be changes in the timing and volume of stormwater runoff and changes in demand for irrigation. It is not possible to reliably quantify the implications of these changes at this time.

Wildfire: Changes in temperature and precipitation may combine to alter risks of wildfire. Changes in wildfire hazard have the potential to impact the Project; however, it is not possible to reliably quantify the implications of these changes at this time.

Water supply reliability: Changes in temperature and precipitation may also influence seasonal and inter-annual availability of water supplies. Consequently, it is reasonable to consider that climate change may affect water supply reliability. It is not possible to reliably quantify these risks for the Project at this time.

2.6 Impacts from Climate Change

The California Natural Resources Agency (CNRA)[28] recently prepared a document that discusses the impacts of climate change upon California, as well as California's climate adaptation strategy. The categories below are topics emphasized in the November 2008 Executive Order (S-13-08) which called on state agencies to develop California's first strategy to identify and prepare for these expected climate impacts. Adaptation strategies are addressed in the next section of this technical report.

2.6.1 Rising Temperatures

New projections by MIT modelers which predict a median probability of surface warming of 5.2 °C by 2100, which is much higher than previous modeling completed in 2003. [29] Researchers modeled temperature changes specifically related to California.[30] The model predicted greater temperature increases in summer than winter, and larger increases inland compared to the coast.

2.6.2 Tipping Elements

The CNRA emphasized "tipping elements", which bring about "abrupt changes that could push natural systems past thresholds beyond which they could not recover". According to the CNRA, there are four main events that could bring about abrupt environmental changes. Each of these four has a particular tipping temperature at which the event is likely to occur. The consequence

[28] California Natural Resources Agency. 2009 California Climate Adaptation Strategy. Discussion Draft. .

[29] Sokolov A, Stone P, Forest C, Prinn R, Sarofim M, et al. (2009) Probabilistic forecast for 21st century climate based on uncertainties in emissions (without policy) and climate parameters. Journal of Climate: 2009 early online release, posted May 2009.

[30] Incorporated by reference. Moser, Susanne, Guido Franco, Sarah Pittiglio, Wendy Chou and Dan Cayan (2008). The Future is Now: An Update on Climate Change Science Impacts and Response Options for California. 2008 Climate Change Impacts Assessment Project - Second Biennial Science Report to the California Climate Action Team, CEC-500-2008-071, Sacramento, CA.

of crossing each threshold could cause a 7-12 m rise in sea level over the course of several centuries as shown in the table below.

Tipping elements that could trigger abrupt environmental changes.

Additional Warming (ºF)	Environmental Change	Length of Time
1-3	Rapid Arctic sea ice melt	10 years
2-4	Irreversible melting of the Greenland Ice Sheet	300+ years
5-9	Irreversible melting of the West Antarctic Ice Sheet	300+ years
5-7	Amazon forest die-back	None given
6-11	Intensification of ENSO cycles	None given

2.6.3 Extreme Natural Events

In addition, CNRA reports that extreme natural events are likely to occur, including higher nighttime temperatures and longer, more frequent heat waves overall; 12-35% decrease in precipitation levels by mid- to late-21st century; increased evaporation and faster incidences of snowmelt that will increase drought conditions, and more precipitation in the form of rain as compared to snow that will decrease water storage in California during the dry season and increase flood events during the wet season.[31]

2.6.4 Precipitation Changes and Rivers

CNRA also states that climate change will intensify California's "Mediterranean climate pattern", with the majority of annual precipitation occurring between November and March and drier conditions during the summer.[32] This will increase droughts and floods and will affect river systems. One of the ways to quantify potential impacts related to river system was through calculating a rise in water temperature and its effects on fisheries resources. [33]

2.6.5 Sea Level Rise

CNRA states that sea level rise can cause damage to coastal communities and loss of land, which could reach tens of billions of dollars per year in direct costs and trillions of dollars of assets in collateral risk. [34] Current calculations of sea level rise from 1900 to 2000 estimate

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[31] Cayan, Dan, Mary Tyree, Mike Dettinger, Hugo Hidalgo, Tapash Das, Ed Maurer, Peter Bromirski, Nicholas Graham, and Reinhard Flick (2009). Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment. PIER Research Report, CEC-500-2009-014, Sacramento, CA: California Energy Commission.

[32] Cayan et al. 2009

[33] Crossin, G.T., S.G. Hinch, S.J. Cooke, D.W. Welch, D.A. Patterson, S.R.M. Jones, A.G. Lotto, R.A. Leggatt, M.T. Mathes, J.M. Shrimpton, G. Van Der Kraak and A.P. Farrell. 2008. Exposure to high temperature influences the behavior, physiology, and survival of sockeye salmon during spawning migration. Canadian Journal of Zoology. 86(2): 127-140.

[34] Kahrl, F. and D. Roland-Holst (2008). California Climate Risk and Response. Berkeley, CA: University of California-Berkeley, Department of Agricultural and Resource Economics.

approximately 7 inches along the California coast. [35] Further, up to 55 inches of sea-level rise globally by the end of the 21st century is predicted under the continued higher emission assumption models.

2.6.6 Low Sea Ice Levels

The CNRA states says that substantial sea ice melting from Greenland and the West Antarctic Ice Sheet has the potential to further raise sea levels. The sea ice extent in the Western Nordic Seas (i.e., Greenland, Norway, and Iceland Seas) is at the lowest level observed in the last 800 years. The implication being that a substantial reduction in sea ice in the Arctic sea promotes alterations in atmospheric circulation and precipitation patterns that extend to the mid-latitudes (e.g., the California coast). Additionally, it was reported that the variations in sea ice extent are correlated with changes in sea surface temperatures and atmospheric and ocean heat transport from the North Atlantic. [36]

The West Antarctic Ice Sheet is a marine-based ice sheet with edges that flow into floating ice shelves. Both the main sheet and the surrounding shelves have been showing signs of shrinking and collapsing due to global warming. Researchers have tracked the fate of at least nine shelves that have receded or collapsed around the Antarctic peninsula in the past 50 years. [37]

2.6.7 Ocean Chemistry

The CNRA also notes that an emerging effect from climate change may be acidification of the ocean. In turn, acidification will affect the ability of hard-shelled invertebrates to create their skeletal structures. [38] The implications of this change being major losses to shellfish industries, and shifts in food resources for ocean fisheries. The primary contributing factors were cited as increasing levels of CO_2 and weather pattern shifts. Increases in CO_2 results in increased uptake by the oceans, which result in decreased pH (acidification). Weather pattern shifts change the amount of calcium carbonate being delivered by rivers from sources stored in rocks, which further exacerbates the ability of invertebrates to form calcified shells. [39]

2.6.8 Permafrost Thaws

One of the main contributing factors to CO_2, outside of human influences, is melting permafrost. When permafrost thaws, it releases carbon into soil or beneath lakes and releases CO_2 and methane into the atmosphere. Scientists are now estimating that there is more than twice the

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[35] Cayan et al. 2009

[36] Fauria, M.M., A. Grinsted, S. Helama, J. Moore, M. Timonen, T. Martma, E. Isaksson, and E. Eronen. 2009. Unprecedented low twentieth century winter sea ice extent in the Western Nordic Seas since A.D. 1200. Climate Dynamics. Published online: 12 June 2009.

[37] Doyle, A. 2009. Antarctic ice shelf set to collapse due to warming. Roche, A. (ed) In Reuters UK. Thomas Reuters. January 19, 2009. Website: http://uk.reuters.com/articlePrint?articleId=UKTRE50I4G520090119

[38] Risien, J. (ed.). 2009. West Coast Regional Marine Research and Information Needs. Corvallis, Oregon: Oregon Sea Grant. ORESU-Q-09-001.

[39] Griffith, E.M., A. Paytan, K. Caldeira, T. D. Bullen and E. Thomas. 2008. A dynamic marine calcium cycle during the past 28 million years. Science. December 12, 2008.

total amount of carbon stored in permafrost as there is in atmospheric carbon dioxide, and "could amount to roughly half those resulting from global land-use change during this century".[40]

2.7 California-specific Adaptation Strategies

The CNRA[41] discusses California's climate adaptation strategy. General themes from the report regarding adaptation strategies are summarized below although the report also includes many specific examples of how California may adapt to a changing climate.

Because climate change is already affecting California and current emissions will continue to drive climate change in the coming decades, regardless of any mitigation measured that may be adopted, the necessity of adaptation to the impacts of climate change is recognized by the state of California. The *2009 California Climate Adaptation Strategy Discussion Draft* begins what will be an on-going process of adaptation, as directed by Gov. Schwarzenegger's Executive Order S-13-08. The goals of the strategy are to analyze risks and vulnerabilities and identify strategies to reduce the risks. Once the strategies are identified and prioritized, government resources would be identified. Finally, the strategy includes identifying research needs and educating the public.

Climate change risks are evaluated using two distinct approaches: (1) projecting the amount of climate change that may occur using computer-based global climate models and (2) assessing the natural or human system's ability to cope with and adapt to change by examining past experience with climate variability and extrapolating this to understand how the systems may respond to the additional impact of climate change. The major anticipated climate changes expected in the State of California include increases in temperature, decreases in precipitation, particularly as snowfall, and increases in sea level, as discussed above. These gradual changes will also lead to an increasing number of extreme events, such as heat waves, wildfires, droughts, and floods. This would impact public health, ocean and coast resources, water supply, agriculture, biodiversity and the transportation and energy infrastructure.

Key preliminary adaptation recommendations included in the *Strategy* are as follows:

- Appointment of a Climate Adaptation Advisory Panel;
- Improved water management in anticipation of reduced water supplies, including a 20% reduction in per capita water use by 2020;
- Consideration of project alternatives that avoid significant new development in areas that cannot be adequately protected from flooding due to climate change;
- Preparation of agency-specific adaptation plans, guidance or criteria by September 2010;
- Consideration of climate change impacts for all significant state projects;
- Assessment of climate change impacts on emergency preparedness;

[40] Schuur, E.A.G. et al. 2008. Vulnerability of Permafrost Carbon to Climate Change: Implications for the Global Carbon Cycle. BioScience. 58(8): 701-714.
[41] California Natural Resources Agency. 2009 California Climate Adaptation Strategy. Discussion Draft.

- Identification of key habitats and development of plans to minimize adverse effects from climate change;
- Development of guidance by the California Department of Public Health by September 2010 for use by local health departments to assess adaptation strategies;
- Amendment of Plans to assess climate change impacts and develop local risk reduction strategies by communities with General Plans and Local Coastal Plans; and
- Inclusion of climate change impact information into fire program planning by state fire fighting agencies.

2.8 Global, National, and California-wide GHG Emissions Inventories

Worldwide emissions of GHGs in 2004 were 26.8 billion tonnes of CO_2e.[42] In 2004, the US emitted about 7 billion tonnes of CO_2e or about 24 tonnes of CO_2e per year per person.[43] Over 80% of the GHG emissions in the US are comprised of CO_2 emissions from energy related fossil fuel combustion. In 2004, California emitted 0.492 billion tonnes of CO_2e, or about 7% of the US emissions.[44] If California were a country, it would be the 16th largest emitter of GHGs in the world.[45] This large number is due primarily to the sheer size of California. Compared to other states, California has one of the lowest per capita GHG emission rates in the country. This is due to California's higher energy efficiency standards, its temperate climate, and the fact that it relies on substantial out-of-state energy generation.

In 2004, 81% of greenhouse gas emissions (in CO_2e) from California were comprised of CO_2 emissions from fossil fuel combustion, with 4% comprised of CO_2 from process emissions. CH_4 and N_2O accounted for 5.7% and 6.8% of total CO_2e respectively, and high GWP gases[46] accounted for 2.9% of the CO_2e emissions. Transportation is by far the largest end-use category of GHG emissions. Transportation includes that used for industry (i.e., shipping) as well as residential use.

2.9 Potential for Reduction of GHG Emissions

In May 2007, the IPCC produced its Working Group III Report on the "scientific, technological, environmental, economic and social aspects" of reducing GHG emissions to alleviate climate change.[47] The report concluded that, even with current policies for sustainable development and mitigation of climate change, global GHG emissions will continue to grow over the next several decades.

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[42] Sum of Annex I and Annex II countries without counting Land-Use, Land-Use Change and Forestry (LULUCF) http://unfccc.int/ghg_emissions_data/predefined_queries/items/3814.php For countries for which 2004 data was unavailable, the most recent year was used.

[43] 2006 Inventory of U.S. Greenhouse Gas Emissions and Sinks. Available online at: http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/RAMR6MBLP4/$File/06ES.pdf

[44] California Air Resources Board. Note that 2004 is typically the most recent inventory year presented by the ARB; as such, USA- and world-wide emissions from 2004 are presented here to keep the comparison years the same.

[45] Anywhere between the 12th and 16th depending upon methodology. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. California Energy Commission.

[46] Such as HFCs and PFCs.

[47] Available online at: http://www.ipcc.ch/ipccreports/ar4-wg3.htm

3 Greenhouse Gas Inventory

This section describes the methods that ENVIRON International Corporation (ENVIRON) used to estimate GHG emissions from CP-HPS Plan after development and full build out for the Project, Variant 1, and Variant 2. It includes some aspects that are fully within the control of Lennar Urban, such as grading and the placement of utilities; some aspects that are in control of the individuals building the houses and commercial buildings, such as construction emissions; and some aspects for which control over emissions is shared by the developers and the residents, such as energy use in the built environment and emissions from traffic by the development's future residents and employees in the commercial areas. In addition, an estimate of "life-cycle" GHG emissions (i.e., GHG emissions from the processes used to manufacture and transport materials used in the buildings and infrastructure) is presented. This estimate is to be used for comparison purposes only and is not included in the final inventory as these emissions would be attributable to other industry sectors under AB 32. The inventory does not consider whether the emissions from the development are "new" in the sense that, absent the development, the emissions may not occur. Each aspect of the GHG inventory is described in this section. Actual GHG emissions at full build-out at CP-HPS Plan are expected to be substantially lower due to regulatory developments; therefore, the GHG emissions reported in this section are a conservative estimate.

3.1 Evaluation of "New" Emissions

Given the global nature of GHG impacts, it is difficult to determine which emissions from a given project are "new" on a global scale. As described in this section, there are methods of estimating emissions from certain aspects of projects, such as that from the additional vehicle travel associated with CP-HPS Plan. However, it is not clear how to determine what proportion of those emissions are truly additional, or new, in the global sense, or what proportion of those emissions would have occurred globally without CP-HPS Plan.

Analyses for evaluating the airborne criteria pollutant impacts of new projects for inclusion in environmental documents have already, in a sense, addressed the issue of what is "new". However, the impacts of GHG emissions differ from those of criteria pollutants in that they are a function of global concentrations rather than local concentrations and, therefore, specific locations of where emissions occur is less important than for criteria pollutants. The calculation of "project" criteria pollutants (oxides of nitrogen, sulfur oxides, carbon monoxide, volatile organic compounds, lead, and particulate matter) in air quality emissions inventories for use in EIRs has a long history. The South Coast Air Quality Management District (SCAQMD) first published a comprehensive manual on the analysis of air quality impacts in 1993, and the Bay Area Air Quality Management District (BAAQMD) followed in 1999. Other smaller districts have prepared detailed guidance documents that describe the methods that should be used to calculate emissions inventories for EIRs from projects, including residential and commercial projects.

The goal of estimating emissions of criteria pollutants from projects is to understand whether there are significant new emissions in California's air basins, which have a limited ability to absorb additional criteria pollutant emissions without adverse air quality impacts. A review of how air quality analyses typically address the issue of whether emissions are "new" is instructive as to how to address the emissions of GHGs. However, unlike with criteria pollutants, the impacts of GHG emissions are a function of their global concentrations, rather than local concentrations. Thus, the question of whether or not a project's GHG impacts are significant, both on a project basis and on a cumulative basis, must be asked based on global, rather than basin-wide, considerations.

When evaluating the air quality impacts for a new project, such as a residential development, the vehicular emissions associated with the residents as they work and shop within the basin are counted as new emissions in traditional air quality analyses, even if those new residents would have moved from another house in the same air basin. The typical rationale for this approach is that the new residential development represents growth in the basin. As a result, all emissions associated with its residents' vehicle travel should be counted as new emissions, even if this might lead to some over-counting of criteria pollutant emissions from CP-HPS Plan.

World rankings of nations' GHG emissions generally depend on which gases are accounted for, and whether land use changes are considered. Without considering land use changes, in recent years, the US has been the top GHG-emitting country in the world. When all of the developing countries are grouped together, they contribute approximately 52% of the world-wide GHG emissions.[48]

To understand the global scale impact of GHGs, it is useful to understand that the increase of new GHG emissions globally is caused by economic and population growth. Emission growth rates are the highest among developing countries. While GHG emissions in developed countries were unchanged over the 1990-2002 period, emissions increased by 47% in developing countries during that same time period. Emissions in China grew about 50% during that time period -- preliminary estimates show that China's GHG emissions increased 35% in 2003 and 2004 alone. This increase in developing country GHG emissions is due to the increasing demand for higher standards of living as a result of GDP growth, requiring more vehicles and greater electricity demand. Also, developing countries often lack the technology or capital to utilize energy efficient products or to construct cleaner burning power plants. GHG emissions in China are growing slightly faster than primary energy use as the fuel mix increasingly favors coal, a high-carbon fuel. China accounts for 39% of projected increase between 2004 and 2030, and will overtake the United States as the world's biggest emitter before 2010.[49]

In the developed world, GHG increases are directly tied to population growth. Therefore, it makes sense to consider operational emissions (including vehicular emissions) from new residences as growth, as residences are rarely removed from the housing supply once constructed. There are exceptions, such as when one housing development replaces another, and, in those cases, the replacement residential development need not be considered growth. There are 256 existing residential dwelling units that are directly being replaced in the CP-HPS Plan. These replacement dwelling units and associated GHG emissions are therefore not considered in the net new GHG emission inventory. Due to the fact that older buildings are less

48 Baumert, K.A., T. Herzog, J. Pershing. 2005. Navigating the Numbers: Greenhouse Gas Data and International Climate Policy. (http://www.wri.org/climate/pubs_description.cfm?pid=4093)

49 http://www.iea.org/textbase/weo/fact_sheets/fs_GlobalEnergyTrends.pdf (accessed June 12, 2007) *World Energy Outlook 2006: Fact Sheet- Global Energy Trends The World's Energy Future: Where Are We Headed?*

energy efficient than newer buildings, this will result in an overestimate of CP-HPS Plan emissions.

However, it is not clear that non-residential (i.e. office space, retail space, and industrial buildings) development should be considered new growth for vehicular travel purposes. To the extent that non-residential development serves existing residential development, its vehicular travel may not be new. For instance, if the new non-residential area serves an area with a high residential/ non-residential balance, then this new non-residential growth will reduce shopping and work trip lengths and will reduce GHG emissions associated with mobile sources. If, however, the new non-residential area results in longer trips for its workers and shoppers than they would have previously made, then it adds GHGs emissions. Non-residential development that could potentially increase VMT would be facilities that draw trips from far away that otherwise would not be made. A theme park, for example, may be viewed as such a development.

In this report, it is assumed that the new non-residential area serves an area with a high residential/ non-residential balance. Therefore, this new non-residential growth likely will reduce shopping and work trip lengths from existing residences, and can reduce GHG emissions associated with mobile sources. Since the stadium is a replacement of an already existing stadium it would not considered to be a new facility that would draw trips from far away that otherwise would not be made since these trips are already being made. Therefore, there is not expected to be an increase in VMT associated with the construction of the new stadium. However, if the stadium is not built, as in Variants 1 and 2, there would be a reduction in trips drawn from afar. These reductions are not considered in the estimation of emissions from Variants 1 and 2. The music venue in CP is considered new non-residential facility that could draw trips that otherwise would not be made. The trips associated with customers and employees of the music venue are considered in the inventory.

The approach described above is different than that for criteria emissions. For criteria pollutants, if new emissions move into the basin, although there is a reduction in criteria emissions elsewhere, these emissions are new to the basin and therefore counted. For GHGs, if the emissions simply moved from one basin to another, the emissions would not be new on a global scale. To evaluate the sustainability of new non-residential developments, one must ask if the shoppers' and workers' travel distances to the new non-residential development are longer or shorter than the distances those same individuals currently travel to their non-residential areas. Since the CP-HPS Plan is an infill development, it is likely that its establishment will not lengthen shopping trips.

To the extent that new non-residential development serves new residential development, much of the non-residential vehicle travel would already be counted in the evaluation of the new residential development. Although the vehicle trips would be already counted elsewhere, the operational emissions from heating and cooling the non-residential areas would be considered to be new, as there are new non-residential buildings that goes along with growth in residential areas.

This report presents two methods for analyzing the GHG emissions from VMT. The first method includes all residential and non-residential land use categories except for the stadium trips since these already exist and will only be displaced. The alternative analysis which is an assessment of the "new" emissions associated with growth assumes GHG emissions from VMT serving non-residential areas will only be counted if the non-residential areas contribute to greater VMT as a result of their locations. If the non-residential development lowers VMT, then it will be considered to have a zero or negative GHG contribution as a result of the fact that it has generated shorter operational vehicle trip lengths than would have otherwise occurred. It should be noted that as CP-HPS Plan is a mixed use community, this issue does not directly affect CP-HPS Plan VMT calculations; all VMT from net new CP-HPS Plan residents are calculated regardless of internal or external destinations or purpose of trip.

3.2 Units of measurement: Tonnes of CO_2 and CO_2e

The term "GHGs" includes gases that contribute to the natural greenhouse effect, such as CO_2, CH_4, N_2O, and water, as well as gases that are only man-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs) and CFCs. The most important greenhouse gas in human-induced global warming is CO_2. While many gases have much higher GWPs than CO_2, CO_2 is emitted in such vastly higher quantities that it accounts for 85% of the GWP of all GHGs emitted by the United States.[50]

The effect each of these gases has on global warming is a combination of the volume of their emissions and their GWP. GWP indicates, on a pound for pound basis, how much a gas will contribute to global warming relative to how much warming would be caused by the same mass of CO_2. CH_4 and N_2O are substantially more potent than CO_2, with GWPs of 21 and 310, respectively. GHG emissions are typically measured in terms of mass of CO_2e. CO_2e are calculated as the product of the mass of a given GHG and its specific GWP.

In many sections of this report, including the final summary sections, emissions are presented in units of CO_2e either because the GWPs of CH_4 and N_2O were accounted for explicitly, or the CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from that particular emissions category.

In this report, "tonnes" will be used to refer to metric tonnes (1,000 kilograms). "Tons" will be used to refer to short tons (2,000 lbs).

Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

3.3 Resources

To estimate GHG emissions from CP-HPS Plan, ENVIRON directly or indirectly relied primarily on four different types of resources: emissions estimation guidance from government-sponsored organizations, government-commissioned studies of energy use patterns, energy surveys by other consulting firms, and emissions estimation software. These sources are described below.

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[50] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004, U.S. Environmental Protection Agency. Available online at: http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/RAMR6MBSC3/$File/06_Complete_Report.pdf

3.3.1 Emissions Estimation Guidance

This inventory was developed using guidance from two government-sponsored organizations to assist in the estimation of GHG emissions. The first is the CCAR, which was established by the California Legislature to assist willing parties in estimating and recording their GHG emissions to use as a baseline for meeting future emissions reduction requirements. Publications by the CCAR include not only recommendations on how to compile a GHG emissions inventory, but also relevant data on energy use and emissions that are utilized in this protocol. The second organization is the IPCC, which was established in 1988 by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). The IPCC's main role is to assess information on climate change which is synthesized in IPCC reports, including methodology reports. These reports also include relevant emission factors and specific scientific data that can be used to estimate GHG activities from various activities.

3.3.2 Emissions and Energy Use Studies

For estimating emissions based on electrical and natural gas energy use, literature information on patterns of energy use must often be employed. Studies commissioned by the CEC provide data on energy use patterns associated with municipal activities, natural resource distribution, and other activities that will take place in CP-HPS Plan. These data were used to estimate energy use patterns which were applied to the specific characteristics of CP-HPS Plan to estimate GHG emissions. In addition to CEC studies, studies performed by individual municipalities or scientific organizations are also used in this report.

3.3.3 Emissions Estimation Software

The ARB, the SCAQMD, and other public and private organizations have developed several software programs to facilitate the calculation of emissions from construction, motor vehicles, and urban developments by streamlining emissions estimation from these sources. This inventory was developed using several models to estimate GHG emissions from the CP-HPS Plan development. These are the OFFROAD2007 model, the EMFAC model, and the URBEMIS model. The features of each of these models are described below.

OFFROAD – OFFROAD2007 is the most recent version of a model developed by the ARB to estimate the activity and emissions of off-road mobile emissions sources, such as construction equipment. OFFROAD contains a database of default values for horsepower, load factor, and hours per day of operation and can calculate emission factors based on the type of equipment and year of use.

EMFAC – EMFAC, also developed by ARB, compiles real fleet data on the county-level for the state of California, including vehicle model year distributions, vehicle class (e.g., light-duty auto (LDA), medium-duty truck, heavy-heavy-duty truck) distributions, and emission rate information to generate fleet-average emission factors for most criteria pollutants and CO_2. EMFAC2007 is the newest version of the program. Emission factors from EMFAC depend on the vehicle class, vehicle technology, speed, year of operation, average ambient air temperature, and relative humidity.

URBEMIS – The URBEMIS software was created by SCAQMD, although it is used by other air districts as well. It estimates emissions associated with different aspects of urban development. The Operational Data module in URBEMIS calculates emissions from mobile sources operating during the use of a development based on emission factors from EMFAC and traffic use information specific to a development. Mobile source emissions during the construction phase are calculated separately in the construction module of URBEMIS. URBEMIS provides county, air district / air basin, or state wide averages for number of daily trips per housing unit and per student at an elementary school in the absence of more specific information from traffic engineers. URBEMIS also provides air district-specific default values for vehicle fleet characteristics (vehicle class distribution and technology categories) and travel conditions (average trip length, trip speed, and relative frequency of each type of trip). URBEMIS (Version 9.2.2), uses EMFAC2007 emission factors and calculates CO_2 emissions using District-specific default parameters for various inputs including vehicle fleet characteristics and travel conditions.

In addition to mobile source emissions, URBEMIS can also calculate emissions associated with the construction phase of a development and emissions from area sources, such as fireplaces, once the development is operational. The URBEMIS construction module enables separate emissions calculations from each of the three typical stages of any construction project: demolition, site grading, and building construction. Based on the timing of construction and size of the development, URBEMIS defaults can be used to estimate emissions. Alternatively, the user can override these defaults by entering specific information about the construction project, such as what types and numbers of equipment are going to be used. In terms of area sources, URBEMIS is equipped to estimate GHG emissions from three types of GHG-emitting area sources based either on program defaults or more specific project information inputted by the user. These uses are natural gas fuel combustion, hearth fuel combustion, and landscaping equipment.

3.4 Indirect GHG Emissions from Electricity Use

As noted above, indirect GHG emissions are created as a result of electricity use. When electricity is used in a building, the electricity generation typically takes place offsite at the power plant; electricity use in a building generally causes emissions in an indirect manner. The CP-HPS Plan development is supplied power by Pacific Gas and Electric Company (PG&E). Accordingly, indirect GHG emissions from electricity usage are calculated using the PG&E carbon-intensity factor of 574 lb CO_2e per MW-hr which is an adjustment of PG&E's 2007 carbon-intensity factor of 636 to account for the 20% Renewable Portfolio Standard required by 2010.[51] This emission factor takes into account the current mix of energy sources used to generate electricity for PG&E and the relative carbon intensities of these sources.[52] Table 5-1 details the calculations for the carbon-intensity factor used.

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[51] California Climate Action Registry (CCAR) Database. Pacific Gas and Electric Company 2007 PUP Report. 2008.

[52] When calculating indirect emissions due to electricity usage, it is important to consider that indirect emissions from using a given amount of electricity will vary with the fuel-mix used to produce electricity. For example, CO_2 emissions per kW-hr from a coal-fired power plant are significantly higher than CO_2 emissions per kW-hr from a natural gas-fired power plant. Therefore, to most accurately estimate GHG emissions from the CP-HPS Plan development, the carbon intensity of the specific mix of energy sources PG&E uses to generate electricity was used to calculate emissions since PG&E is the most likely source of electricity for CP-HPS Plan.

3.5 Vegetation Change

This section presents the calculation of the positive GHG emissions associated with planting new trees at the CP-HPS Plan development. The CP-HPS Plan is on land classified as settlement as classified by the IPCC publication Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines).[53] There will be no changes in the land use classification. The overall CO_2 emissions due to vegetation change will result from the amount that can be expected to be sequestered by new plantings. The amount of CO_2 emissions sequestered by new plantings is discussed in this section.

In this section of this report, the units CO_2 and CO_2e are used interchangeably. CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from vegetation change.

3.5.1 Calculating CO_2 Sequestration by Trees

Planting individual trees on residential property and elsewhere in the CP-HPS Plan will sequester CO_2. Changing vegetation as described above results in a one-time carbon-stock change. Planting trees is also considered to result in a one-time carbon-stock change. Table 3-1 presents default annual CO_2 sequestration rates on a per tree basis, based on values provided by the IPCC. An average of 0.035 tonne CO_2 per year per tree can be assumed for trees planted, if the tree type is not known.

Urban trees are only net carbon sinks when they are actively growing. The IPCC assumes an active growing period of 20 years. Thereafter, the accumulation of carbon in biomass slows with age, and will be completely offset by losses from clipping, pruning, and occasional death. Actual active growing periods are subject to, among other things, species, climate regime, and planting density. In this report, the IPCC default value of 20 years will be assumed. Note that trees may also be replaced at the end of the 20-year cycle, which would result in additional years of carbon sequestration. However, this would be offset by the potential net release of carbon from the removal of the replaced tree.

Approximately 10,000 new net trees will be planted in CP-HPS Plan community.[54] Planting these trees in the community will sequester approximately 7,000 tonnes CO_2. This was calculated by using the average tree sequestration rate of 0.035 tonne CO_2 per year per tree and assuming 20 years of growth. This sequestration brings the net CO_2 emissions from vegetation to -7,000 tonnes (or a net decrease in the amount of CO_2 released). The net CO_2 emissions from vegetation changes are presented in Table 3-1.

3.6 Construction Activities

This section describes the estimation of GHG emissions from construction activities at CP-HPS Plan. GHG emissions from construction phases are largely attributable to fuel use from construction equipment and worker commuting.

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[53] Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm
[54] Site-specific planting data provided by Lennar Urban.

CO_2 emissions associated with different aspects of urban development can be estimated using a combination of software programs. The OFFROAD2007[55] and the EMFAC2007[56] models are used to generate emission factor data for construction equipment and motor vehicles, respectively. These values serve as inputs for the URBEMIS[57] model, which estimates emissions from several different aspects of urban development including from construction sources based on emission factors and information specific to the development.

In this section of this report, the units CO_2 and CO_2e are used interchangeably for diesel construction equipment because CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from construction equipment. For worker commuting, CH_4 and N_2O are explicitly calculated and therefore CO_2 and CO_2e for worker commuting are not equal.

3.6.1 Estimating GHG Emissions from Construction Equipment

This section describes how emissions from off-road equipment used during grading, building construction, and paving are calculated. It is important to note that GHG calculations are intended to estimate long-term emissions, while air quality emission calculations are intended to estimate worst-case daily scenarios. As such, the methodology presented in this section of the report will be different than the approach listed in the corresponding air quality section.

ENVIRON calculated emissions from construction equipment using the URBEMIS methodology. ENVIRON was provided with the number and type of equipment that will be used in the construction of CP-HPS Plan, as well as the duration of the different construction phases.[58] ENVIRON assumed that each piece of equipment will operate for 8 hours a day, five days a week during a given phase duration. An equipment hour is defined as one hour of a piece of equipment being used. Table 3-2 contains specifications for each type of construction equipment (horsepower, load factor, and GHG emission factor) provided by OFFROAD2007 and describes the detailed GHG calculations. CO_2 emissions for each type of construction equipment were calculated as follows:

> *Equipment Emissions [grams] = Total equipment-hours * emission factor [grams per brake horsepower-hour] * equipment horsepower * load factor*[59]

The contributions of CH_4 and N_2O to overall GHG emissions is likely small (< 1% of total CO_2e) from diesel construction equipment,[60] and were therefore not included in this calculation.

The total GHG emissions from all construction equipment are 56,403 tonnes CO_2 at CP and 42,895 tonnes CO_2 at HPS for a total of 99,298 tonnes CO_2.

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[55] California Air Resources Board Mobile Source Emissions Inventory Program. December 2006. http://www.arb.ca.gov/msei/offroad/offroad.htm

[56] Emission Factors (EMFAC2007) model (Version 2.3). November 2006. California Air Resources Board. http://www.arb.ca.gov/msei/onroad/latest_version.htm

[57] Urban Emissions Model (URBEMIS) (Version 8.7 – 2002 / Version 9.2.4 – 2008). Jones & Stokes Associates. Prepared for: South Coast Air Quality Management District. http://www.urbemis.com

[58] Received from MacTech.

[59] Load factor is the percentage of the maximum horsepower rating at which the equipment normally operates.

[60] California Climate Action Registry (CCAR). 2009. *General Reporting Protocol*. Version 3.1. ENVIRON estimates these emissions to be less than 1% of total GHG contributions for diesel fueled equipment.

3.6.2 GHG Emissions from Worker Commuting

Emissions from worker commuting are associated with workers involved in all construction subphases. GHGs are emitted from worker vehicles in two ways: running emissions, produced by driving the vehicle, and startup emissions, produced by turning the vehicle on. The majority of worker commute emissions are running emissions. Table 3-3 details emission calculations for worker commutes.

Total running emissions from worker commuting during each phase were calculated by estimating the total Vehicle Miles Traveled (VMT) by construction workers, and then multiplying this value by the representative GHG emission factors for the vehicles they are expected to drive. The total VMT by construction workers for a given phase is calculated as follows:

VMT = Number of worker trips x average one-way commute length x 2 commutes/day

The number of workers and duration of each subphase was provided to ENVIRON by MacTech. The length of the average one-way commute was assumed to be 14.9 miles[61].

After total VMT for CP-HPS Plan is calculated, GHG emissions for this development can be calculated from the following equation:

CO_2 emissions = VMT * [0.5 * EF_{LDA} + 0.5 * EF_{LDT2}]

Where:

VMT = vehicle miles traveled
EF_{LDA} = emission factor of light duty autos
EF_{LDT2} = emission factor of light duty trucks: up to 8500 GVW

The CO_2 calculation involves the following assumptions:

a. URBEMIS defaults assume that half of the workers commute with light duty trucks (LDTs) and half commute in light duty autos (LDAs).[62]

b. The emission factor depends upon the speed of the vehicle. The URBEMIS default value of 30 miles per hour was used.

c. EMFAC emission factors from the year 2011 were used for EF_{LDA} and EF_{LDT2}.

Startup emissions are CO_2 emitted from starting a vehicle. GHG emissions from startup for this development can be calculated from the following equation:

CO_2 emissions = Number of Work trips * [0.5 * EF_{LDA} + 0.5 * EF_{LDT2}] * 2 commutes/day

For construction workers during all phases, the startup emissions were calculated using the following assumptions:

[61] This represents the home-based work trip length provided by Fehr and Peers for San Francisco.
[62] Page A-9 of the URBEMIS user manual.

a. The number of round trips were equal to the number of worker days,

b. The breakdown in vehicles was 50% light duty autos and 50% light duty trucks,

c. Two engine startups per day with a 12 hour wait before each startup.[63]

The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their GWPs.[64] To incorporate these additional GHGs into the calculations, the total GHG footprint was calculated by dividing the CO_2 emissions by 0.95.

Table 3-3 summarizes the emission calculations for worker commutes. The total amount of GHG emissions from worker commuting during all phases is a one-time emission of 1,807 tonnes at CP and 2,265 tonnes at HPS for a total of 4,073 tonnes.

3.6.3 Hauling

Hauling involves removing material from the site during construction phases. Based on information provided to ENVIRON by MacTech, it is estimated that there will be 44,060 hauling trips for CP-HPS Plan. The number of trips is multiplied by the roundtrip length to determine total VMT. After total VMT for the hauling at CP-HPS Plan is calculated, CO_2 emissions from mobile running for this development can be calculated from the following equation:

CO_2 emissions from mobile running = VMT * EF_{HHD}

Where:

VMT = vehicle miles traveled (based on 14.6 miles round trip distance)
EF_{HHD} = emission factor of heavy heavy-duty trucks

The CO_2 calculation involves the following assumptions:

a. URBEMIS defaults assume that hauling trips use heavy heavy-duty trucks (HHDs).[65]

b. The emission factor depends upon the speed of the vehicle. The URBEMIS default value of 30 miles per hour was used.

c. EMFAC emission factors from the year 2011 were used for EF_{HHD}.

Startup emissions are CO_2 emitted from starting a vehicle. Startup emissions for hauling trips were calculated using the following assumptions:

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[63] The emission factor grows with the length of time the engine is off before each ignition.
[64] USEPA. 2005. *Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle.* Office of Transportation and Air Quality. February.
[65] Page A-12 of the URBEMIS user manual.

a. The breakdown in vehicles was all heavy heavy-duty trucks,

b. Two engine startups per day with a 12 hour wait before each startup.[66]

The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their GWPs.[67] To incorporate these additional GHGs into the calculations, the total GHG footprint was calculated by dividing the CO_2 emissions by 0.95. The total amount of GHG emissions from hauling is a one-time emission of 1,316 tonnes of CO_2e at CP and 901 tonnes of CO_2e at HPS for a total of 2,216 tonnes of CO_2e as shown in Table 3-4.

Table 3-5 shows total one-time GHG emissions for construction, including off-road equipment, worker commuting, and hauling to be 59,526 tonnes CO_2e at CP and 46,061 tonnes CO_2e at HPS for a total of 105,587 tonnes CO_2e for the CP-HPS Plan development.

3.6.4 Uncertainties in Construction GHG Emissions Calculations

ENVIRON was provided with the phase length and number of each type of construction equipment during construction of buildings.[68] The number of construction equipment, worker and haul trips represent MacTech's estimates at time of this report. The calculations also used default values and settings from URBEMIS. This includes no consideration for reductions in GHG emissions due to new regulations and changes in off-road construction equipment and vehicles used for worker commuting and haul trips. As such, these values are somewhat uncertain.

3.7 GHG Emissions Associated with Residential Buildings

This section describes the methods used to estimate the GHGs associated with activities in residential buildings.

The amount of energy—and, therefore, the amount of associated GHG emissions emitted per dwelling unit— will vary with the type of residential building. Accordingly, information on the type of residential buildings that are planned for CP-HPS Plan is required to estimate GHG emissions. The main residential buildings at CP-HPS Plan provided by Lennar Urban are condos, townhomes, and other multi-family homes.

GHGs are emitted as a result of activities in residential buildings when electricity and natural gas are used as energy sources. Combustion of any type of fuel emits CO_2 and other GHGs directly into the atmosphere; when this occurs in a residential building, it is a direct emission source[69] associated with that building. GHGs are also emitted during the generation of electricity from fossil fuels. When electricity is used in a residential building, the electricity generation typically takes place offsite at the power plant; electricity use in a residential building generally causes emissions in an indirect manner.

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[66] The emission factor grows with the length of time the engine is off before each ignition.
[67] USEPA. 2005. *Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle.* Office of Transportation and Air Quality. February.
[68] Provided by MacTech.
[69] California Climate Action Registry (CCAR) General Reporting Protocol (GRP), Version 3.1 (April). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf, Chapter 8

While fuel combustion generates CH_4 and N_2O, the emissions of these GHGs typically comprise less than 1% of CO_2e emissions from electricity generation and natural gas consumption.[70] Fuel oil, kerosene, liquefied petroleum gas, and wood can also be used as fuels, but will likely contribute only in small amounts as combustion sources within residential buildings. Wood burning hearths are addressed in the area sources section of this report.

Energy use in residential buildings is divided into (1) energy consumed by the built environment, and (2) energy consumed by uses that are independent of the construction of the building, such as plug-in appliances. In California, Title 24 governs energy consumed by the built environment, including the HVAC system, water heating, and some fixed lighting. Non-building or 'plug-in' energy use can be further subdivided by specific end-uses (refrigeration, cooking, lighting, etc.). Energy use for each was calculated separately, as described in the following sections. The resulting energy use quantities were then converted to GHG emissions by multiplying by the appropriate emission factors, incorporating information on local electricity production and adjusted to account for the 20% Renewable Portfolio Standard required by 2010.[71]

In this section, the units CO_2 and CO_2e are used interchangeably for residential buildings because CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from residential buildings.

3.7.1 Estimate of Residential Energy Use Intensity

ENVIRON developed CO_2 intensity values (i.e., CO_2 emissions per Dwelling Unit per year) for the residential building types found in CP-HPS Plan using the California Energy Commission Consultant Report entitled 'California Statewide Residential Appliance Saturation Study (RASS)'.[72] The methods that were used and the assumptions that were made in estimating energy use are described below.

3.7.2 Energy Use in the Built Environment

New Californian homes must be designed to meet building energy efficiency standards (Title 24). Compliance with Title 24 is determined from the total daily valuation (TDV) of energy use in the built-environment (on a per square foot per year basis). The regulated energy uses include space heating and cooling, domestic hot water heating, and hard-wired lighting. TDV energy use is a parameter that reflects the burden that a building imposes on an electricity supply system. In general, there is a larger electricity demand and, hence, stress on the supply system during the day (peak times) than at night (off peak). To account for this variation, the calculation of TDV assigns different weights for energy used at different times. For example, a building that uses a given amount of electricity during the peak mid-day period will have a higher TDV value

[70] Ibid. Tables C1 and C2. The methane and nitrous oxide emission factors are negligible compared to the total CO_2 emission factor for electricity generation in California.

[71] The PG&E specific emission factor for electricity deliveries is 636 lbs CO_2/MWh. From the California Climate Action Registry Database: Pacific Gas and Electric Company 2007 PUP Report. 2008. Although this emission factor accounts for only CO_2, the emissions associated with N_2O and CH_4 contribute to less than 1% of the electricity generation CO_2e emissions. Available at: https://www.climateregistry.org/CARROT/public/Reports.aspx This emission factor has been adjusted to 574 lbs CO_2/MWh to account for the 20% RPS required by 2010.

[72] Kema-Xenergy, Itron, RoperASW. California Statewide Residential Appliance Saturation Study (RASS) Volume 2, Study Results, Final Report. June 2004. 300-00-004.

than a building using an equivalent amount of electricity during off-peak hours. Title 24 determines compliance by comparing the energy use of a modeled (or ‘proposed’) home to a minimally Title 24 compliant ‘standard home’ of equal dimensions. Title 24 focuses on building energy efficiency per square foot; it places no limits upon the size of the house or the actual energy used per dwelling unit.

To determine Title 24 compliance for space heating, space cooling, and domestic hot water systems, data from RASS was used to calculate the total energy use per dwelling unit. Estimates for hard-wired lighting will be discussed later in this section. The study estimates the unit energy consumption (UEC) values for individual households surveyed and also provides the saturation number for each type of end-use. The saturation number indicates the proportion of households that have a demand for each type of end-use category.

The most applicable data provided in RASS was used to estimate the UEC values for dwelling units at CP-HPS Plan. Where available, data for multifamily, 5+ unit apartment types in climate zone 5, which is the climate zone in which San Francisco is located, was used. If multifamily or climate zone 5 data was not available, then all household or statewide data was used, respectively. The RASS dataset is comprised of older buildings, which are typically less energy efficient (on a per square foot basis) than newer buildings constructed to meet increasingly stricter efficiency standards. Although the homes used for RASS are likely less energy efficient than Title 24-compliant buildings, the energy use estimates were used to represent 2001 Title-24 compliant homes. The Title 24 standards have been updated twice (in 2005 and 2008) since RASS, and CEC has published reports estimating the percentage deductions in energy use resulting from these new standards[73,74]. Because buildings at CP-HPS Plan would conform to the most updated (and most stringent) standards, ENVIRON accounted for the impact of the Title 24 updates by deducting the estimated percentage savings from the RASS energy use estimates.

RASS provides the annual electricity use per dwelling unit for various heating, cooling, and domestic hot water subcategories. ENVIRON calculated the total electricity demand for each category by multiplying the UEC and saturation values and summing the products for each end-use subcategory within each category. End-use subcategories used to calculate the electrical heating UEC value include conventional electric heating, electrical heat pump space heating, auxiliary heating, and furnace fan. Subcategories included in the cooling category include central air, room air, and evaporative cooling. RASS also provides the UEC values for natural gas usage used for heating and domestic hot water. The same method was used to calculate natural gas usage for each Title 24 category as described above. Natural gas subcategories used to estimate natural gas UEC heating values include primary heat and auxiliary heat; domestic hot water natural gas includes conventional gas water heat.

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[73] California Energy Commission. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF

[74] California Energy Commission. 2007. Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF

Title 24 compliant electricity use on a per dwelling unit basis is 542 kWh per dwelling unit per year. Natural gas use in Title 24 compliant residences on a per dwelling unit basis is 39 MBtu per dwelling unit per year.

Lennar Urban has committed to making all new homes 15% more energy efficient than Title 24 requirements, i.e., 15% more energy efficient on a TDV basis. ENVIRON assumed that all households would uniformly use 15% less annual energy. These calculations are shown in Table 3-6. Title 24 compliant energy use was calculated using the UEC values and saturation values from RASS as described above. These calculations include energy use for heating, air conditioning, DHW. These energy use numbers were then each multiplied by 0.85 to account for Lennar Urban's commitment to a 15% energy efficiency improvement over Title 24. This improvement over Title 24 reduces the electricity use to 286 kWh per year per dwelling unit. For natural gas, this improvement over Title 24 reduces usage on a per dwelling unit basis to 28 MBTU per year per dwelling unit. The calculations for major appliances and plug-in energy use are discussed in the next sections.

3.7.3 Energy Use for Major Appliances and Plug-Ins

Typical major household appliances provided in new residential units include refrigerator, clothes washer and dryer, dishwasher, and cooking range. These are typical appliances provided with a new residential unit that the developer has some control over. Energy demand from using these major appliances is based on UEC and saturations values from RASS.

Table 3-7 summarizes the estimated major appliance energy use for dwelling units at CP-HPS Plan. The annual electricity use of major appliances, taking into account the various types of housing proposed for the CP-HPS Plan, is 971 kWh per year per dwelling unit. In addition the annual natural gas use of major appliances is 3.1 MBtu per dwelling unit.

Lennar Urban has committed to requiring Energy Star appliances for all major appliances rated by Energy Star in newly built residences when the builder supplies appliances with the new home. This includes refrigerators, dishwashers, and clothes washers. There is no Energy Star rating for dryers at this time since there is no significant difference in energy use between different dryer models. Energy Star ratings also are not available for cooking ranges. The average energy improvement for Energy Star rated appliances over standard appliances as reported in Energy Star Annual Report was used to determine the percent reduction in energy use from major appliances.

In addition to major appliances, additional loads such as lighting, office equipment, plug-in cooking equipment and electronics other plug-in electricity loads, such as lighting in a miscellaneous category are also part of the anticipated energy use for a residential development. Similar to the major appliances above, energy use values for plug-in appliances are based on the UEC and saturation values for the miscellaneous category in RASS. The annual electricity use for plug-in appliances (miscellaneous) and lighting is 1,783 kWh for per dwelling unit.

Table 3-8 summarizes the combined energy use including the Title 24 systems, major appliances, and plug-ins. It should be noted that the estimates for residential plug-in energy-use presented here are likely overestimates. The estimates are based upon technologies that were available during the RASS survey, which was conducted in 2003. Future equipment models are likely to be more energy-efficient than current models. If future CP-HPS Plan residents install Energy Star appliances, use more energy efficient equipment, and replace incandescent lights with fluorescent lights, the actual electricity use for plug-ins will be lower than is estimated here. Conversely, future residents may have more small plug-ins (e.g. MP3 player, cell phone, miscellaneous equipment) that could somewhat offset the savings from more energy efficient equipment. However, because refrigerators, lighting, and large appliances contribute to the bulk of the electricity load, and these types of equipment will likely improve in energy efficiency in the future, the estimates presented here are still likely overestimates.

Table 3-8 shows the calculations for the improvement in energy use from Lennar Urban's commitment to a 15% improvement over Title 24 and their commitment to requiring Energy Star major appliances where available. This results in a 12% reduction in electricity use from Energy Star and a combined electricity savings of 9% when compared to a 2005 Title 24 compliant building with current carbon intensity values for electricity use.

3.7.4 Estimation of Annual Greenhouse Gas Emissions from Residential Buildings

Energy use data from Tables 3-8 were multiplied by the emission factors presented in Table 3-9 to generate CO_2 intensity values (i.e., CO_2 emissions per dwelling unit) for each building type. The builder has control over a portion of the estimated energy use for a residential building, the built environment and the initial major appliances. As shown in Table 3-10, the homes that are 15% more energy efficient than Title 24 have lower CO_2 emissions. When combined with Energy Star appliances, as shown in Table 3-10 the dwelling units emit 23% less CO_2 per year than current standard homes for the built environment and major appliances. As shown in Table 3-10, when plug-in loads are considered, dwelling units emit 20% less CO_2 per year, than the current Title 24 compliant homes without energy star appliances.

Table 3-11 shows the yearly CO_2 emissions from CP-HPS Plan by incorporating the aforementioned emission factors and the number of dwelling units for each building type for Title 24 systems and all plug-in energy. The number of dwelling units reflects only the net new units and does not consider the 256 replacement dwelling units. With15% improvements over Title 24, Energy Star appliances annual CO_2 emissions would be reduced to 19,035 tonnes (2.5 tonnes per unit) for CP, 6,642 tonnes (2.5 tonnes per unit) for HPS. The total emissions in this scenario would be 25,677 tonnes per year.

Variant 1 will be the same as the Project with a total of 25,677 tonnes per year. Variant 2 shifts 1,350 dwelling units from CP to HPS. The total net new units at CP will be 6,244 dwelling units with annual CO_2 emissions of 15,651 tonnes per year. HPS will have 4,000 dwelling units with annual CO_2 emissions of 10,026 tonnes per year. The total residential GHG emissions for Variant 2 is 25,677 tonnes CO_2e. This is shown in Table 3-12.

3.7.5 Uncertainties in Residential Building GHG Calculations

Several factors lead to uncertainties in the above analysis. These are described below. As described below, it is believed that these uncertainties result in conservative estimates of the GHG emissions for the residential buildings at CP-HPS Plan.

- Although all buildings in the development will be Title 24 compliant, Title 24 does not specify building dimensions (e.g. size, height, or orientation). Title 24 also provides significant flexibility for window types, window amounts, insulation choice, and other parameters. This uncertainty is not expected to either overestimate or underestimate emissions. Title 24 grants enough flexibility that if a designer puts in more windows than is 'allowed' under the prescriptive measures, the energy efficiency losses can be offset by improving the window quality, or installing a more efficient HVAC system. Although the designs of each residence are not yet known, each home will be Title 24 compliant, and thereby all design features of the home that make it less energy efficient will be offset by design features that make it more energy efficient.
- This analysis did not account for TDV of energy use. As such the reductions in GHG emissions may or may not be quantitatively reflective of the reductions if TDV is accounted for.
- Energy use will vary considerably depending upon the design of the home. The residential units to be built in CP-HPS Plan will vary considerably in size, layout, and overall design. The parameters used here are intended to represent the anticipated energy use of the homes. As such, energy use from the homes that will actually be built in CP-HPS Plan could be different.
- Built environment energy use will vary considerably depending upon the home owners' habits regarding energy use. For instance, homeowners determine the set point of thermostats, the duration of showers, and the usage of air conditioning, among other things. Lennar Urban will have little, if any, influence over these choices made by the homeowner. Current median behavior attributes were assumed for this report. To the extent that individuals are becoming more energy conscious, this will tend to overestimate energy use in the future.
- Plug-in energy use will also vary considerably depending upon the appliances, lights, and other plug-ins installed by the homeowner. Lennar Urban will have little, if any, influence over these choices made by the homeowner. As above, the current median behavior attributes are represented here. To the extent that individuals are becoming more energy conscious, or appliances are becoming more energy efficient, the estimates provided here will tend to overestimate energy use in the future.
- The energy use of the replacement dwelling units will likely be lower than the energy use of the new buildings. This reduction in energy use for the replacement dwelling units has not been accounted for and thus the estimate of energy use is conservative.

3.8 GHG Emissions Associated with Non-Residential Buildings

Non-residential buildings include all structures except residences that may exist in a development such as government, municipal, commercial, retail, and office space. This section describes the methods used to estimate the GHGs associated with activities in non-residential buildings.

The amount of energy used and the associated GHG emissions emitted per square foot of available space vary with the type of non-residential building. For example, food stores are far more energy intensive than warehouses, which have little climate-conditioned space. The CP-HPS Plan description provided data[75] summarizing the general non-residential building categories planned for CP-HPS Plan and the area of floor space planned for each building type. For new developments, the exact types of buildings are typically unknown. As such, not all building categories that may actually exist in CP-HPS Plan are represented below. However, all of the non-residential building area is accounted for, and the tables provided in this section present the differences in energy intensities from building type to building type. The types of non-residential buildings as provided to ENVIRON are:

a. Office

b. Retail

c. Research and Development

d. Artist Studios

e. Community Services

f. Hotel

g. Stadium

h. Performance Venue

Similar to the case for residential buildings, GHGs are emitted as a result of activities in non-residential buildings for which electricity and natural gas are used as energy sources. Combustion of any type of fuel emits CO_2 and other GHGs directly into the atmosphere; when this occurs in a non-residential building this is a direct emission source[76] associated with that building. GHGs are also emitted during the generation of electricity from fossil fuels. When electricity is used in a non-residential building, the electricity generation typically takes place offsite at the power plant; electricity use in a non-residential building generally causes emissions in an indirect manner.

While fuel combustion generates CH_4 and N_2O, the emissions of these GHGs typically comprise less than 1% of CO_2e emissions from electricity generation and natural gas consumption.[77]

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[75] The CP-HPS Plan description was used to estimate total square footage of buildings.
[76] California Climate Action Registry (CCAR) General Reporting Protocol (GRP), Version 3.1 (January 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf , Chapter 8
[77] Ibid., Tables C1 and C2. The methane and nitrous oxide emission factors are negligible compared to the total CO_2 emission factor for electricity generation in California.

Fuel oil, kerosene, liquefied petroleum gas, and wood can also be used as fuels, but generally contribute only in small amounts as combustion sources within non-residential buildings. As such, these minor emissions are not accounted for here.

Similar to energy use in residential buildings, energy use in non-residential buildings is divided into energy consumed by the built environment and energy consumed by uses that are independent of the construction of the building such as plug-in appliances. In California, Title 24 governs energy consumed by the built environment, mechanical systems, and some fixed lighting. Non-building energy use, or "plug-in" energy use can be further subdivided by specific end-use (refrigeration, cooking, office equipment, etc.). The following two steps were performed to quantify the energy use due to non-residential buildings:

1. Calculate energy use from systems covered by Title 24[78] (HVAC system, water heating system, and the lighting system).
2. Calculate energy use from office equipment, plug-in lighting, and other sources not covered by Title 24.

The resulting energy use quantities were then converted to GHG emissions by multiplying by the appropriate emission factors obtained by incorporating information on local electricity production.[79] The total GHG emissions for non-residential buildings in CP-HPS Plan is estimated to be 18,028 tonnes CO_2 per year. Variant 1 is estimated to be 27,418 tonnes CO_2 per year. Variant 2 is estimated to be 16,226 CO_2 per year. The following sections describe the methodologies employed to estimate GHG emissions.

In this section of this report, the units CO_2 and CO_2e are used interchangeably for non-residential buildings because CH_4 and N_2O are assumed to contribute a negligible amount of GWP when compared to the CO_2 emissions from non-residential buildings.

3.8.1 Estimate of Non-residential Energy Use Intensity

ENVIRON developed CO_2 intensity values (CO_2 emissions per sqft per year) for building types found in CP-HPS Plan using data from the California Commercial End-Use Survey (CEUS) except for the Stadium.[80] The methods that were used to estimate these emissions for CP-HPS Plan are described below.

3.8.1.1 CEUS Database

The overall electricity use for the building types except for the Stadium was calculated based on data provided by the CEC.[81] The CEUS data is based on a survey conducted in 2002 of

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[78] Title 24, Part 6, of the California Code of Regulations: California's Energy Efficiency Standards for Residential and Nonresidential Buildings. http://www.energy.ca.gov/title24/

[79] The PG&E specific emission factor for electricity deliveries is 636 lbs CO_2/MWh. From the California Climate Action Registry Database: Pacific Gas and Electric Company 2007 PUP Report. 2008. Although this emission factor accounts for only CO_2, the emissions associated with N_2O and CH_4 contribute to less than 1% of the electricity generation CO_2e emissions. Available at: https://www.climateregistry.org/CARROT/public/Reports.aspx This emission factor has been adjusted to 574 lbs CO_2/MWh to account for the 20% RPS required by 2010.

[80] California Energy Commission (CEC). California Commercial End-Use Survey Results. Data available from Itron Inc. at http://capabilities.itron.com/CeusWeb/Chart.aspx

[81] Workbooks for "PGE – FCZ5" downloaded from http://capabilities.itron.com/CeusWeb/Chart.aspx for all building categories. Access 7/15/2009.

existing buildings. Each building type has a characteristic electricity and natural gas use per square foot of building space. Electricity use per square foot (electricity intensity) for each building sample was extracted from the CEUS data. Similarly, the natural gas use per square foot (natural gas intensity) for each building sample was also extracted.

For this analysis, energy use was based upon buildings in California climate zone 5. Table 3-13 lists the breakdown of electricity use among several end uses for electricity in various non-residential building types. Table 3-14 lists the percentage breakdown of end uses for natural gas in various non-residential building types. The end use data provide an estimate of the percent of the total energy use comprised by Title 24 regulated (built environment) and plug-in electricity in each building type. The Title 24-regulated electricity use (cooling, space heating, water heating, lighting, ventilation) and the non-built electricity use (office equipment, refrigeration, cooking, etc.) are presented in Table 3-16. The Title 24-regulated natural gas use and the non-built natural gas use (primarily from cooking) are presented in Table 3-16.

3.8.1.2 Stadium

The Stadium energy use estimates are based on San Francisco Climate Action Plan which lists 1990 energy use for the Stadium. The Stadium electricity use in 1990 was 5.1 million kWhr per year and natural gas use was 9 million kBtu per year[82]. The new Stadium will likely be more energy efficient than the old Stadium built in 1960. It was assumed that the new Stadium would use 20% less electricity than the old Stadium based on estimates from other new football stadiums[83]. Although the Stadium in 1990 housed both football and baseball, and the new Stadium is anticipated to house only football, no reduction in energy use has been assumed. Accordingly, this is likely an overestimate of Stadium energy use.

The electricity and natural gas use per square foot for each building type are converted to GHG emissions as shown in the next section.

3.8.2 Estimation of Annual Greenhouse Gas Emissions from Non-Residential Buildings

Lennar Urban has committed to making all new non-residential buildings 15% more energy efficient than Title 24 2008 standards, or 15% more energy efficient on a TDV basis. Although ENVIRON is aware that annual energy use and TDV energy do not necessarily scale linearly with each other, as discussed in the residential section, ENVIRON assumed that all sources covered by Title 24 would uniformly use 15% less annual energy. These calculations are shown in Table 3-16. Non-Title 24 regulated energy use is assumed to still use the same amount of energy as a minimally Title 24 compliant building. There is no credit taken for any Energy Star appliances in the non-residential building category since it is difficult to determine which appliances may be present in the various non-residential building categories. In addition, these are generally not supplied with the building. Baseline Title 24 usage rates shown in this table have been adjusted to reflect improvements in Title 24 building codes since their introduction in

[82] San Francisco Department of the Environment and San Francisco Public Utilities Commission. 2004. Climate Action Plan for San Francisco.

[83] The new stadium to be used by the New York Jets and Giants is expected to reduce energy consumption by 30%. The new stadium to be used by the Dallas Cowboys is expected to reduce energy use by 20%.

2002. CEC discusses average savings for improvements from 2002 to 2005 ("Impact Analysis for 2005 Energy Efficiency Standards") as well as from 2005 to 2008 ("Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings"). ENVIRON used these CEC average savings percentages to account for reductions in energy use due to Title 24. The average savings percentages are: for electricity: 8.5% reduction in 2005 and 4.9% reduction in 2008; for natural gas: 5.8% reduction in 2005 and 9.4% reduction in 2008. This methodology results in a reduction of energy use for all building types. Because plug-ins are not covered under Title 24, the decrease in energy use is typically less than 15%, yet still substantial.

Energy use data from Table 3-16 were multiplied by the emission factors presented in Table 3-15 to generate CO_2 intensity values (CO_2 emissions per sqft building area). The results are shown in Table 3-16. The CO_2 intensity values presented in Table 3-15 represent the non-residential building types in CP-HPS Plan described earlier.

Table 3-17 also shows the yearly CO_2 emissions from CP-HPS Plan by incorporating the emission factors developed as discussed above and the square footage of each of the main building categories. The total annual GHG emissions for CP will be 4,263 tonnes CO_2 per year. The total annual GHG emissions for HPS will be 13,766 tonnes CO_2 per year. This is a total of 18,028 tonnes CO_2 per year for CP-HPS Plan.

Variant 1 replaces the Stadium with an additional 2.5 million square feet of R&D space for a total of 5 million square feet of R&D space at HPS. CO_2 emissions are shown in Table 3-18. The CO_2 emissions at HPS for Variant 1 are 23,155 tonnes CO_2 per year for a total of 27,418 tonnes CO_2 per year for Variant 1.

Variant 2 replaces the Stadium with housing units. CO_2 emissions are shown in Table 3-19. The CO_2 emissions at HPS for Variant 2 are 11,963 tonnes CO_2 per year for a total of 16,226 tonnes CO_2 per year for Variant 2.

3.8.3 Uncertainties in Non-residential Building GHG Calculations

Several factors lead to uncertainties in the above analysis. These are described below.

- For new developments, the exact types of buildings are typically unknown. As such, not all building categories that may actually exist in CP-HPS are represented in this analysis. However, all of the commercial building area is accounted for and the best available assessment of the building type composition of CP-HPS Plan was used. The tables provided in this section present the differences in energy intensities from building type to building type.
- Although it is unknown exactly how the buildings will be designed, each building will be Title 24 compliant. Therefore all design features of the building that make it less energy efficient will be offset by design features that make it more energy efficient.
- The exact energy use for the new Stadium is only an estimate based on past energy use of the old Stadium and estimates in typical energy improvements claimed for other new football stadiums. In addition, the uses in the old Stadium included baseball, whereas the new Stadium uses will not include baseball.

3.9 Mobile Sources

This section estimates GHG emissions from mobile sources in CP-HPS Plan. The mobile source emissions considered for this project will be from the typical daily operation of motor vehicles by CP-HPS Plan residents and non-residents.

ENVIRON estimated GHG emissions based upon all miles traveled associated with net new CP-HPS Plan residential and non-residential trips regardless of internal or external destinations or purpose of trip. Traffic patterns, trip rates, and trip lengths are based upon information from the Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study.[84]

ENVIRON estimated alternative GHG emissions which only accounts for the "new" emissions associated with growth. These GHG emissions are based upon all miles traveled by net new CP-HPS Plan residents regardless of internal or external destinations or purpose of trip.

For this alternative GHG emissions, it is assumed that new non-residential (i.e. office space, retail space, and industrial buildings) area serves an area with a high residential/ non-residential balance. Therefore, this new non-residential growth will not, independent of the new residential areas, result in new shopping and work trips. Since the Stadium is replacing Candlestick Park, this is not considered to cause new trips from far away. If the Stadium is not built at HPS, it is assumed that a new Stadium will be built elsewhere in the Bay Area and it is unknown if the trips will be shorter or longer for attendees. The music venue in CP is considered to be a new non-residential facility that could draw trips that otherwise would not be made. The trips associated with customers of the music venue are considered in the inventory. Accordingly, new non-residential space in the CP-HPS Plan development area will not contribute to mobile GHG emissions except for the music venue. However, the emissions from heating and cooling the non-residential areas would be considered to be new, as that would reflect growth in non-residential areas that goes along with growth in residential areas. Accordingly, GHG emissions from VMT serving non-residential areas will only be counted if the non-residential areas contribute to greater VMT as a result of its location such as the music venue. It should be noted that as CP-HPS Plan is a mixed use community, this issue does not directly affect CP-HPS Plan VMT calculations; all VMT from net new CP-HPS Plan residents is calculated regardless of internal or external destinations or purpose of trip.

The CCAR GRP[85] recommends estimating GHG emissions from mobile sources at an individual vehicle level, assuming knowledge of the fuel consumption rate for each vehicle as well as the miles traveled per car. Since these parameters are not known for a future development, the CCAR guidance can not be used as recommended.

For mobile sources, CH_4 and N_2O are explicitly calculated, multiplied by their respective GWP, and added to the CO_2 emissions, to result in total CO_2e emissions from mobile sources.

[84] CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study.

[85] California Climate Action Registry (CCAR). 2009. *General Reporting Protocol*. Version 3.1. January.

3.9.1 Estimating VMT from Mobile Sources

This section explains the general approach used to estimate VMT made by the residents of CP-HPS Plan. Underlying data for the calculations were taken from the Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study provided to ENVIRON.[86]

Traditional traffic models focus upon designing roads and planning a development such that traffic delays will be avoided during peak travel hours. Traditional traffic analyses also provide the total number of daily vehicles on a road which can then be used to calculate toxic or criteria emissions that may have localized health effects. Several steps must be taken to go from a traditional traffic model to a set of calculations that describe VMT made by CP-HPS Plan residents and non-residents.

The first step is to adjust the traffic report trips to account for project design features that reduce trips. As the traditional traffic analysis only predicts weekday driving patterns, this step is to account for differences in weekend and weekday driving patterns. The third step accounts for how many of these trips may be taken using modes of transportation other than cars. The final step is to take all of these parameters into account and calculate the final VMT from CP-HPS Plan residents. These four steps are summarized below:

1. Determine trip rates based on reductions for project design features.
2. Determine the difference in weekend and weekday driving patterns.
3. Determine how many trips are taken by modes other than cars.
4. Calculate final VMT based upon the above scenarios.

The following section describes, in more detail, how these four steps were carried out. An additional step is necessary for the alternative analysis which only considers the "new" GHG emissions associated with growth. This step is to disaggregate the traffic information that is contained in the original traffic report into trips made by CP-HPS Plan residents and into trips made by non-CP-HPS Plan residents as well as the number of trips for attendees of the music venue.

3.9.1.1 Determine trip rates based on reductions for project design features

The Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study provided to ENVIRON included an estimate of the trip rates incorporating the project design features at CP-HPS. The trips and VMT calculated includes all trips and VMT generated by net new CP-HPS Plan residential and non-residential land uses. Once the number of trips is determined, the trip type is important. For example, a home based work (HBW) trip is a trip directly from home to work with no stops in-between, or directly from work to home. A home based shopping trip (HBS) is a trip directly from home to shopping or from shopping to home. A home based other trip (HBO) is a trip directly from home to another destination such as school. Non-home based (NHB) trips are trips between work and other types of destinations such as going to the bank during one's lunch hour. For all trip types, directionality is unimportant. The

[86] CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study.

distribution of residential trip types follow the MTC 2030 model defaults where HBW trips account for 32% of trips, HBO are 47% of trips, and NHB are 21% of trips. Non-residential trip types are HBW account for 26% of trips, HBO accounts for 28% of trips, and NHB are 27% of trips.

3.9.1.2 Determine the difference in weekend and weekday driving patterns

Since the trip rates are based on weekday conditions, ENVIRON calculated weekend traffic by applying differences between the weekend and the weekday traffic based upon a report by Sonoma Technologies.[87] Weekend traffic on major highways was assumed to be 80% of the weekly capacity, and weekend traffic on small streets was assumed to be 80% of weekly capacity[88]. No adjustment to driving patterns was done for the music venue since this is on a per event basis.

3.9.1.3 Determine how many trips are taken by modes other than cars

It is likely that a portion of the CP-HPS Plan residents would take public transportation when travelling out of CP-HPS Plan. Lennar Urban has committed to enhancements of the public transportation in the region. The Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study made an estimate of the total number of vehicle trips taking into account use of several alternative modes including public transit, bicycles, and carpooling.

3.9.1.4 Alternative GHG Emissions Analysis: Dis-aggregate the trips made by CP-HPS Plan residents from trips made by people that do not live in CP-HPS Plan.

As discussed above, the trips generated by the net new residents of CP-HPS Plan represent growth. However, new non-residential areas do not necessarily represent growth since people would already be taking these trips. The new non-residential areas will only serve to displace the location of trips with the exception of the music venue. The music venue will create trips that would otherwise not occur. The trips by attendees of the music venue are therefore counted. The total number of trips of attendees to the music venue was provided by Fehr and Peers and assumes 150 events per year. Therefore we will only account for trips generated from the residential land uses to determine the GHG emissions from CP-HPS Plan. To the extent that those trips visit commercial areas, both inside and outside of the CP-HPS Plan, they will be counted.

3.9.1.5 Calculate final VMT based upon the above scenarios

Each type of trip is associated with an average trip length as estimated by Fehr and Peers based on the Caltrans Household Travel Survey for San Francisco County. Total vehicle miles traveled (VMT) were calculated by multiplying the number of trips by the average trip length for each type of trip.

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[87] Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

[88] A conservative adjustment for weekend travel was assumed for all the trips since information was not available to distinguish between trips on major highways and trips on small streets. The Sonoma Technologies report gives a range of values, but does not present a weighted value, thus a conservative percent reduction in the number of trips was selected.

VMT = Number of Trips * Average Trip Length

The average trip length for HBW is 14.9 miles, HBO is 9.1 and NHB is 9.5. Vehicle trips that are internal to the project area were assumed to be 1 mile. The music venue attendees were assumed to have a trip length of 9.1 miles, the same as the HBO trip length. The value calculated here includes all VMT generated by net new CP-HPS Plan residential and non-residential land use commuting within CP-HPS Plan and all VMT generated by CP-HPS Plan residents and nonresidents commuting to and from CP-HPS Plan as well as attendees of the music venue. The total VMT for CP-HPS Plan residents and non-residents is 309,166,932 as shown in Table 3-20. Using an alternative method, each CP-HPS Plan dwelling unit generates 13,467 VMT per year. The total VMT for CP-HPS Plan residents is 137,958,003 as shown in Table 3-21. For Variant 1, the total VMT for CP-HPS Plan residents and non residents is 351,783,194 VMT per year as shown in Table 3-22. Using the alternative method to estimate trips from residents only for Variant 1, the net new dwelling units would generate 13,720 VMT per year per dwelling unit for a total of 140,548,884 VMT as shown in Table 3-23. For Variant 2, there would be a total of 322,690,366 VMT from residents and nonresidents as shown in Table 3-24. Using the alternative approach for Variant 2, the net new dwelling units would generate 13,557 VMT per year for a total of 138,880,220 VMT as shown in Table 3-25. This VMT was multiplied by the appropriate emission factors in the next section to calculate GHG emissions from mobile sources at CP-HPS Plan.

3.9.2 Estimating GHG Emissions from Mobile Sources

The CO_2 emissions from mobile sources were calculated with the trip rates, trip lengths and emission factors for running and starting emissions from EMFAC2007 as follows:

CO_2 emissions = VMT * $EF_{running}$

Where:

VMT = vehicle miles traveled
$EF_{running}$ = emission factor for running emissions

The CO_2 calculation involves the following assumptions:

- The emission factor depends upon the speed of the vehicle. Here, it was assumed that trips were 30 miles per hour.
- EMFAC emission factors from the year 2020 were used for $EF_{running}$ based on San Francisco County fleet mix and adjusted to account for Pavley Vehicle Standards (see Appendix B for details).

Startup emissions are CO_2 emitted from starting a vehicle. Startup emissions were calculated using the following assumptions:

- The number of starts is equal to the number of trips made annually.
- The breakdown in vehicles was EMFAC fleet mix for San Francisco County in 2020.

- The emission factor for startup was calculated based on a conservative assumption of long waits between starts.

Fleet distribution types are from EMFAC2007 from the year 2020, a year selected to represent full build out. Tables 3-20, 3-22, and 3-24 shows the CO_2 emissions from vehicles associated with residents and nonresidents of CP-HPS Plan, Variant 1, and Variant 2 as calculated according to the methodology described above. Table 3-21, 3-23, and 3-25 shows the alternative analysis of the CO_2 emissions from vehicles associated with residents and music venue only of CP-HPS Plan, Variant 1, and Variant 2 as calculated according to the alternative methodology described above.

Nitrous oxide, CH_4, and HFCs[89] are also emitted from mobile sources. The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of mobile source GHG emissions, taking into account their GWPs.[90] Therefore, CO_2 emissions in Table 3-20 through 3-25 were divided by 0.95 to account for non-CO_2 GHGs. Vehicles associated with the CP-HPS Plan development will emit approximately 105,520 tonnes CO_2e per year. Vehicles associated with the Variant 1 will emit approximately 119,918 tonnes CO_2e per year. Vehicles associated with the Variant 2 will emit approximately 110,068 tonnes CO_2e per year. The alternative analysis estimates that vehicles associated with the CP-HPS Plan will emit approximately 47,049 tonnes CO_2e per year, Variant 1 will emit approximately 47,886 CO_2e per year, and Variant 2 will emit approximately 47,347 CO_2e per year. A sample EMFAC run for San Francisco County is given in Appendix B.

3.9.3 Uncertainty Analysis

In an effort to evaluate the assumptions described in the section it should be noted that changes in estimated fleet distribution and emission factors will likely improve based on anticipated regulations, over and above those currently enacted in law.

3.9.4 Transit Area

Emissions from the transit area are associated with increased public transport needed to service the CP-HPS Plan development. GHGs are emitted from public buses when the vehicles are in transit and when the vehicles are idling at the curbside. Table 3-26 details the emission calculation for transit area. This is based on the net new miles and trips made by transit servicing the CP-HPS Plan. The details of the net new transit service are described in Table 3-27 as provided by Fehr and Peers. Since San Francisco uses carbon free electricity to power its electric buses and trolleys, the mileage and idling time from these vehicles is not quantified.

Total running emissions from transit buses were calculated by multiplying the net new miles and idling time from the CP-HPS Plan by the GHG emission factors for urban buses.

$$CO_2 \text{ emissions} = VMT * EF_{BUS,running} + Idling * EF_{UBUS,idling}$$

Where:

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[89] HFCs can be emissted from air conditioning systems.

[90] USEPA. 2005. *Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle.* Office of Transportation and Air Quality. February. (http://www.epa.gov/otaq/climate/420f05004.pdf)

VMT = net new vehicle miles traveled (from Fehr and Peers)

$EF_{BUS,running}$ = running emission factor for urban buses

Idling = net new idling time (from Fehr and Peers)

$EF_{BUS,idling}$ = idling emission factor for buses

The CO_2 calculations involve the following assumptions:

- $EF_{BUS,running}$ and $EF_{BUS,idling}$ are based on EMFAC emission factors from the year 2020
- The diesel buses servicing CP-HPS will be diesel-hybrid buses that reduce fuel usage by 25%[91]
- San Francisco transit buses use B20 (20% biodiesel, 80% petroleum diesel).[92]
- Startup emissions are expected to be minimal because transit buses are expected to operate the full day.

The idling emission factor for EMFAC's school bus was used for $EF_{BUS,idling}$ because the idling emission factor is not available for urban buses.

The USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their GWPs.[93] To incorporate these additional GHGs into the calculations, the total GHG footprint was calculated by dividing the CO_2 emissions by 0.95.

The total amount of GHG emissions from the transit area is estimated to be 1,730 tonnes of CO_2 per year.

3.10 Municipal Sources

This section explains estimates for emissions stemming from municipal sources such as drinking water and wastewater supply and treatment, lighting in public areas, and municipal vehicles.

3.10.1 Water and wastewater supply and treatment systems

In general, the majority of municipal sector GHG emissions are related to the energy used to convey, treat and distribute water and wastewater. Thus, these emissions are generally indirect emissions from the production of electricity to power these systems. Additional emissions from wastewater treatment include CH_4 and N_2O, which are emitted directly from the wastewater.

The amount of electricity required to treat and supply water depends on the volume of water involved. According to Lennar Urban, the development would generate a total water demand of 0.90 and 0.77 million gallons per day (mgd) for CP and HPS, respectively. Three processes are

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[91] SFMTA Climate Action Plan. Draft for Public Review, December 19, 2008.

[92] Based on CCAR recommendations, emissions from burning biodiesel are not included in emissions estimation. EMFAC emission factors are further reduced by 20% to account for the use of B20.

[93] USEPA. 2005. *Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle.* Office of Transportation and Air Quality. February.

necessary to supply potable water to residential and commercial users: (1) supply and conveyance of the water from the source; (2) treatment of the water to potable standards; and (3) distribution of the water to individual users. After use, the wastewater is treated and reused as reclaimed water. Any reclaimed water produced is generally redistributed to users via pumping.

Indirect emissions resulting from electricity use were determined by multiplying electricity use by the CO_2 emission factor provided by the local electricity supplier, Pacific Gas and Electric Company, (PG&E). Energy use for different aspects of water treatment (e.g. source water pumping and conveyance, water treatment, distribution to users) was determined using the stated volumes of water and energy intensities values (i.e., energy use per unit volume of water) provided by reports from the California Energy Commission (CEC). The emission factors and GHG emissions for all these processes are shown in Table 3-28. The annual emissions from water treatment and distribution, and wastewater treatment are approximately 257 and 230 tonnes CO_2e per year for CP and HPS, respectively. Variant 1 will have the same emissions for CP and 324 tonnes CO_2e per year for HPS. Variant 2 will have 225 and 257 tonnes CO_2e for CP and HPS, respectively. Details on the emissions generated by specific aspects of water treatment and supply systems are provided in the following sections.

3.10.2 Potable Water Source Supply and Conveyance

Most of the water supply in San Francisco is supplied by the Hetch Hetchy system. Supply and conveyance of water from the Hetch Hetchy system has minimal energy usage because it is delivered by gravity. Supplying and conveying water in CP-HPS Plan is estimated to have 0 tonnes of CO_2e emissions per year (see Tables 3-28 through 3-30).

3.10.3 Potable Water Treatment and Distribution

Treating and distributing potable water in CP-HPS Plan are estimated to account for 115 tonnes[94] and 103 tonnes[95] of CO_2e emissions per year, respectively. Variant 1 will be 115 and 146 tonnes of CO_2e emissions per year for treating and distributing potable water. Variant 2 will be 101 and 115 tonnes of CO_2e emissions per year for treating and distributing potable water. Based on the estimated potable water demand, these energy intensity factors, and the PG&E-carbon intensity factor adjusted for the Renewable Portfolio Standard, GHG emissions from potable water treatment and distribution were calculated as shown in Tables 3-28 through 3-30.

3.10.4 Wastewater Treatment

Emissions associated with wastewater treatment include indirect emissions necessary to power the treatment process and direct emissions from degradation of organic material in the

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[94] Emission factor for water treatment is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand. California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.

[95] Emission factor for water distribution is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand. California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.

wastewater. Wastewater treatment indirect emissions in CP-HPS Plan are estimated to account for 268 tonnes of CO_2e emissions per year. Specifically, emissions are estimated to be 141 and 127[96] tonnes of CO_2e emissions per year for CP and HPS, respectively. Variant 1 wastewater treatment indirect emissions are estimated to account for 319 tonnes of CO_2e per year. Variant 2 wastewater treatment indirect emissions are estimated to account for 264 tonnes CO_2e emissions per year. Wastewater treatment direct emissions in CP-HPS Plan are estimated to account for zero tonnes of CO_2e emissions per year since all methane emissions from the wastewater at the Southeast Wastewater Treatment Plant is burned at the flare station or cogeneration plant and non methane emissions are directly emitted from the wastewater as directed by the plant's air permit.

Indirect GHG emissions from the electricity necessary to power the wastewater treatment process were calculated for CP-HPS Plan. Wastewater in San Francisco is handled by the Southeast Pollution Control Plant. The electricity required to operate wastewater treatment plant is estimated to be 1,688 kW-hr per AF[96]. Based on the expected amount of wastewater requiring treatment[97], this energy intensity factor and the PG&E carbon-intensity factor adjusted to account for the Renewable Portfolio Standard, indirect emissions due to wastewater treatment were calculated as shown in Tables 3-28 through 3-30.

Direct emissions from wastewater treatment include emissions of CH_4 and N_2O. All direct methane emissions from the Southeast Pollution Control Plant are burned either at the flare station or cogeneration plant. Therefore, there will be no direct emissions from the wastewater treatment plant.

Variant 1 is expected to have a water demand of 1.11 mgd at HPS. Table 3-29 shows the CO_2 emissions associated with Variant 1. Variant 2 is expected to have a water demand of 0.77 mgd at CP and 0.88 mgd at HPS. Table 3-30 shows the CO_2 emissions associated with Variant 2.

3.10.5 Public Lighting

Lighting sources contribute to GHG emissions indirectly, via the production of the electricity that powers these lights. Lighting sources considered in this source category include streetlights, traffic signals, area lighting for parks and lots, and lighting in public buildings. The emission factor for public lighting is shown in Tables 3-28 through 3-30. Data from a report by the City of Duluth shows that the amount of electricity demanded for all types of public lighting is 149 kW-hr per capita per year.[98] Lennar Urban has committed to using energy efficient street lighting in

[96] Emission factor for wastewater treatment are from the energy requirements for the Southeast Pollution Control Center provided in a Request for Proposals. This information was provided in "SFPUC Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101". All of the direct methane emissions from the wastewater treatment plant are burned at the flare station or cogenerations plant.

[97] Assumed 91% of the water treated is to be reclaimed.

[98] Skoog., C. 2001. This factor was calculated by summing the total electricity needs for municipal uses and dividing by the Duluth population. The Duluth population was calculated by dividing the city's reported GHG emissions by its reported per capita emissions.

CP-HPS Plan. This will reduce street lighting electricity demand by 16%[99]. Using this study, the PG&E-specific carbon-intensity emission factor adjusted for 20% RPS and the expected CP-HPS Plan population of 23,869, emissions from public lighting were calculated.[100] Thus, the CP-HPS Plan-specific emission factor for public lighting would be 0.037 tonnes CO_2e per capita per year. Public lighting emissions in CP-HPS Plan are estimated to account for 878 tonnes CO_2 per year. This is the same for Variant 1 and Variant 2 since the total population will be the same. This number is likely a conservative estimate since CP-HPS Plan is a master-planned compact community may require a lower number of lights than the City of Duluth.

3.10.6 Municipal Vehicles

GHG emissions from municipal vehicles are due to direct emissions from the burning of fossil fuels. Municipal vehicles considered in this source category include vehicles such as police cars, fire trucks, and garbage trucks. The emission factor for municipal vehicles is shown in Tables 3-28 through 3-30. Data from reports by Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, California[101] show that the CO_2 emissions from municipal vehicles would be approximately[102] 0.05 tonnes per capita per year. Using these studies and the expected CP-HPS Plan population of 23,869, emissions from municipal vehicles in CP-HPS Plan were calculated. Municipal vehicle emissions in CP-HPS Plan are estimated to account for 1,194 tonnes CO_2e per year. This is the same for Variant 1 and Variant 2 since the total population will be the same.

In total, all municipal sources including water, wastewater, public lighting and municipal vehicles for CP-HPS Plan is expected to produce 2,559 tonnes of CO_2e annually. Variant 1 is expected to produce 2,653 tonnes of CO_2e annually. Variant 2 is expected to produce 2,553 tonnes of CO_2e annually.

3.11 Area Sources

Area sources emissions stem from hearths (including gas fireplaces, wood-burning fireplaces, and wood-burning stoves) and small mobile fuel combustion sources such as lawnmowers. Fuel combustion associated with these sources produce direct GHG emissions. Since all of the housing units are multi-family, URBEMIS does not estimate a significant amount of emissions from lawn maintenance equipment and these have not been quantified. Since emissions from natural gas-fired stoves and natural gas heating are already included in the residential

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[99] The resultant energy savings is calculated from the annual energy costs found on page 4 of NYSERDA's 2002 How-to Guide to Effective Energy-Efficient Street Lighting.

[100] Population estimate provided by Lennar Urban.

[101] City of Medford. 2001. Climate Action Plan. October. http://www.massclimateaction.org/pdf/MedfordPlan2001.pdf
City of Northampton. 2006. Greenhouse Gas Emissions Inventory. Cities for Climate Protection Campaign. June. http://www.northamptonma.gov/uploads/listWidget/3208/NorthamptonInventoryClimateProtection.pdf
City of Santa Rosa. Cities for Climate Protection: Santa Rosa. http://ci.santa-rosa.ca.us/City_Hall/City_Manager/CCPFinalReport.pdf
Skoog., C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives. October.http://www.ci.duluth.mn.us/city/information/ccp/GHGEmissions.pdf

[102] In an effort to be conservative, the largest per capita number from these four reports was used.

sources[103], calculations based on the URBEMIS method for the remaining types of area sources, natural gas fireplaces was performed.

CP-HPS Plan will have natural gas fireplaces in 10% of its net new residential units based on estimates from Lennar Urban. Wood-burning stoves or fireplaces are prohibited. Direct GHG emissions from these sources were estimated by multiplying the energy use per year by the CO_2 emission factor for natural gas combustion. Annual energy use was determined by the number of fireplaces, the average energy use of each fireplace, and the URBEMIS default fireplace usage rate value of 200 hours/year. In the absence of site-specific energy use values for fireplaces at CP-HPS Plan, the URBEMIS default values of 20,000 BTU/hour/fireplace for multi-family residences was used. Table 3-31 shows an estimated 217 tonnes CO_2 will be generated annually by fuel combustion in natural-gas fireplaces. Variant 2 will have the same total emissions as CP-HPS Plan, but will be distributed in CP and HPS differently as shown in Table 3-32.

3.12 Emissions from Solid Waste Disposal

The residents and non-residential uses at the development will generate waste. A large percentage of this waste will be diverted from landfills either by waste generation reduction, recycling, and composting. San Francisco currently diverts a large portion of its waste generated and has goals to even further reduce the amount of waste sent to a landfill. The remainder of the waste not diverted will be disposed of at a landfill. Landfills emit GHG emissions associated with the anaerobic breakdown of material. The waste disposal rates for the various land uses at the development were estimated based on values reported by the Center for Integrated Waste Management Board (CIWMB)[104]. If no waste disposal rates could be found, waste generation rates for that land use were used. These are likely over-estimates since they do not account for the waste that would be diverted from a landfill. The waste disposal rates were multiplied by the non-biogenic emissions associated with the Altamount Landfill in 2005 which is 0.00674 tonnes of CO_2e emissions per metric ton of waste per year[105]. Tables 3-33 through 3-35 detail the calculation of GHG emissions associated with the waste disposal for CP-HPS Plan, Variant 1 and Variant 2 respectively. The total GHG emissions are anticipated to be 907, 1,038, and 1,038 tonnes CO_2e per year for CP-HPS Plan, Variant 1, and Variant 2 respectively. These estimates are likely conservative given the fact that future residents will be more conscious of waste and the aggressive goals for waste reduction in San Francisco. In addition, this estimate does not account for the carbon sequestration that will occur as a result of disposal of carbon in the landfill that will not degrade.

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[104] CIWMB. 1999 Statewide Waste Characterization Study: Results and Final Report. 340-00-009. Available at http://www.ciwmb.ca.gov/wastechar/Redisp.htm

CIWMB. 2007. Estimated Solid Waste Generation Rates for Industrial Establishments. Available at http://www.ciwmb.ca.gov/WasteChar/wasteGenRates/Industrial.htm

CIWMB. 2006. Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups. 341-06-006. Available at http://www.ciwmb.ca.gov/WasteChar/WasteStudies.htm#2006Industry

[105] Based on information provided by BAAQMD.

3.13 Emissions Sources Not Quantified in Inventory

Several emissions sources were not quantified in this inventory, due to their estimated relatively small[106] contribution to GHG emissions. These sources include emissions from recreational sources and refrigeration leaks which are described in more detail below[107].

3.13.1 Pools and Recreation Centers

The CP-HPS Plan Specific Plan includes neighborhood community areas and parks which may also include pools and recreation centers. At the entitlement stage of development, the degree of uncertainty in the potential end-uses of these recreational areas make a meaningful quantification of GHG emissions difficult. As a result of this uncertainty, ENVIRON did not quantify these emissions at this time.

3.13.2 Refrigeration Leaks

Emissions associated with leaks of high global warming potential gases such as from refrigeration leaks were not quantified. At the entitlement stage of development, the degree of uncertainty in the potential facilities with sources that may have refrigeration leaks make a meaningful quantification of GHG emissions difficult. In addition, since refrigeration systems will be new, they are likely efficient and should be designed to reduce the amount of leaks of high global warming potential gases. As a result of this uncertainty and likely small level of emissions, ENVIRON did not quantify these emissions at this time.

3.14 Project Design Features that Reduce GHG Emissions

The CP-HPS Plan development incorporates many design features to reduce GHG emissions. This section describes the design features that were incorporated into this analysis either directly or indirectly. This section also lists those features that were not quantified in this analysis, but would likely yield further GHG emissions reductions.

3.14.1 Project Design Features whose Emissions Reductions were Incorporated into the Analysis

3.14.1.1 Reductions in emissions from mobile sources

- Provide neighborhood serving retail.
- Provide automobile, public transportation, and pedestrian connections between the Shipyard, Candlestick Point and the larger Bayview neighborhood.
- The Urban Design Plan used at CP-HPS Plan will reduce its footprint and allow for transportation and open space corridors.
- Integrating land use patterns with multimodal street networks that would facilitate walking and cycling for internal trips and transit for trips of greater distance.
- Extend existing Muni routes to better serve the CP-HPS Plan area; increase frequencies on existing routes to provide more capacity; and complement those existing routes with

[106] Typically less than 1% of the overall inventory based upon previous studies.
[107] Black carbon was also not considered. Major sources of black carbon emissions are not present at CP-HPS Plan.

new transit facilities and routes that would serve the CP-HPS Plan's proposed land use program and transit demand.

3.14.1.2 Vegetation preservation

- The project is a redevelopment project and will not result in the conversion of any new land to settlement.
- Up to 10,000 trees new trees will be planted at CP-HPS Plan.

3.14.1.3 Energy Savings

- Homes and businesses will exceed the 2008 Standards for Title 24 Part 6 energy efficiency standards by at least 15%.
- Where appliances are offered by homebuilders, Energy Star appliances will be installed.
- Energy efficient street lighting will be used.

3.14.2 Project Design Features whose Emissions Reductions were not Incorporated into the Analysis but would yield further GHG emissions savings

While these project design features have not been quantified as part of this GHG emissions inventory, they are part of CP-HPS Plan and will likely result in further GHG emission reductions.

3.14.2.1 Reductions in emissions from mobile sources

- Transportation Demand Management Plan to reduce the auto use and encourage residents, employees and visitors to use alternative modes of travel, such as transit, walking, and bicycling.

3.14.2.2 Energy Savings

- The energy savings resulting from the replacement of 256 older homes with new more energy efficient homes.

3.14.2.3 Water Conservation

- The CP-HPS Plan would provide a network of reclaimed-water mains for dual plumbing in commercial buildings and for irrigation of landscaped areas. Reclaimed water mains would distribute reclaimed water with a source expected to be developed by the City.

3.15 Summary of Emissions from CP-HPS Plan

Emissions from the various aspects of CP-HPS Plan are presented in Table 3-36. One-time vegetation emissions are estimated to be -7,000 tonnes CO_2. One-time construction emissions are estimated to be 105,587 tonnes CO_2e. Emissions from residential buildings are estimated to be 25,677 tonnes CO_2e per year, or 17% of the annual project emissions. Emissions from non-residential buildings are estimated to be 18,028 tonnes CO_2e per year, or 12% of the annual project emissions. Emissions from mobile sources are estimated to be 105,520 tonnes CO_2e per year, or 69% of the annual project emissions. Emissions from municipal sources (water distribution, public lighting, and municipal vehicles) are estimated to be 2,559 tonnes CO_2e per year, or 2% of the annual project emissions. Emissions from area sources (fireplaces) are estimated to be 217 tonnes CO_2e per year, or less than 0.2% of the annual project emissions. Emissions from the additional transit services are estimated to be 1,730 tonnes CO_2e per year, or less than 1% of the annual project emissions. Emissions from waste disposal at landfills are estimated to be 907 tonnes CO_2e per year, or 1% of the annual project emissions.

Also noted in Table 3-36 is whether the emissions are attributable to a one-time action or are anticipated to occur on an annual basis, during each year after the full build-out of the development. The only one-time emissions are associated with construction and land use change emissions. There are 98,587 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to 154,639 tonnes. Of this, 68% result from vehicular emissions associated with residential activities. Approximately 29% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low) then the one-time emissions account for approximately 2,465 tonnes, or 2% of the annual emissions. Taking these one-time emissions into account, the annual emissions are 157,104 tonnes per year.

Emissions from the CP-HPS Plan using the alternative method for estimating mobile source is shown in Table 3-37. The annual emissions from the use of the development amount to 96,168 tonnes. Taking one-time emissions into account, the annual emissions are 98,633 tonnes per year.

Emissions from the various aspects of Variant 1 are presented in Table 3-38. Both the one-time emissions and emissions that are expected to occur each year after build-out of the CP-HPS Plan development are presented. There are 98,587 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to 178,651 tonnes CO_2e/year. Of the annual emissions, slightly more than 67% result from vehicular emissions associated with residential activities, and 29% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately 2,465 tonnes, or 2% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 181,115 tonnes/year.

Emissions from Variant 1 using the alternative method for estimating mobile source is shown in Table 3-39. The annual emissions from the use of the development amount to 106,619 tonnes. Taking one-time emissions into account, the annual emissions are 109,084 tonnes per year.

Emissions from the various aspects of Variant 2 are presented in Table 3-40. Both the one-time emissions and emissions that are expected to occur each year after build-out of the CP-HPS Plan development are presented. There are 98,587 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to 157,509 tonnes CO_2e/year. Of the annual emissions, slightly less than 70% result from vehicular emissions associated with residential activities, and 26% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately

2,465 tonnes, or 2% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 159,974 tonnes/year.

Emissions from Variant 1 using the alternative method for estimating mobile source is shown in Table 3-41. The annual emissions from the use of the development amount to 94,789 tonnes. Taking one-time emissions into account, the annual emissions are 97,254 tonnes per year.

It is important to note that these emissions are estimated assuming that the carbon intensity of the electricity supply system and transportation system do not in the future change beyond that which is required by enacted legislation. This assumption is clearly incorrect, as AB 32 and other legislative and regulatory mandates will result in GHG emission reductions in both areas.

AB 32 requires that GHG emissions from California be reduced to 1990 levels by 2020. This represents a reduction of approximately 28.5% from projected 2020 growth. The goals of AB 32 are likely to be reached by increasing renewable or non-carbon producing electricity production, and changing the transportation system to rely on a set of increasingly lower carbon fuels. As most of the carbon footprint of CP-HPS Plan results from either transportation or electricity use, these carbon emissions are likely overestimated as a result of the implementation measures of AB 32. Section 4 puts CP-HPS Plan emissions in context and includes an analysis of the CP-HPS Plan compared to a ARB Scoping Plan No Action Taken (NAT) scenario following the regulations considered by ARB in adopting the 2020 No Action Taken scenario as part of the Scoping Plan for AB32.

Furthermore, Governor Schwarzenegger's Executive Order S-3-05 set a target to reduce GHG emissions by 2050 to levels 80% less than the 1990 levels. It is likely that future measures will be implemented to reach this goal that similarly may result in reductions of GHG emissions for sources in CP-HPS Plan beyond those stated in this report. This is further discussed in Section 5 of this report.

3.16 Life Cycle Emissions of Building Materials

An estimate of "life-cycle" GHG emissions (i.e., GHG emissions from the processes used to manufacture and transport materials used in the buildings and infrastructure) is presented in this section and attached as Appendix C. This estimate is to be used for comparison purposes only and is not included in the final inventory as these emissions would be attributable to other industry sectors under AB 32. For instance, the concrete industry is required by law to report emissions and undergo certain early action emission reduction measures under AB 32. Furthermore, for a life-cycle analysis for building materials, somewhat arbitrary boundaries must be drawn to define the processes considered in the life-cycle analysis.[108] Recognizing the uncertainties associated with a life-cycle analysis, the California Air Pollution Control Officers Association (CAPCOA) released a white paper which states: "The full life-cycle of GHG emissions from construction activities is not accounted for in the modeling tools available, and

[108] For instance, in the case of building materials, the boundary could include the energy to make the materials, the energy used to make the machine that made the materials, and the energy used to make the machine that made the machine that made the materials.

the information needed to characterize GHG emissions from manufacture, transport, and end-of-life of construction materials would be speculative at the CEQA analysis level.[109]"

The calculations and results discussed here and presented more fully in Appendix C are estimates and should be used only for a general comparison to the overall GHG emissions estimated in the Climate Change Technical Report. Life Cycle Assessment (LCA) emissions vary based on input assumptions and assessment boundaries (e.g., how far back to trace the origin of a material). Assumptions made in this report are generally conservative. However, due to the open-ended nature of LCAs, the analysis is highly uncertain.

Appendix C is an ENVIRON report that evaluates the life cycle GHG emissions associated with the building materials for this project. The life cycle GHG emissions include the embodied energy from the materials manufacture and the energy used to transport those materials to the site. The report then compares the life cycle GHG emissions to the overall annual operational emissions. The materials analyzed in the report include materials for 1) residential and non-residential buildings, and 2) site infrastructure. This report calculates the overall life cycle emissions from construction materials to be approximately 3,068 to 16,285 tonnes CO_2 / year. This represents 2 to 10% of the annualized GHG emissions from the CP-HPS Plan area.

The report estimated the life cycle GHG emissions for buildings by conducting an analysis of available literature on LCAs for buildings. According to these studies, approximately 75 - 97% of GHG emissions from buildings are associated with energy usage during the operational phase; the other 3 - 25% of the GHG emissions are due to material manufacture and transport. Using the GHG emissions from the operation of buildings, 3% to 25% of building emissions corresponds to approximately 0.9 - 9% of the project emissions.

The report calculated the life cycle GHG emissions for certain components of infrastructure (roads, storm drains, utilities, gas, electricity, and cable). This analysis considered the manufacture and transport of concrete only, as ENVIRON assumed that other construction materials such as steel would be present in much smaller quantities. The majority of the emissions for infrastructure result from the manufacture of concrete. If a 40 year lifespan of the infrastructure is assumed, the total annualized emissions from embodied energy in infrastructure materials are approximately 1.1% of the project emissions.

The overall life cycle emissions, annualized by 40 years, are 3,068 to 16,285 tonnes CO_2 / year, or 2 – 10% of the annualized GHG emissions from the CP-HPS project. The bulk of these emissions (0.9 - 10%) are from general life cycle analysis studies and do not reflect specific information from CP-HPS.

Again, note that the calculations and results presented in this life cycle report are estimates and should be used only for a general comparison to the overall GHG emissions estimated in the Climate Change Technical Report. LCA emissions vary based on input assumptions and assessment boundaries (e.g., how far back to trace the origin of a material). Assumptions made

[109] CAPCOA. 2008. CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act. Available online at: http://www.capcoa.org/ceqa/?docID=ceqa&PHPSESSID=df1348d6f7eff0fc2a8263d19f6d10dd

in this report are generally conservative. However, due to the open-ended nature of LCAs, and the fact that literature evaluation, not site specific studies were used to analyze the embodied energy, the analysis should be considered to yield highly uncertain results. Additionally, these estimates likely double count emissions from other industry sectors.

4 Inventory in Context

4.1 CP-HPS Plan Greenhouse Gas inventory in Context

The BAAQMD has published draft significance thresholds for GHG emissions applicable to development projects. However, at this time these standards and screening thresholds for residential/commercial projects are still under consideration. Accordingly, this section is intended to place the GHG emissions from the proposed residential development in context with respect to intensity, consistency with AB 32 goals, and magnitude. For the intensity comparison, we compare the built environment emissions with that from ARB Scoping Plan No Action Taken scenario comparison of standard energy use for buildings in California in the same climate zone. In addition, we compare anticipated mobile emissions to current San Francisco County mobile emissions and emissions savings from water usage in the development. For comparison with AB 32 goals, we compare the GHG emissions with the overall reductions levels mandated under AB 32. Finally, the emissions from CP-HPS Plan at build-out are compared to California and global GHG emissions in order to put CP-HPS Plan emissions in a global context.

4.2 Characterization of Emissions

In 2004, 81% of greenhouse gas emissions (in CO_2e) from California were comprised of CO_2 emissions from fossil fuel combustion, with 4% comprised of CO_2 from process emissions. CH_4 and N_2O accounted for 5.6% and 6.8% of total CO_2e respectively, and high GWP gases[110] accounted for 2.9% of the CO_2e emissions. Transportation is by far the largest end-use category of GHGs. Transportation includes that used for industry (i.e., shipping) as well as residential use.

4.3 Comparison with AB 32-mandated Emissions Limits

AB 32 requires that statewide GHG emission in 2020 be equal to 1990 levels. California-wide GHG emissions in 1990 were 0.427 billion tonnes.[111] It is projected that emissions in 2020 under a No Action Taken scenario accounting for growth will be 0.596 billion tonnes[112]. This would require a 28.5% decrease in emissions by 2020 to achieve AB 32 goals. The population in California is projected to be 42,210,000 in 2020. In order to achieve AB 32 mandated goals, the per capita emissions would have to be 10.1 tonnes CO_2e (see Table 4-1 for calculation details). This includes emissions from the agricultural and manufacturing sector, as well as industrial transportation, allocated on a per capita basis.

CP-HPS Plan has estimated emissions of 154,639 tonnes per year, or 6.5 tonnes per capita per year, 4.5 tonnes per service population per year, or 15.1 tonnes per dwelling unit.[113] Variant 1 has estimated emissions of 178,651 tonnes per year, or 7.5 tonnes per capita per year, 4.4 tonnes per service population per year, or 17.4 tonnes per dwelling unit. Variant 2 has estimated emissions of 157,509 tonnes per year, or 6.6 tonnes per capita per year, 4.6 tonnes per service population per year, or 15.3 tonnes per dwelling unit per year. The California per

[110] Such as HFCs and PFCs.
[111] http://www.arb.ca.gov/cc/inventory/1990level/1990level.htm. California Air Resources Board.
[112] http://www.arb.ca.gov/cc/inventory/data/forecast.htm#summary_forescast
[113] Based upon 23,869 residents and 10,373 jobs (this excludes the 357 jobs associated with the stadium since these are existing jobs). Variant 1 will have 16,638 jobs and Variant 2 will have 10,379 jobs.

capita CO_2 emissions includes industries such as heavy industry, refining, and transportation of materials while the CP-HPS Plan per capita CO_2 emissions do not include these emissions. AB 32 will be reducing emissions in a variety of different ways, including increasing energy efficiency and introducing more renewable energy sources. It is difficult to compare CP-HPS Plan per capita emissions to the AB 32 goals as it is not clear what fraction of the reduction will be achieved in which sectors, and what portion will be achieved from energy efficiency and what fraction will be achieved by renewable resources. This is discussed more fully below.

4.4 ARB Scoping Plan No Action Taken Comparison

In order to put the GHG emission inventory into context and justify an improvement heading towards meeting the reduction goals set for 2020, it is necessary to compare the GHG emission inventory expected for CP-HPS Plan to the GHG emissions that would occur from a community that would be built today without CP-HPS Plan design features and energy reduction commitments made by Lennar Urban. This baseline comparison is referred to as No Action Taken (NAT) which follows the regulations considered by ARB in developing its 2020 No Action Taken estimate as part of the Scoping Plan. This represents the GHG emission inventory if things were continued to be built according to current standards. The major categories of the GHG emission inventory are considered separately. These include residential and non-residential buildings, mobile sources, municipal lighting, and water sources. The remaining categories include municipal vehicles and area sources. These categories represent a small fraction of the total inventory and do not have appropriate emission factors to quantify the reductions that are likely to occur at CP-HPS Plan compared to NAT.

4.4.1 Vegetation

Lennar Urban has committed to planting 10,000 new trees. The NAT analysis for vegetation assumes that this commitment is not taken.

4.4.2 The Built Environment

The energy use and GHG emissions from the modeled homes for CP-HPS Plan were compared to the energy use and GHG emissions from minimally Title 24 compliant 2005 buildings using the current carbon intensity factor for electricity (no Renewable Portfolio Standard adjustment)[114]. It was also assumed that the comparison homes had standard appliances instead of Energy Star appliances. The same assumptions used to evaluate the energy use from the RASS survey is used for the NAT analysis. CP-HPS Plan is 24% better than the NAT home for energy use covered by Title 24. In addition, when major appliances are considered, the homes of CP-HPS Plan are 23% better than the NAT homes. When the rest of plug-in energy use is considered, CP-HPS Plan homes are 20% better than the NAT homes. These comparisons are summarized in Tables 3-11 and 3-12. It is important to recognize that areas in which the developer has control over the energy use, building envelope and major appliances, show an improvement over NAT. This comparison does not take into account that the energy use of occupants is expected to change as people become more conscious of energy use and climate change issues, and more sensitive to the cost of energy, and use less energy.

[114] The 2005 version of Title 24 is what was in effect at the time that ARB developed the Scoping Plan 2020 No Action Taken.

CO_2 emissions per dwelling unit for CP-HPS Plan homes are approximately 2.5 tonnes per dwelling unit per year. For the NAT housing, emissions are approximately 3.2 tonnes per dwelling unit per year. CP-HPS Plan homes, per dwelling unit, emit approximately 0.64 tonnes less CO_2 per year than the NAT housing.

Homes in CP-HPS Plan are 20% more energy efficient than the current NAT. As such, CP-HPS Plan residential units are heading toward meeting AB 32 goals on a per dwelling unit basis, without any decrease in GHG intensity from energy production beyond the 20% Renewable Portfolio Standard for 2010, which is likely to occur. It also does not account for changes in occupant behavior.

A similar comparison for non-residential buildings compares CP-HPS Plan non-residential buildings energy use and GHG emissions from a minimally 2005 Title 24 compliant building using the current carbon intensity factor for electricity (no Renewable Portfolio Standard adjustment). Unlike residential homes, the developer has little control over the appliances and plug-in energy use that will occur in the buildings. When typical plug-in energy use is considered for the non-residential buildings, CP-HPS Plan is 18% better than NAT, Variant 1 is 17% better than NAT and Variant 2 is 17% better than NAT. This does not account for non-residential occupants using energy efficient appliances.

There are some uncertainties and limitations that need to be pointed out for the residential and non-residential building NAT comparison. ENVIRON used survey data of existing buildings to represent future building energy use. ENVIRON made an attempt to adjust the baseline energy use value for residential and non-residential buildings based upon CEC reports indicating improvements in Title 24 building codes. The existing building stock is likely less efficient than the requirements for new buildings under Title 24. To the extent that CP-HPS Plan's mix changes the calculated savings may differ.

4.4.3 Transportation

Consistent with one of the options in the OPR Guidance, this section discusses a comparison of project emissions with the goals of AB 32. Since the Stadium is replacing Candlestick Park, this is not considered to cause new trips from far away. If the Stadium is not built at HPS, it is assumed that a new Stadium will be built elsewhere in the Bay Area and it is unknown if the trips will be shorter or longer for attendees.

Vehicle emissions will be reduced in the future regardless of the development location, as the implementation of AB 32 will require improvements in vehicle mileage, increased use of public transit, and the incorporation of low-carbon fuels into the transportation fuel supply[115]. Transportation emissions presented here are based upon EMFAC2007 values, which are based upon past vehicle emission trends and do not incorporate the known regulatory actions as described above. In fact, on a VMT basis, EMFAC2007 assumes that CO_2 emissions in 2030 are slightly higher than they are currently. This is clearly unlikely, given the mandates of AB 32 and the likelihood of federal regulation.

[115] The Low Carbon Fuel Standard (LCFS) mandated under Governor Schwarzenegger's Executive Order S-01-07 and currently being developed by the California Air Resources Board (ARB) requires a reduction in carbon intensity of California's transportation fuels by at least 10% by 2020.

ENVIRON estimated the trip rate for a NAT scenario assuming that the number of trips made assuming none of the trips use alternative transportation or internal to the project site development due to the transit, pedestrian and bicycle pathways and mixed of uses. These modified trip rates were applied to the same methodology outlined for the traffic calculations including the weekend trip rate adjustment. The same number of trips to the music venue was assumed for the NAT scenario. Table 4-2 shows a total VMT for the NAT scenario as 516,667,601 miles per year. The emission factor uses the EMFAC2007 value for 2020 with no adjustments. The NAT scenario would release 258,330 tonnes of CO_2e per year. CP-HPS Plan represents a 59% reduction in VMT and CO_2e emissions per year compared to NAT. Table 4-3 shows the calculations for Variant 1 which estimates a release of 277,459 tonnes of CO_2e per year. Table 4-4 shows the calculations for Variant 2 which estimates a release of 257,568 tonnes per CO_2e per year.

4.4.4 Water and Wastewater

The NAT comparison for water and wastewater treatment and distribution was based on a the same water usage as the CP-HPS Plan due to the incorporation of San Francisco Green Building Ordinance. Tables 4-5 through 4-7 show the calculations for the NAT scenario. A report by the Consortium for Energy Efficiency (CEE) estimates that 15 to 30% of water energy use savings will come as a result of water use efficiency improvements.

4.4.5 Public Lighting

The NAt comparison for public lighting assumes that energy efficient street lights will not be used. Tables 4-5 through 4-7 shows the CO_2e emissions for public lighting for the NAT scenario as 1,023 tonnes CO_2e per year. Table 4-5 through 4-7 shows CP-HPS Plan's public lighting is 14% less than NAT.

Overall for the municipal category CP-HPS Plan is 7% better than NAT. Variant 1 is 7% and Variant 2 is 7%.

4.4.6 Transit Service

The NAT comparison of transit service assumes that the project will use regular diesel buses and diesel fuel. The estimate of emissions for the NAT scenario is shown in Table 3-23. The NAT transit service emissions are 2,884 tonnes CO_2e per year. CP-HPS Plan is 40% better than NAT transit service emissions.

Tables 4-8 through 4-10 summarize the comparisons between CP-HPS Plan, Variant 1, Variant 2 and the NAT scenarios discussed in this section. When all emissions, including those where a NAT analysis was not able to be performed are considered, CP-HPS Plan shows a 51% improvement over NAT. Variant 1 shows a 49% improvement over NAT. Variant 2 shows a 50% improvement over NAT. Further discussions on how these emissions will be reduced based on current and future regulations not considered under the NAT scenario are discussed in Section 5. These regulations are likely to allow CP-HPS Plan to achieve its share in meeting AB 32 goals and head to the further emission reduction goals of Executive Order S-03-05.

4.5 Comparison with State, Global, and Worldwide GHG Emissions

The emissions from CP-HPS Plan at build-out are compared to California and global GHG emissions to put the emissions from CP-HPS Plan in context. CP-HPS Plan's annual emissions are approximately 154,639 metric tonnes CO_2e per year, and 98,587 tonnes of one-time emissions. If the one-time emissions are annualized by a development lifetime of 40 years (2,465 tonnes CO_2e per year), the overall yearly emissions are approximately 157,104 tonnes CO_2e per year. This is equivalent to approximately 6.5 tonnes per capita per year.[116]

Worldwide emissions of GHGs in 2004 were 26.8 billion tonnes of CO_2e per year.[117] In 2004, the US emitted about 7 billion tonnes of CO_2e.[118] Over 80% of the GHG emissions in the US are comprised of CO_2 emissions from energy related fossil fuel combustion. In 2004, California emitted 0.480 billion tonnes of CO_2e, or about 7% of the US emissions. 157,104 tonnes of CO_2e per year from CP-HPS Plan would be approximately 0.00058% of the world wide emissions, 0.0022% of the United State's emissions, or 0.032% of California's annual GHG emissions.

[116] Assuming a CP-HPS Plan population of 23,869.
[117] Sum of Annex I and Annex II countries without counting Land-Use, Land-Use Change and Forestry (LULUCF) http://unfccc.int/ghg_emissions_data/predefined_queries/items/3814.php For countries that 2004 data was unavailable, the most recent year was used.
[118] 2006 Inventory of U.S. Greenhouse Gas Emissions and Sinks. Available online at: http://yosemite.epa.gov/oar/globalwarming.nsf/UniqueKeyLookup/RAMR6MBLP4/$File/06ES.pdf

5 Impact of Regulatory Developments on CP-HPS Plan's GHG Inventory

There are a number of regulatory developments on both the federal and state level that will impact GHG emissions at CP-HPS Plan. For example, the Pavley Standards, and the Energy Independence and Security Act of 2007 all affect vehicle emissions, and because this is enacted legislation, these were incorporated into the estimated emissions from the CP-HPS Plan.

Executive order S-03-05 mandates that California emit 80% less GHGs in 2050 than it emitted in 1990. As of 2004, California was emitting 12% more GHG emissions than in 1990. For California to emit 80% less than it emitted in 1990, the emissions would be only 18% of the 2004 emissions. Accounting for a population growth from 35,840,000 people in 2004 to approximately 55,000,000 people in 2050, the emissions per capita would have to be only 12% of what they were in 2004. This means 88% reductions in per capita GHG emissions from today's emissions intensities must be realized in order to achieve California's 2050 GHG goals. Clearly, energy efficiency and reduced vehicle miles traveled will play important roles in achieving this aggressive goal, but the decarbonization of fuel will also be necessary.

The extent to which GHG emissions from traffic at CP-HPS Plan will change in the future depends on the quantity (e.g. number of vehicles, average daily mileage) and quality (i.e. carbon content) of fuel that will be available and required to meet both regulatory standards and residents' needs. As discussed above, renewable power requirements, the low carbon fuel standard, and vehicle emissions standards will all decrease GHG emissions per unit of energy delivered or per vehicle mile traveled. In this section we discuss the impact that future regulated fuel decarbonization may have on vehicular emissions at CP-HPS Plan.

The California Energy Commission (CEC) published "State Alternative Fuels Plan"[119] in which it noted the existence of "challenging but plausible ways to meet 2050 [transportation] goals." The main finding from this analysis is that reducing today's average per capita driving miles by about 5 percent (or back to 1990 levels), in addition to the decarbonization strategies listed below, would achieve S-03-05 goals of 80% below 1990 levels. The approach described below is directly[120] from the CEC report.

An 80 percent reduction in GHG emissions associated with personal transportation can be achieved even though population grows to 55 million, an increase of 50 percent. The following set of measures could be combined to produce this result:

1. Lowering the energy needed for personal transportation by tripling the energy efficiency of on-road vehicles in 2050 with:

   a. Conventional gas, diesel, and flexible fuel vehicles (FFVs) averaging more than 40 miles per gallon (mpg).

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[119] State Alternative Fuels Plan. December 2007 CEC-600-2007-011-CMF. Available online at: http://www.energy.ca.gov/2007publications/CEC-600-2007-011/CEC-600-2007-011-CMF.PDF

[120] Ibid. Page 67 and 68.

b. Hybrid gas, diesel, and FFVs averaging almost 60 mpg.

c. All electric and plug-in hybrid electric vehicles (PHEVs) averaging well over 100 mpg (on a greenhouse gas equivalents (GGE) basis) on the electricity cycle.

d. Fuel cell vehicles (FCVs) averaging over 80 mpg (on a GGE basis).

2. Moderating growth in per capita driving, reducing today's average per capita driving miles by about 5 percent or back to 1990 levels.
3. Changing the energy sources for transportation fuels from the current 96 percent petroleum-based to approximately:

   a. 30 percent from gasoline and diesel from traditional petroleum sources or lower GHG emission fossil fuels such as natural gas.

   b. 30 percent from transportation biofuels.

   c. 40 percent from a mix of electricity and hydrogen.

4. Producing transportation biofuels, electricity, and hydrogen from renewable or very low carbon-emitting technologies that result in, on average, at least 80 percent lower life cycle GHG emissions than conventional fuels.
5. Encouraging more efficient land uses and greater use of mass transit, public transportation, and other means of moving goods and people.

The measures described above are the types of measures that will yield required reductions. Although these types of measures are expected to occur and are consistent with the CP-HPS Plan development plan, CP-HPS Plan is not claiming any credit for these measures.

5.1 Renewable Power Requirements

A major component of California's Renewable Energy Program is the Renewables Portfolio Standard (RPS) established under Senate Bills 1078 (Sher) and 107 (Simitian). Under the RPS, certain retail sellers of electricity are required to increase the amount of renewable energy each year by at least 1% until 20% by December 31, 2010. Executive Order S-14-08 sets an even higher goal of 33% by 2020. Renewable sources of electricity include wind, small hydropower, solar, geothermal, biomass, and biogas. The increase in renewable sources for electricity production will decrease indirect GHG emissions from CP-HPS Plan because electricity production from renewable sources is generally considered "carbon neutral."[121] For purposes of this semi-quantitative analysis, ENVIRON assumes that the production of electricity from these renewable sources does not produce any net emissions of CO_2.

[121] There is some debate on the carbon neutrality of using biomass and biogas for electricity production. While some may argue that the carbon released as CO_2 from biomass or biogas combustion originated from the atmosphere and thus does not contribute any net additional carbon to the atmosphere, others argue that the combustion still releases CO_2 into the atmosphere and thus cannot be ignored. For sake of the semi-quantitative analysis presented here, we assume that electricity production from renewable sources is carbon neutral. However, this should not be interpreted as a policy judgment for either argument.

The utility provider for the CP-HPS Plan development is assumed to be PG&E as the CP-HPS Plan Specific Plan is situated largely in San Francisco County. As shown in Table 5-1, 11% of the energy delivered by PG&E was procured from renewable sources in 2007.[122] Total electricity delivery for that year was 79,450,904 megawatt-hours (MWh). Based on PG&E's 2007 Power/Utility Protocol (PUP) Report to the CCAR[123], their CO_2 emissions per total power delivered was 636 lbs CO_2/MWh. Considering the total amount of energy delivered and the percentage of energy from renewables, ENVIRON estimated that once the 20% renewables target for 2010 was achieved, that CO_2 emission factor would decrease to 574 lbs CO_2/MWh. In addition, if the proposed 33% renewables target for 2020 was achieved, the CO_2 emission factor would decrease even further to 481 lbs CO_2/MWh. These represent indirect GHG emissions reductions by approximately 10% and 24%, respectively.

5.2 Low Carbon Fuel Standard (LCFS)

As mentioned previously, the LCFS requires a reduction in carbon intensity of transportation fuels by at least 10% by 2020. The LCFS encompasses the life cycle emissions for fuels (i.e., "well-to-wheel"). Thus, not only does it include the vehicle tailpipe emissions from the use of the fuel, it also includes all the energy used to produce, process, and transport the fuel. By design, the implementation of the LCFS would decrease the overall GHG emissions for California. However, its impact on vehicle tailpipe emissions is not obvious. As the CP-HPS Plan GHG inventory only considers the vehicle tailpipe emissions, and not the life cycle emissions for transportation, it is difficult to quantitatively assess the impacts of the LCFS on the inventory. The LCFS will directly affect the emission factor and the fuel economy since alternate fuels will have various energy/carbon content. Fuels identified as possible alternatives to conventional gasoline and diesel include biodiesel, ethanol E85, and compressed natural gas (CNG). According to a study by TIAX, LLC, well-to-wheel GHG emissions for E85 derived from Midwest corn feedstock and CNG from North America would be expected to be roughly 22% and 30% lower relative to reformulated gasoline.[124]

Table 5-2 presents a few scenarios to illustrate the impact of LCFS on tailpipe emissions at CP-HPS Plan. The baseline scenario represents the current vehicle miles traveled at CP-HPS Plan. Total annual vehicle miles travelled (VMT) is 309,166,932 miles per year for this scenario we will assume a fleet distribution of 95% gasoline vehicles and 5% diesel vehicles and a fleet average emission factor. The GHG inventory for vehicle tailpipe emissions in this scenario is approximately 56,881 metric tonnes CO_2 per year.[125] The GHG emissions depend on the emission factors for each fuel (kg CO_2/gallon of fuel), average fuel economy (miles per gallon), and the VMT.[126]

[122] The renewable energy distribution is based on 2007 data available at: http://www.pgecorp.com/corp_responsibility/reports/2007/environment/energy-future.html
[123] Available at: http://www.climateregistry.org./CarrotDocs/
[124] California Energy Commission (CEC) and California Air Resources Board (ARB). 2007. State Alternative Fuels Plan. Commission Report. CEC-600-2007-011-CMF. December.
[125] This figure only includes CO_2 and not CO_2e and does not include start-up emissions for purposes of comparison to this analysis.
[126] The emissions estimated in Table 5-2 here are derived differently compared to emissions calculated from the EMFAC model runs for the CP-HPS Plan inventory; the estimated emissions for the baseline scenario are roughly within 10% of the vehicle emissions developed using EMFAC. This difference is likely due to improvements in vehicle technology estimated for 2011. However, for purposes of this semi-quantitative analysis, this should be

Scenario A represents a replacement of conventional California diesel with biodiesel. While the emission factor for biodiesel is lower (9.52 kg CO_2/gal) compared to conventional California diesel (9.96 kg CO_2/gal), the average fuel economy of vehicles running on California diesel is higher (7.9 mpg) than for vehicles running on biodiesel (7.1 mpg).[127,128] The result is that the overall tailpipe vehicle emissions at CP-HPS Plan would increase slightly if California diesel were replaced by biodiesel. This is a case where the overall life cycle analysis GHG emissions for biodiesel are lower than that for conventional California diesel, but the actual tailpipe emissions would be slightly higher.

Scenario B represents a replacement of conventional California gasoline with an 85% ethanol blend (E85). Compared to conventional California gasoline, E85 has a lower emission factor on a per gallon basis (6.10 kg CO_2/gal)[129] but also a lower fuel economy (15.2 mpg)[130] due to the lower energy content of E85. The resulting tailpipe emissions at CP-HPS Plan in this scenario would be roughly 7.2% lower than the baseline scenario. In this case the decreased fuel economy for E85 vehicles was more than offset by the lower emission factor, resulting in lower tailpipe emissions.

Scenario C represents a replacement of conventional California gasoline with compressed natural gas (CNG). Compared to conventional California gasoline, CNG has a lower emission factor on a per equivalent gallon basis (6.86 kg CO_2/equivalent gallon).[131] The current commercially available car running on CNG has a higher fuel economy (28 mpg)[132] than that for the average gasoline vehicle. The resulting tailpipe emissions at CP-HPS Plan in this scenario would be over 53% lower than the baseline scenario. In this case, the increased fuel economy for CNG and the lower emission factor both contribute to the lower tailpipe emissions.

These scenarios illustrate that the alternative fuels available in the future can have different effects on vehicle tailpipe emissions which is accounted for in the CP-HPS Plan GHG inventory. The degree of impact on the CP-HPS Plan's GHG inventory can be slight to moderate depending on the fuel mix available. The semi-quantitative analysis presented here is only speculative. As a first-order assumption, this analysis does not account for improvements in vehicle technology (i.e., emission factors and fuel economy are constant) or changes in VMT for CP-HPS Plan's population. In reality, vehicle technologies are likely to improve and VMT will

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acceptable since the emissions presented in this table are only for comparative purposes and are not meant to represent actual emissions at CP-HPS Plan.

127 Emission factors for fuels were from the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) Version 3.1 (2009)

128 Average fuel economy data for biodiesel from the Department of Energy website: http://www.fueleconomy.gov/feg/biodiesel.shtml
Average fuel economy data for diesel-fueled vehicles obtained from fuel usage and VMT projections for 2008 from the California Department of Transportation report "California Motor Vehicle Stock, Travel, and Fuel Forecast" available at: http://www.dot.ca.gov/hq/tsip/smb/documents/mvstaff/mvstaff05.pdf

129 Emission factors for fuels were from the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) Version 3.1 (2009)

130 Average fuel economy data for E85 from the Department of Energy website: http://www.fueleconomy.gov/feg/ethanol.shtml

131 Emission factors for fuels were from the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) Version 3.1 (2009)

132 Fuel economy for a 2008 Honda Civic fueled by CNG available at: http://www.fueleconomy.gov/feg/byfueltype.htm

increase as CP-HPS Plan’s population increases. Nevertheless, the LCFS, by definition, should result in lower overall GHG emissions in California. However, these emission reductions are not reflected in CP-HPS Plan’s GHG inventory.

6 Conclusion

ENVIRON prepared an emissions inventory for the CP-HPS Plan development and the two project Variants. This emissions inventory was prepared consistent with the methodologies established by the CCAR where possible. The CP-HPS Plan emissions inventory considers nine categories of GHG emissions: emissions due to vegetation changes, emissions from construction activities, residential emissions, commercial building emissions, mobile source emissions, municipal emissions, area source emissions, transit service emissions, and waste disposal emissions. Emission from recreation centers were not calculated since they are a small fraction of the overall inventory. The emissions from construction and land use change would be one-time emissions events, while the other emissions would occur annually, throughout the life of CP-HPS Plan. An assessment of the impact of rules to reduce GHG intensity in electricity production and vehicle use was also included.

A variety of methods were employed to develop the GHG emissions inventory. In addition to well established emission factors for certain activities and emission estimates based on similar activities in other representative communities, several different estimation software were used. These included EMFAC, OFFROAD, and URBEMIS.

Emissions from the various components of the CP-HPS Plan development are presented in Tables 3-36. There are 98,587 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to 154,639 tonnes CO_2e/year. Of the annual emissions, slightly more than 68% result from vehicular emissions associated with residential activities, and 29% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately 2,465 tonnes, or 2% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 157,104 tonnes/year. As discussed below, these figures reflect conservative assumptions that likely overstate the GHG emissions that would result from this project.

Emissions from the various aspects of Variant 1 are presented in Table 3-38. Both the one-time emissions and emissions that are expected to occur each year after build-out of the CP-HPS Plan development are presented. There are 98,587 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to 178,651 tonnes CO_2e/year. Of the annual emissions, slightly more than 67% result from vehicular emissions associated with residential activities, and 29% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately 2,465 tonnes, or 2% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 181,115 tonnes/year. As discussed below, these figures reflect conservative assumptions that likely overstate the GHG emissions that would result from this project.

Emissions from the various aspects of Variant 2 are presented in Table 3-40. Both the one-time emissions and emissions that are expected to occur each year after build-out of the CP-HPS Plan development are presented. There are 98,587 tonnes of CO_2e one-time emissions. The annual emissions from the use of the development amount to 157,509 tonnes CO_2e/year. Of the annual emissions, slightly more than 70% result from vehicular emissions associated with residential activities, and 26% result from the energy use associated with residential and non-residential buildings. If the one-time emissions are annualized assuming a 40-year development life (which is likely low), then the one-time emissions account for approximately 2,465 tonnes, or 2% of the annual emissions. Taking these annualized one-time emissions into account, the annual emissions are 159,974 tonnes/year. As discussed below, these figures reflect conservative assumptions that likely overstate the GHG emissions that would result from this project.

Compared to California's 2020 NAT per capita emissions, 14.1 tonnes CO_2e per capita, a 28.5% decrease in emissions by 2020 is required to achieve AB 32 goals. In order to achieve AB 32 mandated goals, the per capita emissions would have to be 10.1 tonnes CO_2e. CP-HPS Plan has estimated emissions of 154,639 tonnes per year, or 6.5 tonnes per capita per year.[133] This estimate does not include emissions from heavy industry, refining, or commercial transportation that are included in the California figure of 10.1 tonnes CO_2e per capita.

As a result of the various design elements incorporated into the CP-HPS Plan project, the development approaches AB 32's goal of 28.5% below NAT in several areas. For example, as designed, homes in CP-HPS Plan are expected to be 20% more energy efficient than the current housing stock in California, as shown in Tables 4-8 through 4-10. The non-residential units are 17-18% more energy efficient than the average California non-residential buildings stock. Vehicular emissions from CP-HPS Plan residents are 57-59% less per dwelling unit than NAT. Additionally, CP-HPS Plan's municipal sources are 16-18% better than NAT which does not include water efficiency measures and energy efficient street lighting. Transit services are 40% better than NAT. The emission savings combined for CP-HPS Plan represent a 51% for CP-HPS, 49% for Variant 1 and 50% for Variant 2 reduction from a NAT situation without taking into consideration changes in emission factors, occupant energy use reductions, and categories that do not permit a NAT comparison for at this time. It should be noted that each estimate was developed using a different methodology; any conclusions based upon a comparison of these numbers should note the difference in methodologies. It is yet unclear as to how to compare construction, waste disposal, and area emissions to AB 32 mandated goals.

The GHG emission inventory for CP-HPS Plan was based on several conservative assumptions. In addition, anticipated state and federal regulatory developments are expected to result in lower GHG emissions from CP-HPS Plan than are represented in this analysis. California's Renewables Portfolio Standard (RPS) anticipated 33% target for 2020 will also decrease CP-HPS Plan's GHG inventory from electricity use. Reaching the anticipated 2020 target would result in a decrease of roughly 24%.

Thus, while the CP-HPS Plan project already comes close to achieving the GHG levels necessary to achieve AB 32's mandates, upon implementation of existing and anticipated legislative and regulatory mandates, actual emissions associated with CP-HPS Plan will likely be considerably lower.

[133] Assuming a population of 23,869 residents in CP-HPS Plan.

Table 3-1
CO_2 Sequestration Capacity of New Vegetation Plantings
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Vegetation Species[1]	IPCC Species Class Designation	Sequestered CO_2 / Unit[2] [tonne/unit/year]	Unit	Total Quantity of New Vegetation[1]	Unit	CO_2 Sequestration Capacity of New Vegetation[3] [tonne]
Miscellaneous	Miscellaneous Trees	0.035	trees	10,000	trees	7,000
Total	-	-		**10,000**	**trees**	**7,000**

Notes:
1. Lennar Urban has committed to planting 10,000 net new trees in the development.
2. Species class-specific sequestration values are provided in Table 8.2 of "2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4". For species that do not appear in Table 8.2, the species was classifed as "miscellaneous" and the average value of all listed data was used.
3. An active growing period of 20 years was assumed for the new trees planted.

Sources:

1. IPCC. 2006. Guidelines for National Greenhouse Gas Inventories Volume 4. Available online at http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.htm

Table 3-2
GHG Emissions from Construction Equipment[1]
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Location	Equipment	Horsepower	Load Factor	Total Equipment Hours	Emission Factor[3] (g/bhp-hr)	CO_2e Emission[4,5] (tonne)
Candlestick Point	Asphalt Layer	100	0.62	21,900	568.3	772
	Barge	1000	0.51	2,607	568.3	756
	Bobcat	44	0.55	21,900	568.3	301
	Compactor	8	0.43	22,769	568.3	45
	Crane	399	0.43	18,250	568.3	1,779
	Cement Truck	479	0.57	11,298	568.3	1,753
	Dozer	357	0.59	26,245	568.3	3,142
	Offroad Dump Truck	479	0.57	28,505	568.3	4,423
	Excavator	168	0.57	41,019	568.3	2,232
	Rough Terrain Fork Lift	93	0.6	28,852	568.3	915
	Grader	174	0.61	21,900	568.3	1,321
	Haul Trucks	479	0.57	37,543	568.3	5,825
	Loader	164	0.54	105,155	568.3	5,292
	Man Lift	60	0.46	82,386	568.3	1,292
	Onsite Field Truck	479	0.57	37,543	568.3	5,825
	Pile Driver	291	0.75	7,821	568.3	970
	Pump Truck	479	0.57	11,298	568.3	1,753
	Roller	104	0.53	22,248	568.3	697
	Scraper	313	0.72	29,026	568.3	3,717
	Soil Stabilizer	238	0.51	21,900	568.3	1,511
	Water Truck	479	0.57	77,867	568.3	12,082
	Total					**56,403**
Hunter's Point Shipyard	Asphalt Layer	100	0.62	17,033	568.3	600
	Barge	1000	0.51	26,767	568.3	7,758
	Bobcat	44	0.55	33,024	568.3	454
	Compactor	8	0.43	18,424	568.3	36
	Crane	399	0.43	26,940	568.3	2,627
	Dozer	357	0.59	32,502	568.3	3,891
	Drill Rig	291	0.75	3,129	568.3	388
	Offroad Dump Truck	479	0.57	28,157	568.3	4,369
	Excavator	168	0.57	40,845	568.3	2,223
	Rough Terrain Fork Lift	93	0.6	25,898	568.3	821
	Grader	174	0.61	17,033	568.3	1,027
	Haul Trucks	479	0.57	16,686	568.3	2,589
	Loader	164	0.54	61,529	568.3	3,097
	Man Lift	60	0.46	21,900	568.3	344
	Onsite Field Truck	479	0.57	18,076	568.3	2,805
	Pile Driver	291	0.75	4,867	568.3	604
	Pump Truck	479	0.57	3,129	568.3	485
	Roller	104	0.53	17,033	568.3	534
	Scraper	313	0.72	11,819	568.3	1,514
	Soil Stabilizer	238	0.51	17,033	568.3	1,175
	Water Truck	479	0.57	35,805	568.3	5,556
	Total					**42,895**
Overall Emissions from Construction Equipment						**99,298**

Notes:
1. The list of equipment during each construction phase was provided by Mactech.
2. The equipment-hour of individual equipment is calculated based on the phase duration.
3. The values of Horsepower, Load Factor, and Emission Factor of each type of equipment are from OFFROAD2007 defaults.
4. The CO_2 Emission calculation formula for each piece of equipment is:
   CO_2 Emission = Equipment Hours x HP x Load Factor x Emission Factor x Unit Conversion Factor
5. Assume $CO_2 = CO_2e$ because the contribution of CH_4 and N_2O to overall GHG emissions is likely small (< 1% of total CO_2e) from diesel construction equipment.

Abbreviations:
bhp - brake horsepower
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
hr - hour

Table 3-3
GHG Emissions from Worker Commutes
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Location	Worker Round Trips[1]	Trip Length [2]	EF^3_{LDA}		EF_{LDT2}		CO_2 Emissions[4]		Total CO_2 Emissions	Total CO_2e Emissions[5,6]
			Running	Startup	Running	Startup	Running	Startup		
		(miles)	(g/mile)	(g/trip)	(g/mile)	(g/trip)	(tonne)			
Candlestick Point	144,870	29.8	340	209	424	259	1,649	68	1,717	1,807
Hunter's Point Shipyard	181,588	29.8	340	209	424	259	2,067	85	2,152	2,265
Total									**3,869**	**4,073**

Notes:
1. Worker trips were calculated based on the average number of workers and duration of each project phase as provided by Mactech.
2. The roundtrip length is 29.8 miles based on the Home-Work trip lenth for San Francisco provided by Fehr and Peers.
3. The running emission factor depends on the speed of the vehicle. The emission factor used in this calculation refers to the URBEMIS 9.2.4 default vehicle speed: 30 MPH.
The startup emission factor depends on the settling period before driving. The startup emissions were conservatively calculated based on a 12 hour wait before each engine startup.
4. GHG Running Emission calculation formula: GHG Emission = Roundtrips x Trip Length x (0.5 x EF_{LDA} + 0.5 x $EF_{LDT2})_{Running}$
GHG Startup Emission calculation formula: GHG Emission = Worker Trips x (0.5 x EF_{LDA} + 0.5 x $EF_{LDT2})_{Startup}$
URBEMIS 9.2.4 assumes that LDA and LDT have a 50:50 mixing ratio.
5. $CO_2e = CO_2 / 0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their global warming potentials.
6. The emission factor values of calendar year 2011, the anticipated start date of the project, were used for all calculations.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
EF - Emission Factor
HFC - hydro fluorocarbons
hr - hour
LDA - Light Duty Auto
LDT - Light Duty Truck
MPH - Miles per hour
URBEMIS - Urban Emissions Model

Table 3-4
GHG Emissions from Hauling Trips
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Location	Hauling Round Trips[1]	Trip Length[2]	EF^3_{HHD}		CO_2 Emissions[4]		Total CO_2 Emissions	Total CO_2e Emissions[5,6]
			Running	Startup	Running	Startup		
		(miles)	(g/mile)	(g/trip)	(tonne)			
Candlestick Point	26,158	14.6	1,610	389	1,230	20	1,250	1,316
Hunter's Point Shipyard	17,902	14.6	1,610	389	842	14	855.6	901

Notes:
1. Hauling trips are calculated based on information provided by Mactech.
2. Trip length is based on URBEMIS default for San Francisco consumer non-work of 7.3 miles one way.
3. The running emission factor depends on the speed of the vehicle. The emission factor used in this calculation refers to the URBEMIS 9.2.4 default vehicle speed: 30 MPH.
   The startup emission factor depends on the settling period before driving. The startup emissions are conservatively calculated based on a 12 hour wait before each engine startup.
4. URBEMIS 9.2.4 assumes that all haulers drive heavy-heavy-duty trucks.
   CO_2 Running Emission calculation formula: CO_2 Emission = trips x trip length x $EF_{HHD\text{-}Running}$
   CO_2 Startup Emission calculation formula: CO_2 Emission = Hauler Trips x $EF_{HHD\text{-}Startup}$
5. $CO_2e = CO_2 / 0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs account for 5% of GHG emissions from on-road vehicles, taking into account their global warming potentials.
6. The emission factor values of calendar year 2011, the anticipated start date of the project, are used for all calculations.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
g - gram
GHG - Greenhouse Gas
EF - Emission Factor
GVW - Gross Vehicle Weight
HFC - Hydro Fluorocarbons
HHD - Heavy-Heavy Duty
hr - hour
MPH - Miles per hour
URBEMIS - Urban Emissions model

Table 3-5
Overall Construction GHG Emissions
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Location	Construction Equipment	Worker Commuting	Hauling	Total GHG Emissions
	(tonnes CO_2e)			
Candlestick Point	56,403	1,807	1,316	**59,526**
Hunter's Point Shipyard	42,895	2,265	901	**46,061**
Total	**99,298**	**4,073**	**2,216**	**105,587**

Notes:
1. See previous tables for calculation detail. The table includes emissions from construction equipment, worker commuting and hauling.

Abbreviations:
CO_2e - carbon dioxide equivalent
GHG - Greenhouse Gas

Table 3-6
Energy Use per Residential Dwelling Unit: Title-24 Regulated Heating and Cooling
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Dwelling Type[1]	Electricity Delivered (kW-hr/DU/year)									Natural Gas Delivered (MBTU/DU/yr)							
	Heating[2,3]	Cooling[2]	Domestic Hot Water[2,3]	RASS Total	% reduction due to 2005 standards relative to 2001[4,5]	2005 Estimated Total	% reduction due to 2008 vs. 2005 standards[6]	2008 Estimated Total	2008 Estimated Total (with 15% improvement over Title 24)[7]	Heating[2,3]	Domestic Hot Water[2,3]	RASS total	% reduction due to 2005 standards relative to 2001[4]	2005 Estimated Total	% reduction due to 2008 vs. 2005 standards[6]	2008 Estimated Total	2008 Estimated Total (with 15% improvement over Title 24)[7]
Multifamily CP	422	5	115	542	19.8%	435	22.7%	336	286	22.2	17.1	39.3	6.7%	36.7	10%	33.0	28.1
Multifamily HPS	422	5	115	542	19.8%	435	22.7%	336	286	22.2	17.1	39.3	6.7%	36.7	10%	33.0	28.1

Notes:
1. Based on information provided by Lennar Urban.
2. Based on the California Residential Appliance Saturation Survey (RASS), which collected data from over 21,100 households statewide. When available, RASS data tabulated for multifamily homes in the climate zone in which the CP-HPS Plan would be located (Climate Zone 5) were considered in this analysis. Otherwise, the average of all household types or statewide values were used.
3. Homes can be heated using electricity and/or natural gas. Homes can also use water heaters that use electricity and/or natural gas. The mix of types is based on the RASS report saturation percentage.

4. Reductions are taken with the assumption that the RASS estimate reflects heating/cooling/hot water electricity use for homes that are minimally compliant with 2001 Title 24 Standards (this version was the most current at the time of the RASS study). More than 90% of the homes that participated in the survey were constructed before 1997. Because older homes tend to use more energy, the numbers shown here may overestimate actual energy use at a new development such as Bayview Waterfront.
5. Based on report by California Energy Commission on estimated first-year electricity savings due to 2005 standards for single-family and multi-family homes, relative to 2001 standards.
6. Based on California Energy Commission report on estimated first-year electricity savings due to 2008 standards for single-family and multi-family homes, relative to 2005 standards.
7. There is an additional 15% improvement over Title 24 for the Candlestick Pointand Hunter's Point Shipyard.

Abbreviations:
CP - Candlestick Point
DU - Dwelling
HPS -Hunter's Point Shipyard
IB - India Basin
kW-hr - kilowatt-hour
MBTU - million british thermal units
RASS - Residential Appliance Saturation Survey

Source:

California Energy Commission. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF
California Energy Commission. 2007. Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF
Kema-Xenergy, Itron, RoperASW. 2004. California Statewide Residential Appliance Saturation Study (RASS) Volume 2, Study Results, Final Report. June. 300-00-004. Available at: http://www.energy.ca.gov/reports/400-04-009/2004-08-17_400-04-009VOL2B.PDF

Table 3-7
Energy Use per Residential Dwelling Unit: Appliances and Plug-ins
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

		Electricity Delivered (kW-hr/DU/year)[2]								Natural Gas Delivered (MBTU/DU/yr)[2]		
Type	**Dwelling Type[1]**	**Refrigerator**	**Clothes Washer**	**Clothes Dryer[3]**	**Dishwasher**	**Cooking Range (Electric)[4]**	**Total Major Appliances**	**MELs**	**Total**	**Clothes Dryer (Gas)[3]**	**Gas Cooking Range[4]**	**Total**
Standard Appliances	**Multifamily CP**	744	4	93	28	101	971	1,783	2,753	0.7	2.3	3.1
	Multifamily HPS	744	4	93	28	101	971	1,783	2,753	0.7	2.3	3.1
Energy Star Appliances[5]	**Multifamily CP**	633	3	93	23	101	853	1,783	2,635	0.7	2.3	3.1
	Multifamily HPS	633	3	93	23	101	853	1,783	2,635	0.7	2.3	3.1

Notes:
1. Information provided by Lennar Urban.
2. Energy use per residential dwelling unit is based on information in RASS report.
either electric or
4. Cooking ranges can be either gas or electric. The mix of types is based on the RASS report saturation percentage.
5. Average energy savings above standard products are applied to refrigeration (15%), clothes washer (30%), dishwasher (20%) as reported in Energy Star and Other Climate Protection Partnerships 2007 Annual Report Table 9.

Abbreviations:
CP - Candlestick Point
DU - Dwelling Unit
HPS -Hunter's Point Shipyard
kW-hr - kilowatt-hour
MBTU - million british thermal units
MEL - Miscellaneous electric load
RASS - Residential Appliance Saturation Survey

Source:
Environmental Protection Agency (USEPA). 2007 Annual Report. Energy Star and Other Climate Protection Partnerships. Available at: http://www.energystar.gov/ia/partners/publications/pubdocs/2007%20Annual%20Report%20-%20Final%20 11-10-08.pdf
Kema-Xenergy, Itron, RoperASW. California Statewide Residential Appliance Saturation Study (RASS) Volume 2, Study Results, Final Report. June 2004. 300-00-004.

Table 3-8
Energy Use per Residential Dwelling Unit
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Title 24 Compliance	Dwelling Type	Electricity Delivered[1,2]					Natural Gas Delivered[1,2]		
		Heating, Cooling, and Domestic Hot Water	Hard Wired Lighting[3]	Major Appliances	Plug-ins[3,4]	Total	Heating and Domestic Hot Water	Gas Dryers and Oven Ranges	Total
		[kW-hr / DU / year]					(MBTU natural gas / DU / year)		
Minimally Title 24 Compliant (2005)	Multifamily CP	435	429	971	1,783	3,617	37	3	40
	Multifamily HPS	435	429	971	1,783	3,617	37	3	40
Minimally Title 24 Compliant (2008)	Multifamily CP	336	429	971	1,783	3,518	33	3	36
	Multifamily HPS	336	429	971	1,783	3,518	33	3	36
15% Better Than Title 24 and Energy Star Appliances[5]	Multifamily CP	286	364	853	1,783	3,285	28	3	31
	Multifamily HPS	286	364	853	1,783	3,285	28	3	31
Percentage Improvement over Title 24 (2005)	Multifamily CP	34%	15%	12%	0%	9%	15%	--	14%
	Multifamily HPS	34%	15%	12%	0%	9%	15%	--	14%

Notes:

1. Energy use shown is based on the California Residential Appliance Saturation Survey (RASS), which collected data from over 21,100 households statewide. Only RASS data tabulated for the multifamily homes in the climate zone in which Bayview Waterfront would be located (Climate Zone 5) were considered in this analysis.
2. For energy uses that can be electric or natural gas the mix of types is based on the RASS report saturation percentage.
3. Hard wired lighting is assumed to be all outdoor lighting and half of the energy for indoor lighting listed under miscellaneous electricity load in the RASS report. The other indoor lighting is assumed to be plug-ins. Lighting is 60% of the miscellaneous electricity load according to the RASS report.

4. "Plug-ins" refers to electricity use associated with plug-in lighting, plug-in appliances, and miscellaneous electric loads. This energy use is calculated based on the RASS report.
5. Lennar Urban has committed to a 15% improvement in energy use in the building envelope over 2008 Title 24 standards and inclusion of energy star appliances for Candlestick Point and Hunter's Point Shipyard.

Abbreviations:
CP - Candlestick Point
DU - Dwelling Unit
HPS -Hunter's Point Shipyard
IB - India Basin
kW-hr - kilowatt-hour
MBTU - million british thermal units
RASS - Residential Appliance Saturation Survey

Source:
Kema-Xenergy, Itron, RoperASW. California Statewide Residential Appliance Saturation Study (RASS) Volume 2, Study Results, Final Report. June 2004. 300-00-004.

Table 3-9
Emission Factors for Different Energy Sources for Buildings with Renewable Portfolio Standards
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Energy Source	Source Units	lb CO_2/source unit
Electricity[1]	(kW-hr)	0.636
Electricity RPS[2]	(kW-hr)	0.574
Natural Gas[3]	(MBTU)	117.0

Notes:
1. Emission factor for electricity provided by Pacific Gas and Electric, obtained from the California Climate Action Registry Database.
2. Emission factor for electricity has been adjusted to account for the 20% Renewable Portfolio Standard Required of electricity providers by 2010.
2. Emission factor for natural gas was obtained from California Climate Action Registry Reporting Protocol, Table C6.

Abbreviations:
kW-hr - kilowatt-hour
lb - pound
MBTU - million British thermal units
RPS - Renewable Portfolio Standards

Sources:
California Climate Action Registry General Reporting Protocol, Version 3.1 (January 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

California Climate Action Registry Database: PG&E 2007 PUP Report. 2008. Available at: https://www.climateregistry.org/CARROT/public/Reports.aspx

Table 3-10
CO_2e Emissions per Dwelling Unit with Renewable Portfolio Standard
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Title 24[1] Compliance	Type[2]	Title-24 Systems[1]		Title-24 Systems and Major Appliances		Title-24 Systems and All MELs		Title-24 Systems	Title-24 Systems and Major Appliances	Title-24 Systems and All MELs
		CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Electricity[3]	CO_2 Natural Gas[4]	CO_2 Total	CO_2 Total	CO_2 Total
		(lbs / DU / year)						(tonnes / DU / year)		
Minimally Title 24 Compliant (2005)	Multifamily CP	549	4291	1166	4649	2299	4649	2.2	2.6	3.2
	Multifamily HPS	549	4291	1166	4649	2299	4649	2.2	2.6	3.2
Minimally Title 24 Compliant (2008)	Multifamily CP	439	3862	996	4220	2019	4220	2.0	2.4	2.8
	Multifamily HPS	439	3862	996	4220	2019	4220	2.0	2.4	2.8
15% Better Than Title 24 and Energy Star Appliances[5]	Multifamily CP	373	3283	862	3641	1885	3641	1.7	2.0	2.5
	Multifamily HPS	373	3283	862	3641	1885	3641	1.7	2.0	2.5
Percentage Improvement over Title 24 (2005)	Multifamily CP	32%	24%	26%	22%	18%	22%	24%	23%	20%
	Multifamily HPS	32%	24%	26%	22%	18%	22%	24%	23%	20%

Notes:
1. Title 24 - California Code of Regulations (CCR), Title 24, also known as the California Building Standards Code.
2. Information provided by Lennar Urban.
3. The minimally Title 24 Complaint (2005) scenario converted from kW-hr to lb CO_2 using emission factor from the California Climate Action Registry Database: PG&E 2007 PUP Report. 2008. All other scenarios converted from kW-hr to lb CO_2 using emission factor adjusted for the RPS.
4. Converted from MBTU to lb CO_2 using emission factor from California Climate Action Registry General Reporting Protocol (CCAR GRP).
5. Lennar Urban has committed to a 15% improvement in energy use in the building envelope over Title 24 standards and inclusion of energy star appliances at Candlestick Point and Hunter's Point Shipyard.

Abbreviations:
CO_2 - carbon dioxide
CP - Candlestick Point
DU - Dwelling Unit
HPS -Hunter's Point Shipyard
IB - India Basin
kW-hr - kilowatt-hour
lb - pound
SF - Square Feet
RPS - Renewable Portfolio Standards

Sources:

California Climate Action Registry General Reporting Protocol, Version 3.1 (June 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

California Climate Action Registry Database: PG&E 2007 PUP Report. 2008. Available at: Available at: https://www.climateregistry.org/CARROT/public/Reports.aspx

Table 3-11
CO_2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units with Renewable Portfolio Standard
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Title 24[1] Compliance	Housing Type	# Dwelling Units[2]	Title-24 Systems			Title-24 Systems and Major Appliances			Title-24 Systems and All MELs		
			CO_2 Emission Factor	Total CO_2 Emissions		CO_2 Emission Factor	Total CO_2 Emissions		CO_2 Emission Factor	Total CO_2 Emissions	
			(tonne CO_2 / DU / year)	(tonne CO_2 / year)		(tonne CO_2 / DU / year)	(tonne CO_2 / year)		(tonne CO_2 / DU / year)	(tonne CO_2 / year)	
Minimally Title 24 Compliant (2005)	Multifamily CP	7,594	2.2	16,672	**16,672**	2.6	20,031	**20,031**	3.2	23,934	**23,934**
	Multifamily HPS	2,650	2.2	5,818	**5,818**	2.6	6,990	**6,990**	3.2	8,352	**8,352**
Minimally Title 24 Compliant (2008)	Multifamily CP	7,594	2.0	14,815	**14,815**	2.4	17,967	**17,967**	2.8	21,491	**21,491**
	Multifamily HPS	2,650	2.0	5,170	**5,170**	2.4	6,270	**6,270**	2.8	7,499	**7,499**
15% Better Than Title 24 and Energy Star Appliances	Multifamily CP	7,594	1.7	12,593	**12,593**	2.0	15,511	**15,511**	2.5	19,035	**19,035**
	Multifamily HPS	2,650	1.7	4,394	**4,394**	2.0	5,413	**5,413**	2.5	6,642	**6,642**
Percentage Improvement over Title 24 (2005)	Multifamily CP	7,594	24%	24%	**24%**	23%	23%	**23%**	20%	20%	**20%**
	Multifamily HPS	2,650	24%	24%	**24%**	23%	23%	**23%**	20%	20%	**20%**

Notes:
1. Title 24 - California Code of Regulations (CCR), Title 24, also known as the California Building Standards Code.
2. Information provided by Lennar Urban.

Abbreviations:
CP - Candlestick Point
CO_2 - carbon dioxide
HPS -Hunter's Point Shipyard
DU - Dwelling Units
MEL - Miscellaneous electric loads
RPS - Renewable Portfolio Standards

Sources:
California Climate Action Registry General Reporting Protocol, Version 3.1 (January 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

Table 3-12
CO_2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units with Renewable Portfolio Standard
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 2
San Francisco, California

Title 24[1] Compliance	Housing Type	# Dwelling Units[2]	Title-24 Systems			Title-24 Systems and Major Appliances			Title-24 Systems and All MELs		
			CO_2 Emission Factor	Total CO_2 Emissions		CO_2 Emission Factor	Total CO_2 Emissions		CO_2 Emission Factor	Total CO_2 Emissions	
			(tonne CO_2 / DU / year)	(tonne CO_2 / year)		(tonne CO_2 / DU / year)	(tonne CO_2 / year)		(tonne CO_2 / DU / year)	(tonne CO_2 / year)	
Minimally Title 24 Compliant (2005)	Multifamily CP	6,244	2.2	13,708	**13,708**	2.6	16,470	**16,470**	3.2	19,679	**19,679**
	Multifamily HPS	4,000	2.2	8,782	**8,782**	2.6	10,551	**10,551**	3.2	12,607	**12,607**
Minimally Title 24 Compliant (2008)	Multifamily CP	6,244	2.0	12,182	**12,182**	2.4	14,773	**14,773**	2.8	17,670	**17,670**
	Multifamily HPS	4,000	2.0	7,804	**7,804**	2.4	9,464	**9,464**	2.8	11,320	**11,320**
15% Better Than Title 24 and Energy Star Appliances	Multifamily CP	6,244	1.7	10,354	**10,354**	2.0	12,753	**12,753**	2.5	15,651	**15,651**
	Multifamily HPS	4,000	1.7	6,633	**6,633**	2.0	8,170	**8,170**	2.5	10,026	**10,026**
Percentage Improvement over Title 24 (2005)	Multifamily CP	6,244	24%	24%	**24%**	23%	23%	**23%**	20%	20%	**20%**
	Multifamily HPS	4,000	24%	24%	**24%**	23%	23%	**23%**	20%	20%	**20%**

Notes:
1. Title 24 - California Code of Regulations (CCR), Title 24, also known as the California Building Standards Code.
2. Information provided by Lennar Urban.

Abbreviations:
CP - Candlestick Point
CO_2 - carbon dioxide
HPS -Hunter's Point Shipyard
DU - Dwelling Units
MEL - Miscellaneous electric loads
RPS - Renewable Portfolio Standards

Sources:
California Climate Action Registry General Reporting Protocol, Version 3.1 (January 2009). Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

Table 3-13
Electricity End-Use Distribution for Non-Residential Building Types
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

CEUS Building Type	Heating	Cooling	Ventilation	Water Heating	Cooking	Refrigeration	Exterior Lighting	Interior Lighting	Office Equipment	Miscellaneous	Process	Motors	Air Compressors
Large Office	3.50%	17.56%	17.53%	0.72%	0.80%	1.98%	1.38%	27.76%	20.80%	2.09%	0.01%	5.37%	0.50%
Lodging	4.61%	13.31%	12.34%	0.97%	7.82%	5.11%	3.69%	36.62%	1.03%	8.40%	---	5.89%	0.22%
Retail	1.00%	9.77%	12.53%	1.01%	1.48%	10.12%	3.50%	45.57%	3.57%	7.22%	0.54%	3.21%	0.49%
Miscellaneous	1.53%	6.45%	8.04%	2.61%	3.21%	8.52%	11.13%	32.79%	3.77%	10.92%	1.10%	7.62%	2.31%
Included in Title 24 Building Envelope Energy Budget?[1]	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No

Notes:
1. Only end uses regulated by Title 24 are included in the Title 24 building envelope energy budget. Hard-wired lighting (exterior lighting and some interior lighting) are part of Title 24, but are not considered part of the building envelope energy budget.

Abbreviations:
CEUS - California Commercial End-Use Survey

Source:
Itron, Incorporated. 2006. California Commercial End-Use Survey Results. CEC-400-2006-005. Available at http://www.energy.ca.gov/ceus/

Table 3-14
Natural Gas End-Use Distribution for Non-Residential Building Types
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Candlestick Point

CEUS Building Type	Heating	Cooling	Water Heating	Cooking	Miscellaneous	Process
Large Office	87.32%	---	7.65%	0.35%	0.00%	4.68%
Lodging	14.09%	0.85%	66.82%	12.75%	5.48%	---
Retail	68.29%	---	18.87%	10.91%	1.94%	---
Miscellaneous	30.50%	---	44.13%	4.82%	1.14%	19.41%
Included in Title 24 Building Envelope Energy Budget?[1]	Yes	Yes	Yes	No	No	No

Notes:
1. Only end uses regulated by Title 24 are included in the Title 24 building envelope energy budget.

Abbreviations:
CEUS - California Commercial End-Use Survey

Source:
Itron, Incorporated. 2006. California Commercial End-Use Survey Results. CEC-400-2006-005. Available at http://www.energy.ca.gov/ceus/

Table 3-15
Emission Factors by Energy Source
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Energy Source	Unit	Conversion Factor [lb CO_2e/Unit]	Conversion Factor [tonne CO_2e/Unit]
Electricity[1]	kWh	0.636	2.88E-04
Electricity-RPS[2]	kWh	0.574	2.60E-04
Natural Gas[3]	kBTU	0.117	5.31E-05

Notes:

1. Emission factor for electricity provided by PG&E for the year 2007, obtained from the California Climate Action Registry Database.
2. Emission factor for electricity has been adjusted to account for the 20% Renewable Portfolio Standard Required of electricity providers by 2010.
3. Emission factor for natural gas obtained from California Climate Action Registry Reporting Protocol, Table C6.

Abbreviations:

CO_2e - carbon dioxide equivalent
kBTU - 1000 British thermal units
kWh - kilowatt-hour
lb - pound
PG&E - Pacific Gas & Electric Company
RPS - Renewable Portfolio Standard

Sources:

California Climate Action Registry 2009. General Reporting Protocol, Version 3.1. Available at: http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf
California Climate Action Registry. 2008. Database: Pacific Gas and Electric Company 2007 PUP Report. Available at: https://www.climateregistry.org/CARROT/public/Reports.aspx

Table 3-16
Energy and GHG Emissions Intensity for Non-Residential Building Types
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Candlestick Point

				Usage Rate[1] [Unit/SF-yr]																	CO_2e EF[5] [tonnes/SF-yr]		
Building Type	**CEUS Building Type**	**Energy Source**	**Unit**	**Total Energy Intensity (kWh/Segment FS/Year)**	**2002 Title 24[3]**	**2005 Title 24 Reduction[2]**	**2005 Title 24[3]**		**Non-Title 24[4]**		**Overall based on 2005 Title 24**		**Non-Title 24[4]**		**Overall based on 2008 Title 24**	**15% Improvement over Title 24[6]**		**Non-Title 24[4]**		**Overall Project[6]**	**Overall based on 2005 Title 24**	**Overall based on 2008 Title 24**	**Overall Project[6]**
Hotel	Lodging	Electricity	kWh	10.03	3.13	8.5%	2.87	+	6.90	=	9.76	+	6.90	=	9.62	2.32	+	6.90	=	9.22	2.82E-03	2.51E-03	2.40E-03
		Natural Gas	kBTU	39.15	32.01	5.8%	30.15	+	7.14	=	37.29	+	7.14	=	34.46	23.22	+	7.14	=	30.36	1.98E-03	1.83E-03	1.61E-03
Office	Large Office	Electricity	kWh	15.25	6.00	8.5%	5.49	+	9.25	=	14.74	+	9.25	=	14.47	4.43	+	9.25	=	13.69	4.25E-03	3.77E-03	3.56E-03
		Natural Gas	kBTU	23.28	22.11	5.8%	20.83	+	1.17	=	22.00	+	1.17	=	20.04	16.04	+	1.17	=	17.21	1.17E-03	1.06E-03	9.13E-04
Community Space	Large Office	Electricity	kWh	15.25	6.00	8.5%	5.49	+	9.25	=	14.74	+	9.25	=	14.47	4.43	+	9.25	=	13.69	4.25E-03	3.77E-03	3.56E-03
		Natural Gas	kBTU	23.28	22.11	5.8%	20.83	+	1.17	=	22.00	+	1.17	=	20.04	16.04	+	1.17	=	17.21	1.17E-03	1.06E-03	9.13E-04
Retail	Retail	Electricity	kWh	12.65	3.07	8.5%	2.81	+	9.57	=	12.39	+	9.57	=	12.25	2.27	+	9.57	=	11.85	3.57E-03	3.19E-03	3.08E-03
		Natural Gas	kBTU	5.51	4.80	5.8%	4.53	+	0.71	=	5.23	+	0.71	=	4.81	3.49	+	0.71	=	4.19	2.78E-04	2.55E-04	2.23E-04
Performance Venue	Miscellaneous	Electricity	kWh	8.98	1.67	8.5%	1.53	+	7.30	=	8.83	+	7.30	=	8.76	1.24	+	7.30	=	8.54	4.69E-04	2.28E-03	2.22E-03
		Natural Gas	kBTU	27.24	20.33	5.8%	19.15	+	6.91	=	26.06	+	6.91	=	24.26	14.74	+	6.91	=	21.65	1.38E-03	1.29E-03	1.15E-03

Hunter's Point Shipyard

				Usage Rate[1] [Unit/SF-yr]																	CO_2e EF[5] [tonnes/SF-yr]		
Building Type	**CEUS Building Type**	**Energy Source**	**Unit**	**Total Energy Intensity (kWh/Segment FS/Year)**	**2002 Title 24[3]**	**2005 Title 24 Reduction[2]**	**2005 Title 24[3]**		**Non-Title 24[4]**		**Overall based on 2005 Title 24**		**Non-Title 24[4]**		**Overall based on 2008 Title 24**	**15% Improvement over Title 24[6]**		**Non-Title 24[4]**		**Overall Project[6]**	**Overall based on 2005 Title 24**	**Overall based on 2008 Title 24**	**Overall Project[6]**
R&D	Large Office	Electricity	kWh	15.25	6.00	8.5%	5.49	+	9.25	=	14.74	+	9.25	=	14.47	4.43	+	9.25	=	13.69	4.25E-03	3.77E-03	3.56E-03
		Natural Gas	kBTU	23.28	22.11	5.8%	20.83	+	1.17	=	22.00	+	1.17	=	20.04	16.04	+	1.17	=	17.21	1.17E-03	1.06E-03	9.13E-04
Community Space and Artist Studio	Large Office	Electricity	kWh	15.25	6.00	8.5%	5.49	+	9.25	=	14.74	+	9.25	=	14.47	4.43	+	9.25	=	13.69	4.25E-03	3.77E-03	3.56E-03
		Natural Gas	kBTU	23.28	22.11	5.8%	20.83	+	1.17	=	22.00	+	1.17	=	20.04	16.04	+	1.17	=	17.21	1.17E-03	1.06E-03	9.13E-04
Neighborhood Retail	Retail	Electricity	kWh	12.65	3.07	8.5%	2.81	+	9.57	=	12.39	+	9.57	=	12.25	2.27	+	9.57	=	11.85	3.57E-03	3.19E-03	3.08E-03
		Natural Gas	kBTU	5.51	4.80	5.8%	4.53	+	0.71	=	5.23	+	0.71	=	4.81	3.49	+	0.71	=	4.19	2.78E-04	2.55E-04	2.23E-04

Notes:

1. Baseline usage rates for all buildings except for the stadium were taken from the 2006 California Commercial End-Use Survey (CEUS), performed by Itron under contract to the California Energy Commission (CEC). ENVIRON used data for PG&E, Zone 5.
2. Baseline Title 24 usage rates shown in this table have been adjusted to reflect improvements in Title 24 building codes since their introduction in 2002. CEC discusses average savings for improvements from 2002 to 2005 ("Impact Analysis for 2005 Energy Efficiency Standards") as well as from 2005 to 2008 ("Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings"). ENVIRON used these CEC average savings percentages, which are: for electricity: 8.5% reduction in 2005 and 4.9% reduction in 2008; for gas: 5.8% reduction in 2005 and 9.4% reduction in 2008.
3. Includes only Title 24-regulated building envelope uses of electricity (heating, cooling, ventilation, water heating) and gas (heating, water heating).
4. Includes all other uses of electricity (cooking, refrigeration, exterior lighting, interior lighting, office equipment, miscellaneous, process, motors, air compressors) and gas (cooking, miscellaneous, process) not included in the Title 24-regulation building envelope energy use.
5. GHG emission factors (EF) are calculated by multiplying the corresponding usage rates or usages by the conversion factors listed in Table 3-15. The 2005 Title 24 scenario uses the current PG&E electricity carbon intensity factor. All other scenarios use the electricity carbon intensity value that has been adjusted to account for the 20% RPS in 2010.
6. The usage rate with 15% improvement over Title 24 is calculated as the baseline Title 24 usage reduced by 15% plus the baseline non-Title 24 usage.

Abbreviations:

CEC - California Energy Commission
CEUS - California Commerical End-Use Survey
CO_2e - carbon dioxide equivalent
EF - emission factor
GHG - greenhouse gas
kBTU - kilo (1000) British thermal units
kWh - kilowatt hours
PG & E - Pacific Gas and Electric
RPS - Renewable Portfolio Standard
SF - square feet
tonnes - metric tonnes
yr - year

Sources:

Itron, Incorporated. 2006. California Commercial End-Use Survey Results. CEC-400-2006-005. Available at http://www.energy.ca.gov/ceus/
San Francisco Department of the Environment and San Francisco Public Utilities Commission. 2004. Climate Action Plan for San Francisco.
California Energy Commission. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF
California Energy Commission. 2007. Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF

Table 3-17
Electricity Usage and Resulting GHG Emissions for Non-Residential Building Types: Project
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Candlestick Point											**Annual Total based on 2005 Title 24**		**Annual Total based on 2008 Title 24**		**Annual Total (with 15% Improvement over Title 24)**	
					Usage Rate[1] [Unit/SF-yr]			**CO_2e EF[4] [tonnes/SF-yr]**			**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage[3] [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**
Building Type	**CEUS Building Type**	**Total Area [SF]**	**Energy Source**	**Unit**	**Overall based on 2005 Title 24[2]**	**Overall based on 2008 Title 24[2]**	**Overall Project[3]**	**Overall based on 2005 Title 24**	**Overall based on 2008 Title 24**	**Overall Project**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**
Hotel	Lodging	150,000	Electricity	kWh	9.76	9.62	9.22	2.82E-03	2.51E-03	2.40E-03	1,464,745	422	1,443,680	376	1,382,354	360
			Natural Gas	kBTU	37.29	34.46	30.36	1.98E-03	1.83E-03	1.61E-03	5,593,967	297	5,168,788	274	4,554,088	242
Office	Large Office	150,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	2,210,867	637	2,170,546	565	2,053,163	534
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	3,300,084	175	3,006,396	160	2,581,798	137
Community Space	Large Office	50,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	736,956	212	723,515	188	684,388	178
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	1,100,028	58	1,002,132	53	860,599	46
Retail	Retail	760,000	Electricity	kWh	12.39	12.25	11.85	3.57E-03	3.19E-03	3.08E-03	9,413,888	2,714	9,309,170	2,423	9,004,310	2,344
			Natural Gas	kBTU	5.23	4.81	4.19	2.78E-04	2.55E-04	2.23E-04	3,977,575	211	3,654,250	194	3,186,805	169
Performance Venue	Miscellaneous	75,000	Electricity	kWh	8.83	8.76	8.54	2.55E-03	2.28E-03	2.22E-03	662,573	191	656,949	171	640,577	167
			Natural Gas	kBTU	26.06	24.26	21.65	1.38E-03	1.29E-03	1.15E-03	1,954,241	104	1,819,256	97	1,624,103	86
Grand Total Area		1,185,000								Electricity	14,489,028	4,178	14,303,859	3,724	13,764,791	3,583
										Natural Gas	15,925,895	845	14,650,823	778	12,807,394	680

Hunter's Point Shipyard											**Annual Total based on 2005 Title 24**		**Annual Total based on 2008 Title 24**		**Annual Total (with 15% Improvement over Title 24)**	
					Usage Rate[1] [Unit/SF-yr]			**CO_2e EF[4] [tonnes/SF-yr]**			**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage[3] [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**
Building Type	**CEUS Building Type**	**Total Area [SF]**	**Energy Source**	**Unit**	**Overall based on 2005 Title 24[2]**	**Overall based on 2008 Title 24[2]**	**Overall Project[3]**	**Overall based on 2005 Title 24**	**Overall based on 2008 Title 24**	**Overall Project**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**
R&D	Large Office	2,500,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	38,026,906	10,965	37,333,387	9,719	35,314,398	9,193
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	56,761,451	3,012	51,710,017	2,744	44,406,932	2,357
Community Space and Artist Studio	Large Office	80,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	1,179,129	340	1,157,624	301	1,095,020	285
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	1,760,045	93	1,603,411	85	1,376,959	73
Neighborhood Retail	Retail	125,000	Electricity	kWh	12.39	12.25	11.85	3.57E-03	3.19E-03	3.08E-03	1,548,337	446	1,531,113	399	1,480,972	386
			Natural Gas	kBTU	5.23	4.81	4.19	2.78E-04	2.55E-04	2.23E-04	654,206	35	601,028	32	524,145	28
											Annual Based on 1990 Energy Use				**Annual Based on 20% Better Energy Use for New Stadium**	
Stadium[5]	---	---	Electricity	kWh							5,100,000	1,471			4,080,000	1,062
			Natural Gas	kBTU							9,000,000	478			7,200,000	382
Grand Total Area		2,705,000								Electricity	45,854,371	13,222	40,022,124	10,419	41,970,390	10,926
										Natural Gas	68,175,703	3,618	53,914,456	2,861	53,508,037	2,840

Notes:
1. Baseline usage rates for all buildings except for the stadium were taken from the 2006 California Commercial End-Use Survey (CEUS), performed by Itron under contract to the California Energy Commission (CEC). ENVIRON used data for PG&E, Zone 5.
2. Baseline Title 24 usage rates shown in this table have been adjusted to reflect improvements in Title 24 building codes since their introduction in 2002. CEC discusses average savings for improvements from 2002 to 2005 ("Impact Analysis for 2005 Energy Efficiency Standards") as well as from 2005 to 2008 ("Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings"). ENVIRON used these CEC average savings percentages, which are: for electricity: 8.5% reduction in 2005 and 4.9% reduction in 2008; for gas: 5.8% reduction in 2005 and 9.4% reduction in 2008.
3. The usage rate with 15% improvement over Title 24 is calculated as the baseline Title 24 usage reduced by 15% plus the baseline non-Title 24 usage.
4. GHG emission factors (EF) are calculated by multiplying the corresponding usage rates or usages by the conversion factors listed in Table 3-15. The 2005 Title 24 scenaro uses the current PG&E electricity carbon intensity factor. All other scenarios use the electricity carbon intensity value that has been adjusted to account for the 20% RPS in 2010.
5. The energy use for the Stadium is based on the energy use in 1990 from Climate Action Plan for San Francisco Table 2.4 estimate of energy use and assumes a 20% decrease in energy use for a new stadium.

Abbreviations:
CEC - California Energy Commission
CEUS - California Commerical End-Use Survey
CO_2e - carbon dioxide equivalent
EF - emission factor
GHG - greenhouse gas
kBTU - kilo (1000) British thermal units
kWh - kilowatt hours
PG & E - Pacific Gas and Electric
RPS - Renewable Portfolio Standard
SF - square feet
tonnes - metric tonnes
yr - year

Sources:

Itron, Incorporated. 2006. California Commercial End-Use Survey Results. CEC-400-2006-005. Available at http://www.energy.ca.gov/ceus/
San Francisco Department of the Environment and San Francisco Public Utilities Commission. 2004. Climate Action Plan for San Francisco.
California Energy Commission. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF
California Energy Commission. 2007. Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF

Table 3-18
Electricity Usage and Resulting GHG Emissions for Non-Residential Building Types: Variant 1
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Candlestick Point											**Annual Total based on 2005 Title 24**		**Annual Total based on 2008 Title 24**		**Annual Total (with 15% Improvement over Title 24)**	
					Usage Rate[1] [Unit/SF-yr]			**CO_2e EF[4] [tonnes/SF-yr]**			**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage[3] [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**
Building Type	**CEUS Building Type**	**Total Area [SF]**	**Energy Source**	**Unit**	**Overall based on 2005 Title 24[2]**	**Overall based on 2008 Title 24[2]**	**Overall Project[3]**	**Overall based on 2005 Title 24**	**Overall based on 2008 Title 24**	**Overall Project**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**
Hotel	Lodging	150,000	Electricity	kWh	9.76	9.62	9.22	2.82E-03	2.51E-03	2.40E-03	1,464,745	422	1,443,680	376	1,382,354	360
			Natural Gas	kBTU	37.29	34.46	30.36	1.98E-03	1.83E-03	1.61E-03	5,593,967	297	5,168,788	274	4,554,088	242
Office	Large Office	150,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	2,210,867	637	2,170,546	565	2,053,163	534
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	3,300,084	175	3,006,396	160	2,581,798	137
Community Space	Large Office	50,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	736,956	212	723,515	188	684,388	178
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	1,100,028	58	1,002,132	53	860,599	46
Retail	Retail	760,000	Electricity	kWh	12.39	12.25	11.85	3.57E-03	3.19E-03	3.08E-03	9,413,888	2,714	9,309,170	2,423	9,004,310	2,344
			Natural Gas	kBTU	5.23	4.81	4.19	2.78E-04	2.55E-04	2.23E-04	3,977,575	211	3,654,250	194	3,186,805	169
Miscellaneous	Miscellaneous	75,000	Electricity	kWh	8.83	8.76	8.54	2.55E-03	2.28E-03	2.22E-03	662,573	191	656,949	171	640,577	167
			Natural Gas	kBTU	26.06	24.26	21.65	1.38E-03	1.29E-03	1.15E-03	1,954,241	104	1,819,256	97	1,624,103	86
Grand Total Area		1,185,000								Electricity	14,489,028	4,178	14,303,859	3,724	13,764,791	3,583
										Natural Gas	15,925,895	845	14,650,823	778	12,807,394	680

Hunter's Point Shipyard											**Annual Total based on 2005 Title 24**		**Annual Total based on 2008 Title 24**		**Annual Total (with 15% Improvement over Title 24)**	
					Usage Rate[1] [Unit/SF-yr]			**CO_2e EF[4] [tonnes/SF-yr]**			**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage[3] [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**
Building Type	**CEUS Building Type**	**Total Area [SF]**	**Energy Source**	**Unit**	**Overall based on 2005 Title 24[2]**	**Overall based on 2008 Title 24[2]**	**Overall Project[3]**	**Overall based on 2005 Title 24**	**Overall based on 2008 Title 24**	**Overall Project**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**
R&D	Large Office	5,000,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	73,695,553	21,249	72,351,525	18,835	68,438,755	17,816
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	110,002,813	5,838	100,213,211	5,318	86,059,946	4,567
Community Space and Artist Studio	Large Office	80,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	1,179,129	340	1,157,624	301	1,095,020	285
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	1,760,045	93	1,603,411	85	1,376,959	73
Neighborhood Retail	Retail	125,000	Electricity	kWh	12.39	12.25	11.85	3.57E-03	3.19E-03	3.08E-03	1,548,337	446	1,531,113	399	1,480,972	386
			Natural Gas	kBTU	5.23	4.81	4.19	2.78E-04	2.55E-04	2.23E-04	654,206	35	601,028	32	524,145	28
Grand Total Area		5,205,000								Electricity	76,423,019	22,036	75,040,262	19,535	71,014,747	18,487
										Natural Gas	112,417,064	5,966	102,417,650	5,435	87,961,051	4,668

Notes:
1. Baseline usage rates for all buildings except for the stadium were taken from the 2006 California Commercial End-Use Survey (CEUS), performed by Itron under contract to the California Energy Commission (CEC). ENVIRON used data for PG&E, Zone 5.
2. Baseline Title 24 usage rates shown in this table have been adjusted to reflect improvements in Title 24 building codes since their introduction in 2002. CEC discusses average savings for improvements from 2002 to 2005 ("Impact Analysis for 2005 Energy Efficiency Standards") as well as from 2005 to 2008 ("Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings"). ENVIRON used these CEC average savings percentages, which are: for electricity: 8.5% reduction in 2005 and 4.9% reduction in 2008; for gas: 5.8% reduction in 2005 and 9.4% reduction in 2008.
3. The usage rate with 15% improvement over Title 24 is calculated as the baseline Title 24 usage reduced by 15% plus the baseline non-Title 24 usage.
4. GHG emission factors (EF) are calculated by multiplying the corresponding usage rates or usages by the conversion factors listed in Table 3-15. The 2005 Title 24 scenaro uses the current PG&E electricity carbon intensity factor. All other scenarios use the electricity carbon intensity value that has been adjusted to account for the 20% RPS in 2010.

Abbreviations:
CEC - California Energy Commission
CEUS - California Commerical End-Use Survey
CO_2e - carbon dioxide equivalent
EF - emission factor
GHG - greenhouse gas
kBTU - kilo (1000) British thermal units
kWh - kilowatt hours
PG & E - Pacific Gas and Electric
RPS - Renewable Portfolio Standard
SF - square feet
tonnes - metric tonnes
yr - year

Sources:

Itron, Incorporated. 2006. California Commercial End-Use Survey Results. CEC-400-2006-005. Available at http://www.energy.ca.gov/ceus/
San Francisco Department of the Environment and San Francisco Public Utilities Commission. 2004. Climate Action Plan for San Francisco.
California Energy Commission. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF
California Energy Commission. 2007. Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF

Table 3-19
Electricity Usage and Resulting GHG Emissions for Non-Residential Building Types: Variant 2
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Candlestick Point											**Annual Total based on 2005 Title 24**		**Annual Total based on 2008 Title 24**		**Annual Total (with 15% Improvement over Title 24)**	
Building Type	**CEUS Building Type**	**Total Area [SF]**	**Energy Source**	**Unit**	**Usage Rate[1] [Unit/SF-yr]**			**CO_2e EF[4] [tonnes/SF-yr]**			**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage[3] [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**
					Overall based on 2005 Title 24[2]	**Overall based on 2008 Title 24[2]**	**Overall Project[3]**	**Overall based on 2005 Title 24**	**Overall based on 2008 Title 24**	**Overall Project**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**
Hotel	Lodging	150,000	Electricity	kWh	9.76	9.62	9.22	2.82E-03	2.51E-03	2.40E-03	1,464,745	422	1,443,680	376	1,382,354	360
			Natural Gas	kBTU	37.29	34.46	30.36	1.98E-03	1.83E-03	1.61E-03	5,593,967	297	5,168,788	274	4,554,088	242
Office	Large Office	150,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	2,210,867	637	2,170,546	565	2,053,163	534
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	3,300,084	175	3,006,396	160	2,581,798	137
Community Space	Large Office	50,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	736,956	212	723,515	188	684,388	178
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	1,100,028	58	1,002,132	53	860,599	46
Retail	Retail	760,000	Electricity	kWh	12.39	12.25	11.85	3.57E-03	3.19E-03	3.08E-03	9,413,888	2,714	9,309,170	2,423	9,004,310	2,344
			Natural Gas	kBTU	5.23	4.81	4.19	2.78E-04	2.55E-04	2.23E-04	3,977,575	211	3,654,250	194	3,186,805	169
Miscellaneous	Miscellaneous	75,000	Electricity	kWh	8.83	8.76	8.54	2.55E-03	2.28E-03	2.22E-03	662,573	191	656,949	171	640,577	167
			Natural Gas	kBTU	26.06	24.26	21.65	1.38E-03	1.29E-03	1.15E-03	1,954,241	104	1,819,256	97	1,624,103	86
Grand Total Area		1,185,000								Electricity	14,489,028	4,178	14,303,859	3,724	13,764,791	3,583
										Natural Gas	15,925,895	845	14,650,823	778	12,807,394	680

Hunter's Point Shipyard											**Annual Total based on 2005 Title 24**		**Annual Total based on 2008 Title 24**		**Annual Total (with 15% Improvement over Title 24)**	
Building Type	**CEUS Building Type**	**Total Area [SF]**	**Energy Source**	**Unit**	**Usage Rate[1] [Unit/SF-yr]**			**CO_2e EF[4] [tonnes/SF-yr]**			**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**	**Usage[3] [Unit/yr]**	**CO_2e Emissions[4] [tonnes/yr]**
					Overall based on 2005 Title 24[2]	**Overall based on 2008 Title 24[2]**	**Overall Project[3]**	**Overall based on 2005 Title 24**	**Overall based on 2008 Title 24**	**Overall Project**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**	**Overall**
R&D	Large Office	2,500,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	36,847,777	10,625	36,175,762	9,417	34,219,378	8,908
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	55,001,406	2,919	50,106,605	2,659	43,029,973	2,284
Community Space and Artist Studio	Large Office	80,000	Electricity	kWh	14.74	14.47	13.69	4.25E-03	3.77E-03	3.56E-03	1,179,129	340	1,157,624	301	1,095,020	285
			Natural Gas	kBTU	22.00	20.04	17.21	1.17E-03	1.06E-03	9.13E-04	1,760,045	93	1,603,411	85	1,376,959	73
Neighborhood Retail	Retail	125,000	Electricity	kWh	12.39	12.25	11.85	3.57E-03	3.19E-03	3.08E-03	1,548,337	446	1,531,113	399	1,480,972	386
			Natural Gas	kBTU	5.23	4.81	4.19	2.78E-04	2.55E-04	2.23E-04	654,206	35	601,028	32	524,145	28
Grand Total Area		2,705,000								Electricity	39,575,242	11,411	38,864,500	10,117	36,795,370	9,579
										Natural Gas	57,415,658	3,047	52,311,045	2,776	44,931,078	2,385

Notes:
1. Baseline usage rates for all buildings except for the stadium were taken from the 2006 California Commercial End-Use Survey (CEUS), performed by Itron under contract to the California Energy Commission (CEC). ENVIRON used data for PG&E, Zone 5.
2. Baseline Title 24 usage rates shown in this table have been adjusted to reflect improvements in Title 24 building codes since their introduction in 2002. CEC discusses average savings for improvements from 2002 to 2005 ("Impact Analysis for 2005 Energy Efficiency Standards") as well as from 2005 to 2008 ("Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings"). ENVIRON used these CEC average savings percentages, which are: for electricity: 8.5% reduction in 2005 and 4.9% reduction in 2008; for gas: 5.8% reduction in 2005 and 9.4% reduction in 2008.
3. The usage rate with 15% improvement over Title 24 is calculated as the baseline Title 24 usage reduced by 15% plus the baseline non-Title 24 usage.
4. GHG emission factors (EF) are calculated by multiplying the corresponding usage rates or usages by the conversion factors listed in Table 3-15. The 2005 Title 24 scenaro uses the current PG&E electricity carbon intensity factor. All other scenarios use the electricity carbon intensity value that has been adjusted to account for the 20% RPS in 2010.

Abbreviations:
CEC - California Energy Commission
CEUS - California Commerical End-Use Survey
CO_2e - carbon dioxide equivalent
EF - emission factor
GHG - greenhouse gas
kBTU - kilo (1000) British thermal units
kWh - kilowatt hours
PG & E - Pacific Gas and Electric
RPS - Renewable Portfolio Standard
SF - square feet
tonnes - metric tonnes
yr - year

Sources:

Itron, Incorporated. 2006. California Commercial End-Use Survey Results. CEC-400-2006-005. Available at http://www.energy.ca.gov/ceus/
San Francisco Department of the Environment and San Francisco Public Utilities Commission. 2004. Climate Action Plan for San Francisco.
California Energy Commission. 2003. Impact Analysis: 2005 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2005standards/archive/rulemaking/documents/2003-07-11_400-03-014.PDF
California Energy Commission. 2007. Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings. Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF

Table 3-20
Greenhouse Gas Emissions from Vehicles for the Year 2020: Project with Pavley Standards
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2]		Trip Distance[4]	Daily Adjusted VMT (miles)	Annual Adjusted VMT (miles)	Emission Factor Running (g/mile)[5]	Emission Factor Starts (g/start)[6]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
		Unadjusted	Weekend/Weekday Adjustment[3]	(miles)								
	Residential - Home Based Work	2,734	2,578	14.90	38,405	14,017,979			4,346	102	4,447	4,681
	Residential - Home Based Other	4,015	3,786	9.10	34,451	12,574,433			3,898	149	4,047	4,260
	Residential - Non-Home Based	1,794	1,692	9.50	16,069	5,865,325			1,818	67	1,885	1,984
Hunter's Point	Residential - Internal Trips	4,398	4,147	1.00	4,147	1,513,583	**310**	**108**	469	164	633	666
	Nonresidential - Home Based Work	3,640	3,432	14.90	51,143	18,667,174			5,787	135	5,922	6,234
	Nonresidential - Home Based Other	6,801	6,412	9.10	58,350	21,297,687			6,602	253	6,855	7,216
	Nonresidential - Non-Home Based	3,828	3,610	9.50	34,290	12,515,967			3,880	142	4,022	4,234
	Nonresidential - Internal Trips	7,236	6,823	1.00	6,823	2,490,244			772	269	1,041	1,096
Total Trips		**34,447**	**32,478**		**243,678**	**88,942,393**			**27,572**	**1,281**	**28,853**	**30,371**
	Residential - Home Based Work	7,889	7,438	14.90	110,824	40,450,805			12,540	293	12,833	13,508
	Residential - Home Based Other	11,586	10,924	9.10	99,412	36,285,254			11,248	431	11,679	12,294
	Residential - Non-Home Based	5,177	4,881	9.50	46,370	16,925,200			5,247	192	5,439	5,726
	Residential - Internal Trips	12,379	11,672	1.00	11,672	4,260,273			1,321	460	1,781	1,875
Candlestick Point	Nonresidential - Home Based Work	7,818	7,371	14.90	109,834	40,089,485	**310**	**108**	12,428	291	12,718	13,388
	Nonresidential - Home Based Other	14,605	13,771	9.10	125,312	45,738,753			14,179	543	14,722	15,497
	Nonresidential - Non-Home Based	8,222	7,752	9.50	73,642	26,879,197			8,333	306	8,638	9,093
	Nonresidential - Internal Trips	14,710	13,870	1.00	13,870	5,062,481			1,569	547	2,116	2,228
	Music Venue-Worker	400	400	14.90	5,960	894,000			277	16	293	308
	Music Venue-Customer	2,666	2,666	9.10	24,261	3,639,090			1,128	43	1,171	1,233
Total Trips		**85,453**	**80,745**		**621,156**	**220,224,539**			**68,270**	**3,122**	**71,392**	**75,149**
Totals		**119,899**	**113,223**		**864,834**	**309,166,932**			**95,842**	**4,403**	**100,244**	**105,520**

Notes:

1. The trip type distribution is based on Fehr and Peers traffic study. The trip type distribution is consistent with Caltrans Household Travel Survey. This applies to everything except internal trips and the Music Venue.

Trip Type	Residential Trip Type Distribution	NonResidential Trip Type Distribution
Home Based Work	32%	26%
Home Based Other	47%	48%
Non-Home Based	21%	27%

2. The daily trips are based on Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study trip generation rates for residential land use. For internal trips a vehicle occupance of 1.6 persons was assumed.

3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies. No adjustment was made to the music venue trips since this is based on a per event calculation. It is assumed that there are 150 events per year.

4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.
5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco. The emission factor has been updated to incorporate Pavley vehicle emission standards.
6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.
7. $CO_2e=CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:
ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study.
Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 3-21
Alternative Greenhouse Gas Emissions from Vehicles for the Year 2020: Project with Pavley Standards
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2] Unadjusted	Daily One-Way Trips[2] Weekend/Weekday Adjustment[3]	Trip Distance[4] (miles)	Daily Adjusted VMT (miles)	Annual Adjusted VMT (miles)	Emission Factor Running (g/mile)[5]	Emission Factor Starts (g/start)[6]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
Hunter's Point	Home Based Work	2,734	2,578	14.90	38,405	14,017,979	310	108	4,346	102	4,447	4,681
	Home Based Other	4,015	3,786	9.10	34,451	12,574,433			3,898	149	4,047	4,260
	Non-Home Based	1,794	1,692	9.50	16,069	5,865,325			1,818	67	1,885	1,984
	Internal Trips	4,398	4,147	1.00	4,147	1,513,583			469	164	633	666
Total Resident Trips		**12,941**	**12,202**		**93,072**	**33,971,321**			**10,531**	**481**	**11,012**	**11,592**
Candlestick Point	Home Based Work	7,889	7,438	14.90	110,824	40,450,805	310	108	12,540	293	12,833	13,508
	Home Based Other	11,586	10,924	9.10	99,412	36,285,254			11,248	431	11,679	12,294
	Non-Home Based	5,177	4,881	9.50	46,370	16,925,200			5,247	192	5,439	5,726
	Internal Trips	12,379	11,672	1.00	11,672	4,260,273			1,321	460	1,781	1,875
	Music Venue-Customer	2,666	2,666	9.10	24,261	6,065,150			1,880	72	1,952	2,055
Total Resident Trips		**39,697**	**37,581**		**292,539**	**103,986,683**			**32,236**	**1,449**	**33,685**	**35,458**
Totals		**52,639**	**49,783**		**385,611**	**137,958,003**			**42,767**	**1,930**	**44,697**	**47,049**

Notes:

1. The trip type distribution is based on Fehr and Peers traffic study. The trip type distribution is consistent with Caltrans Household Travel Survey. This applies to everything except internal trips and the Music Venue.

Trip Type	Trip Type Distribution
Home Based Work	32%
Home Based Other	47%
Non-Home Based	21%

2. The daily trips are based on Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study trip generation rates for residential land use. For internal trips a vehicle occupance of 1.6 persons was assumed. Only the Customer Music Venue trips are considered "new" trips.
3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies. No adjustment was made to the music venue trips since this is based on a per event calculation. It is assumed that there are 250 events per year.
4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.
5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco. The emission factor has been updated to incorporate Pavley vehicle emission standards.
6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.
7. $CO_2e=CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:

ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunter's Point Shipyard Phase II Development Transportation Study.
Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 3-22
Greenhouse Gas Emissions from Vehicles for the Year 2020: Variant 1 with Pavley Standards
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2]		Trip Distance[4]	Daily Adjusted VMT	Annual Adjusted VMT	Emission Factor	Emission Factor	Annual CO_2 Emissions	Annual CO_2 Emissions Starts	Total Annual CO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
		Unadjusted	Weekend/Weekday Adjustment[3]	(miles)	(miles)	(miles)	Running (g/mile)[5]	Starts (g/start)[6]	Running (tonne)	(tonne)		
Hunter's Point	Residential - Home Based Work	2,981	2,810	14.90	41,876	15,284,733			4,738	111	4,849	5,104
	Residential - Home Based Other	4,378	4,128	9.10	37,564	13,710,739			4,250	163	4,413	4,645
	Residential - Non-Home Based	1,956	1,844	9.50	17,522	6,395,353			1,983	73	2,055	2,163
	Residential - Internal Trips	3,404	3,209	1.00	3,209	1,171,376	310	108	363	127	490	515
	Nonresidential - Home Based Work	5,556	5,556	14.90	82,792	30,218,924			9,368	219	9,587	10,092
	Nonresidential - Home Based Other	10,380	10,380	9.10	94,458	34,477,268			10,688	409	11,097	11,681
	Nonresidential - Non-Home Based	5,843	5,843	9.50	55,510	20,261,184			6,281	230	6,511	6,854
	Nonresidential - Internal Trips	7,949	7,949	1.00	7,949	2,901,506			899	313	1,213	1,277
Total Trips		**42,448**	**41,721**		**340,880**	**124,421,083**			**38,571**	**1,645**	**40,216**	**42,332**
Candlestick Point	Residential - Home Based Work	7,889	7,438	14.90	110,824	40,450,805			12,540	293	12,833	13,508
	Residential - Home Based Other	11,586	10,924	9.10	99,412	36,285,254			11,248	431	11,679	12,294
	Residential - Non-Home Based	5,177	4,881	9.50	46,370	16,925,200			5,247	192	5,439	5,726
	Residential - Internal Trips	12,379	11,672	1.00	11,672	4,260,273			1,321	460	1,781	1,875
	Nonresidential - Home Based Work	7,818	7,818	14.90	116,491	42,519,150	310	108	13,181	308	13,489	14,199
	Nonresidential - Home Based Other	14,605	14,605	9.10	132,906	48,510,799			15,038	576	15,614	16,436
	Nonresidential - Non-Home Based	8,222	8,222	9.50	78,105	28,508,240			8,838	324	9,162	9,644
	Nonresidential - Internal Trips	14,710	14,710	1.00	14,710	5,369,299			1,664	580	2,245	2,363
	Music Venue-Worker	400	400	14.90	5,960	894,000			277	16	293	308
	Music Venue-Customer	2,666	2,666	9.10	24,261	3,639,090			1,128	43	1,171	1,233
Total Trips		**85,453**	**83,337**		**640,711**	**227,362,110**			**70,482**	**3,224**	**73,706**	**77,586**
Totals		**127,900**	**125,057**		**981,591**	**351,783,194**			**109,053**	**4,869**	**113,922**	**119,918**

Notes:

1. The trip type distribution is based on Fehr and Peers traffic study. The trip type distribution is consistent with Caltrans Household Travel Survey. This applies to everything except internal trips and the Music Venue.

Trip Type	Residential Type Distribution	NonResidential Trip Type Distribution
Home Based Work	32%	26%
Home Based Other	47%	48%
Non-Home Based	21%	27%

2. The daily trips are based on Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study trip generation rates for residential land use. For internal trips a vehicle occupance of 1.6 persons was assumed.

3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies. No adjustment was made to the music venue trips since this is based on a per event calculation. It is assumed that there are 150 events per year.

4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.

5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco. The emission factor has been updated to incorporate Pavley vehicle emission standards.

6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.

7. $CO_2e=CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:

ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

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Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 3-23
Alternative Greenhouse Gas Emissions from Vehicles for the Year 2020: Variant 1 with Pavley Standards Alternative Method
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2]		Trip Distance[4]	Daily Adjusted VMT (miles)	Annual Adjusted VMT (miles)	Emission Factor Running (g/mile)[5]	Emission Factor Starts (g/start)[6]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
		Unadjusted	Weekend/Weekday Adjustment[3]	(miles)								
Hunter's Point	Home Based Work	2,981	2,810	14.90	41,876	15,284,733			4,738	111	4,849	5,104
	Home Based Other	4,378	4,128	9.10	37,564	13,710,739			4,250	163	4,413	4,645
	Non-Home Based	1,956	1,844	9.50	17,522	6,395,353	**310**	**108**	1,983	73	2,055	2,163
	Internal Trips	3,404	3,209	1.00	3,209	1,171,376			363	127	490	515
Total Resident Trips		**12,719**	**11,992**		**100,170**	**36,562,202**			**11,334**	**473**	**11,807**	**12,429**
Candlestick Point	Home Based Work	7,889	7,438	14.90	110,824	40,450,805			12,540	293	12,833	13,508
	Home Based Other	11,586	10,924	9.10	99,412	36,285,254			11,248	431	11,679	12,294
	Non-Home Based	5,177	4,881	9.50	46,370	16,925,200	**310**	**108**	5,247	192	5,439	5,726
	Internal Trips	12,379	11,672	1.00	11,672	4,260,273			1,321	460	1,781	1,875
	Music Venue-Customer	2,666	2,666	9.10	24,261	6,065,150			1,880	72	1,952	2,055
Total Resident Trips		**39,697**	**37,581**		**292,539**	**103,986,683**			**32,236**	**1,449**	**33,685**	**35,458**
Totals		**52,416**	**49,573**		**392,709**	**140,548,884**			**43,570**	**1,922**	**45,492**	**47,886**

Notes:

1. The trip type distribution is based on Fehr and Peers traffic study. The trip type distribution is consistent with Caltrans Household Travel Survey. This applies to everything except internal trips and the Music Venue.

Trip Type	Trip Type Distribution
Home Based Work	32%
Home Based Other	47%
Non-Home Based	21%

2. The daily trips are based on Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study trip generation rates for residential land use. For internal trips a vehicle occupance of 1.6 persons was assumed. Only the Customer Music Venue trips are considered "new" trips.

3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies. No adjustment was made to the music venue trips since this is based on a per event calculation. It is assumed that there are 250 events per year.

4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.

5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco. The emission factor has been updated to incorporate Pavley vehicle emission standards.

6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.

7. $CO_2e=CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:

ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study.
Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 3-24
Greenhouse Gas Emissions from Vehicles for the Year 2020: Variant 2 with Pavley Standards
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2]		Trip Distance[4]	Daily Adjusted VMT (miles)	Annual Adjusted VMT (miles)	Emission Factor Running (g/mile)[5]	Emission Factor Starts (g/start)[6]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
		Unadjusted	Weekend/Weekday Adjustment[3]	(miles)								
	Residential - Home Based Work	3,813	3,595	14.90	53,564	19,551,003			6,061	142	6,203	6,529
	Residential - Home Based Other	5,600	5,280	9.10	48,048	17,537,677			5,437	208	5,645	5,942
	Residential - Non-Home Based	2,502	2,359	9.50	22,412	8,180,422			2,536	93	2,629	2,767
	Residential - Internal Trips	7,898	7,446	1.00	7,446	2,717,868			843	294	1,136	1,196
Hunter's Point	Nonresidential - Home Based Work	3,319	3,319	14.90	49,456	18,051,356	**310**	**108**	5,596	131	5,727	6,028
	Nonresidential - Home Based Other	6,201	6,201	9.10	56,425	20,595,089			6,384	244	6,629	6,978
	Nonresidential - Non-Home Based	3,490	3,490	9.50	33,159	12,103,073			3,752	138	3,890	4,094
	Nonresidential - Internal Trips	8,426	8,426	1.00	8,426	3,075,427			953	332	1,286	1,353
Total Trips		**41,248**	**40,116**		**278,937**	**101,811,915**			**31,562**	**1,582**	**33,144**	**34,888**
	Residential - Home Based Work	6,898	6,503	14.90	96,901	35,369,021			10,964	256	11,221	11,811
	Residential - Home Based Other	10,131	9,552	9.10	86,923	31,726,783			9,835	377	10,212	10,749
	Residential - Non-Home Based	4,527	4,268	9.50	40,545	14,798,909			4,588	168	4,756	5,006
	Residential - Internal Trips	8,524	8,037	1.00	8,037	2,933,388			909	317	1,226	1,291
Candlestick Point	Nonresidential - Home Based Work	8,307	8,307	14.90	123,770	45,176,121	**310**	**108**	14,005	328	14,332	15,086
	Nonresidential - Home Based Other	15,518	15,518	9.10	141,211	51,542,181			15,978	612	16,590	17,463
	Nonresidential - Non-Home Based	8,735	8,735	9.50	82,985	30,289,685			9,390	344	9,734	10,247
	Nonresidential - Internal Trips	12,354	12,354	1.00	12,354	4,509,273			1,398	487	1,885	1,984
	Music Venue-Worker	400	400	14.90	5,960	894,000			277	16	293	308
	Music Venue-Customer	2,666	2,666	9.10	24,261	3,639,090			1,128	43	1,171	1,233
Total Trips		**78,059**	**76,340**		**622,948**	**220,878,451**			**68,472**	**2,948**	**71,421**	**75,180**
Totals		**119,307**	**116,456**		**901,884**	**322,690,366**			**100,034**	**4,530**	**104,564**	**110,068**

Notes:

1. The trip type distribution is based on Fehr and Peers traffic study. The trip type distribution is consistent with Caltrans Household Travel Survey.

Trip Type	Residential Trip Type Distribution	NonResidential Trip Type Distribution
Home Based Work	32%	26%
Home Based Other	47%	48%
Non-Home Based	21%	27%

2. The daily trips are based on Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study trip generation rates for residential land use. For internal trips a vehicle occupance of 1.6 persons was assumed.
3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies. No adjustment was made to the music venue trips since this is based on a per event calculation. It is assumed that there are 150 ev per year.
4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.
5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco. The emission factor has been updated to incorporate Pavley vehicle emission standards.
6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.
7. $CO_2e = CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4 N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:

ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study.
Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 3-25
Alternative Greenhouse Gas Emissions from Vehicles for the Year 2020: Variant 2 with Pavley Standards
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2] Unadjusted	Daily One-Way Trips[2] Weekend/Weekday Adjustment[3]	Trip Distance[4] (miles)	Daily Adjusted VMT (miles)	Annual Adjusted VMT (miles)	Emission Factor Running (g/mile)[5]	Emission Factor Starts (g/start)[6]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total AnnualCO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
Hunter's Point	Home Based Work	3,813	3,595	14.90	53,564	19,551,003	310	108	6,061	142	6,203	6,529
	Home Based Other	5,600	5,280	9.10	48,048	17,537,677			5,437	208	5,645	5,942
	Non-Home Based	2,502	2,359	9.50	22,412	8,180,422			2,536	93	2,629	2,767
	Internal Trips	7,898	7,446	1.00	7,446	2,717,868			843	294	1,136	1,196
Total Resident Trips		**19,813**	**18,680**		**131,471**	**47,986,970**			**14,876**	**737**	**15,613**	**16,434**
Candlestick Point	Home Based Work	6,898	6,503	14.90	96,901	35,369,021	310	108	10,964	256	11,221	11,811
	Home Based Other	10,131	9,552	9.10	86,923	31,726,783			9,835	377	10,212	10,749
	Non-Home Based	4,527	4,268	9.50	40,545	14,798,909			4,588	168	4,756	5,006
	Internal Trips	8,524	8,037	1.00	8,037	2,933,388			909	317	1,226	1,291
	Music Venue-Customer	2,666	2,666	9.10	24,261	6,065,150			1,880	72	1,952	2,055
Total Resident Trips		**32,745**	**31,026**		**256,666**	**90,893,250**			**28,177**	**1,190**	**29,367**	**30,913**
Totals		**52,557**	**49,706**		**388,138**	**138,880,220**			**43,053**	**1,927**	**44,980**	**47,347**

Notes:

1. The trip type distribution is based on Fehr and Peers traffic study. The trip type distribution is consistent with Caltrans Household Travel Survey.

Trip Type	Trip Type Distribution
Home Based Work	32%
Home Based Other	47%
Non-Home Based	21%

2. The daily trips are based on Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study trip generation rates for residential land use.
3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies.
4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.
5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco. The emission factor has been updated to incorporate Pavley vehicle emission standards.
6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.
7. $CO_2e=CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:

ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study.
Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 3-26
Greenhouse Gas Emission from Transit Area
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Scenario	Net New Miles[1]	Net New Idling Time[1]	Emission Factor[2,3]		CO_2 Emisisons[4]		Total CO_2e Emissions
			Running	Idling	Running	Idling	
	(miles/yr)	(minutes/yr)	(g/mile)	(g/idle-hr)	(metric tonnes)		
No Action Taken	974,303	2,205,615	2,805	4,098	2,733	151	2,884
Project			1,683	2,459	1,640	90	1,730

Notes:

1. Net new annual miles and net new idling time for SFMTA transit due to the project are based on data from Fehr & Peers.
2. The running emission factors are based on EMFAC emission factors for an urban diesel bus. The idling emission factors are based on a diesel school bus.
3. For the Project scenario the running emission factor value has been adjusted to account for fuel economy improvements resulting from using hybrid buses. The running and idling emission factors have been reduced by 25% to account for the increased fuel efficiency of hybrid buses based on SFMTA reports on fuel improvements above 25%. The running and idling emission factors have been further adjusted to account for reduced CO_2 emissions resulting from the use of B20 fuel instead of regular diesel. Based on CCAR recommendations, emissions from burning biodiesel are not included as direct mobile emissions.
4. GHG Running Emission calculation formula: GHG Emissions = Net New Miles x Running Emission Factor x Conversion Factors
GHG Idling Emission calculation formula: GHG Emissions = New New Idling Time x Idling Emission Factor x Conversion Factors

Abbreviations:

B20 - a blend of 20 percent by volume biodiesel with 80 percent by volume petroleum diesel
CO_2 - carbon dioxide
CCAR - California Climate Action Registry
EMFAC - Emission Factors Database
SFMTA - San Francisco Municipal Transportation Agency

Sources:

California Climate Action Registry (CCAR) General Reporting Protocol Version 3.1, January 2009.
SFMTA Climate Action Plan, Draft for Public Review, December 19, 2008.

Table 3-27
Net New Transit Annual Vehicle Miles Traveled and Idle Time
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Line	Type of Vehicle	Net New One-Way Freeway Mileage	Net New One-Way Local Mileage	Total Annual Runs	Net New Annual Miles	Net New Annual Idle Time (mins)[1]	Net New Annual Idle Time (days)
CPX	MC STD	4	4.6	15,300	131,580	145,350	101
HPX	MC STD	1.3	5.2	12,750	82,875	121,125	84
Route 48 (current 19)	MC STD	0	0.5	47,925	23,963	95,850	67
Route 48 Short Line	MC STD	0	5.2	9,450	49,140	196,560	137
Route 23	MC STD						
Route 24	TC STD	0	1.7	106,650	181,305	533,250	370
Route 28L Extension	MC STD	0	5.5	55,350	304,425	608,850	423
Route 28L Short Line	MC STD	0	6.5	37,800	245,700	491,400	341
Route 29 Extension	MC STD	0	0.3	62,100	18,630	74,520	52
Route 29 Short Line	MC STD	0	4.6	25,650	117,990	471,960	328
Route 44	MC STD						
Route 54	MC STD						
T-Third	LRV2						
Hybrid Motor Coach			*MC STD*		*974,303*	*2,205,615*	*1,532*
Electric Trolley Car			*TC STD*		*181,305*	*533,250*	*370*
Light Rail Vehicle		***Total by Vehicle Type***	*LRV2*				
		Total			***1,155,608***	***2,738,865***	***1,902***

Notes: Shaded cells indicate transit lines where the mileage does not change in the CP/HP project.

1. Idle time represents two factors: layover time at the end of each run and the time spent idling at stops. Layover time is assumed to be two minutes for each one-way transit trip and is only used for the CPX and HPX lines as they are the only new transit lines for CP/HP. The two minutes assumes that the driver will turn off the vehicle's engine for a majority of the layover time. The time spent idling at stops is based on new stops along each line. The stops are assumed to be located about every 1/8 mile for local routes and about every 1/4 mile for the express and limited routes, with modifications made based on the CP/HP Proposed Transit Plan.

Source: Fehr & Peers, 2009

Table 3-28
GHG Emission Factors for Municipal Sources: Project Scenario with Renewable Portfolio Standard
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Source[1]	Energy Requirements	Units	Emission Factor[11]	Units	Source Quantity		Units	Total CO_2e Emissions		Units
					CP	HPS		CP	HPS	
Lighting										
Public Lighting[2]	141	kW-hr/capita/yr	0.037	tonne CO_2e/capita/year	17,694	6,175	residents (capita)	651	227.28	tonne CO_2e
Municipal Vehicles										
Municipal Vehicles[3]	--	--	0.05	tonne CO_2e/capita/year	17,694	6,175	residents (capita)	885	309	
Water and Wastewater [4]										
Water Supply and Conveyance (Potable)[5]	0	kW-hr/Mgal	0.00	tonne CO_2e/Mgal	0.88	0.79	MM gallons/day	0	0	tonne CO_2e
Water Treatment (Potable)[6]	111	kW-hr/Mgal	0.03	tonne CO_2e/Mgal	0.88	0.79	MM gallons/day	9	8	tonne CO_2e
Water Distribution (Potable)[7]	1,272	kW-hr/Mgal	0.33	tonne CO_2e/Mgal	0.88	0.79	MM gallons/day	106	95	tonne CO_2e
Wastewater Treatment and Discharge (Indirect Emissions)[8]	1,688	kW-hr/Mgal	0.44	tonne CO_2e/Mgal	0.88	0.79	MM gallons/day	141	127	tonne CO_2e
Wastewater Treament Plant (Direct Emissions)[9]	--	--	0.084	tonne CO_2e/capita/year	0.00	0.00	MM gallons/day	0	0	tonne CO_2e
							Water and Wastewater Total:	**257**	**230**	tonne CO_2e
							Municipal Sources Total:	**1,793**	**766**	tonne CO_2e

Notes:

1. Public lighting includes streetlights, traffic signals, area lighting and lighting municipal buildings. Emissions from the Water and Wastewater category are primarily due to the energy required for supply, treatment and distribution.

2. Emission factor for public lighting is based on a study of energy usage and GHG emissions from Duluth, MN (Skoog, 2001) and the electricity generation emission factor from PG&E. The CP-HPS Plan to install energy-efficient street lighting which will reduce street lighting electricity demand by 16%. The resultant energy savings is calculated from the annual energy costs found on page 4 of NYSERDA's 2002 How-to Guide to Effective Energy-Efficient Street Lighting.

3. Emission factors for municipal vehicles are based on the most conservative number from studies of GHG emissions for four cities of different sizes: Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, CA. Population data provided by the US Census (2000).

4. Source quantities for water and wastewater are based on ARUP's estimates.

5. Emission factor for the supply and conveyance of potable water is based on a CEC (2006) study. 85% of the water supply in San Francisco is supplied via gravity from the Hetch Hetchy basin. The CEC (2006) study suggests that Hetch Hetchy system is gravity-dominated and has minimal net carbon emissions.

6.Emission factor for water treatment is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

7.Emission factor for water distribution is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

8. Emission factor for wastewater treatment are from the energy requirements for the Southeast Pollution Control Center provided in a Request for Proposals. This information was provided in "SFPUC Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101".

9. All methane emissions from the wastewater at the Southeast Wastewater Treatment Plant is burned at the flare station or cogeneration plant, and no methane emissions are directly emitted from the wastewater as directed by the plant's air per

11. GHG emissions attributed to electricity use are calculated using the PG&E carbon-intensity factor, which is 0.574 lbs CO2 per kW-hr after adjustment to reflect 20% renewable energy in accordance with the Renewables Portfolio Standard.

Abbreviations:

CEC - California Energy Commission
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
EPRI - Electric Power Research Institute
GHG - greenhouse gas
HPS - Hunter's Point Shipyard
kW-hr - kilowatt hour
MMgal - million gallons
MW-hr - megawatt hour
NYSERDA - New York State Energy Research and Development Authority
PG&E - Pacific Gas and Electric
psi - pound per square inch
SFPUC - San Francisco Public Utility Commission
Tg - teragram
USEPA - United States Environmental Protection Agency

Sources:

California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.
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Table 3-29
GHG Emission Factors for Municipal Sources: Variant 1 with Renewable Portfolio Standard
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Source[1]	Energy Requirements	Units	Emission Factor[10]	Units	Source Quantity		Units	Total CO_2e		Units
					CP	HPS[11]		CP	HPS	
Lighting										
Public Lighting[2]	141	kW-hr/capita/yr	0.037	tonne CO_2e/capita/year	17,694	6,175	residents (capita)	651	227.28	tonne CO_2e
Municipal Vehicles										
Municipal Vehicles[3]	--	--	0.05	tonne CO_2e/capita/year	17,694	6,175	residents (capita)	885	309	
Water and Wastewater [4]										
Water Supply and Conveyance (Potable)[5]	0	kW-hr/Mgal	0.00	tonne CO_2e/Mgal	0.88	1.11	MM gallons/day	0	0	tonne CO_2e
Water Treatment (Potable)[6]	111	kW-hr/Mgal	0.03	tonne CO_2e/Mgal	0.88	1.11	MM gallons/day	9	12	tonne CO_2e
Water Distribution (Potable)[7]	1,272	kW-hr/Mgal	0.33	tonne CO_2e/Mgal	0.88	1.11	MM gallons/day	106	134	tonne CO_2e
Wastewater Treatment and Discharge (Indirect Emissions) [8]	1,688	kW-hr/Mgal	0.44	tonne CO_2e/Mgal	0.88	1.11	MM gallons/day	141	178	tonne CO_2e
Wastewater Treament Plant (Direct Emissions) [9]	--	--	0.084	tonne CO_2e/capita/year	0.00	0.00	MM gallons/day	0	0	tonne CO_2e
							Water and Wastewater Total:	**257**	**324**	tonne CO_2e
							Municipal Sources Total:	**1,793**	**860**	tonne CO_2e

Notes:

1. Public lighting includes streetlights, traffic signals, area lighting and lighting municipal buildings. Emissions from the Water and Wastewater category are primarily due to the energy required for supply, treatment and distribution.

2. Emission factor for public lighting is based on a study of energy usage and GHG emissions from Duluth, MN (Skoog, 2001) and the electricity generation emission factor from PG&E. The CP-HPS Plan to install energy-efficient street lighting which will reduce street lighting electricity demand by 16%. The resultant energy savings is calculated from the annual energy costs found on page 4 of NYSERDA's 2002 How-to Guide to Effective Energy-Efficient Street Lighting.

3. Emission factors for municipal vehicles are based on the most conservative number from studies of GHG emissions for four cities of different sizes: Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, CA. Population data provided by the US Census (2000).

4. Source quantities for water and wastewater are based on ARUP's estimates.

5. Emission factor for the supply and conveyance of potable water is based on a CEC (2006) study. 85% of the water supply in San Francisco is supplied via gravity from the Hetch Hetchy basin. The CEC (2006) study suggests that Hetch Hetchy system is gravity-dominated and has minimal net carbon emissions.
6.Emission factor for water treatment is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.
7.Emission factor for water distribution is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.
8. Emission factor for wastewater treatment are from the energy requirements for the Southeast Pollution Control Center provided in a Request for Proposals. This information was provided in "SFPUC Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101".

9. All methane emissions from the wastewater at the Southeast Wastewater Treatment Plant is burned at the flare station or cogeneration plant, and no methane emissions are directly emitted from the wastewater as directed by the plant's air permit.

10. GHG emissions attributed to electricity use are calculated using the PG&E carbon-intensity factor, which is 0.574 lbs CO2 per kWh after adjustment to reflect 20% renewable energy in accordance with the Renewables Portfolio Standard.

11. Water demand for Hunter's Point has been adjusted from the Project Scenario in two ways: (1) water demand allocated for the stadium has been removed to reflect the "no stadium" scenario, and (2) the water demand allocated for research & development has been doubled to reflect the correspoinding increase in square footage. No changes were made to water dermand for Candlestick Point.

Abbreviations:

CEC - California Energy Commission
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
EPRI - Electric Power Research Institute
GHG - greenhouse gas
HPS - Hunter's Point Shipyard
IB - India Basin
kW-hr - kilowatt hour
MMgal - million gallons
MW-hr - megawatt hour
NYSERDA - New York State Energy Research and Development Authority
PG&E - Pacific Gas and Electric
psi - pound per square inch
SFPUC - San Francisco Public Utility Commission
Tg - teragram
USEPA - United States Environmental Protection Agency

Sources:
California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.
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City of Santa Rosa. Cities for Climate Protection: Santa Rosa. http://ci.santa-rosa.ca.us/City_Hall/City_Manager/CCPFinalReport.pdf
EPRI. 2001. Summary Report for California Energy Commission Energy Efficiency Studies. Http://www.energy.ca.gov/pier/iaw/reports/2003_09_26_Appendix_2_7.pdf
New York State Energy Research and Development Authority (NYSERDA), 2002. *How-to Guide to Effective Energy-Efficient Street Lighting for Municipal Elected/Appointed Officials.* October.
San Francisco Public Utilities Commission. 2003. Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101.
Skoog., C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives.
U.S. Census Bureau. http://www.census.gov/main/www/cen2000.html
USEPA. 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. #430-R-07-002. April. http://epa.gov/climatechange/emissions/downloads06/07Waste.pdf

Table 3-30
GHG Emission Factors for Municipal Sources: Variant 2 with Renewable Portfolio Standard
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Source[1]	Energy Requirements	Units	Emission Factor[10]	Units	Source Quantity		Units	Total CO_2e Emissions		Units
					CP[12]	HPS[11]		CP[13]	HPS[13]	
Lighting										
Public Lighting[2]	141	kW-hr/capita/yr	0.037	tonne CO_2e/capita/year	14,549	9,320	residents (capita)	536	343	tonne CO_2e
Municipal Vehicles										
Municipal Vehicles[3]	--	--	0.05	tonne CO_2e/capita/year	14,549	9,320	residents (capita)	727	466	
Water and Wastewater [4]										
Water Supply and Conveyance (Potable)[5]	0	kW-hr/Mgal	0.00	tonne CO_2e/Mgal	0.77	0.88	MM gallons/day	0	0	tonne CO_2e
Water Treatment (Potable)[6]	111	kW-hr/Mgal	0.03	tonne CO_2e/Mgal	0.77	0.88	MM gallons/day	8	9	tonne CO_2e
Water Distribution (Potable)[7]	1,272	kW-hr/Mgal	0.33	tonne CO_2e/Mgal	0.77	0.88	MM gallons/day	93	106	tonne CO_2e
Wastewater Treatment and Discharge (Indirect Emissions) [8]	1,688	kW-hr/Mgal	0.44	tonne CO_2e/Mgal	0.77	0.88	MM gallons/day	123	141	tonne CO_2e
Wastewater Treament Plant (Direct Emissions) [9]	--	--	0.084	tonne CO_2e/capita/year	0.00	0.00	MM gallons/day	0	0	tonne CO_2e
							Water and Wastewater Total:	**225**	**257**	tonne CO_2e
							Municipal Sources Total:	**1,488**	**1,066**	tonne CO_2e

Notes:

1. Public lighting includes streetlights, traffic signals, area lighting and lighting municipal buildings. Emissions from the Water and Wastewater category are primarily due to the energy required for supply, treatment and distribution.

2. Emission factor for public lighting is based on a study of energy usage and GHG emissions from Duluth, MN (Skoog, 2001) and the electricity generation emission factor from PG&E. The CP-HPS Plan to install energy-efficient street lighting which will reduce street lighting electricity demand by 16%. The resultant energy savings is calculated from the annual energy costs found on page 4 of NYSERDA's 2002 How-to Guide to Effective Energy-Efficient Street Lighting.

3. Emission factors for municipal vehicles are based on the most conservative number from studies of GHG emissions for four cities of different sizes: Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, CA. Population data provided by the US Census (2000).

4. Source quantities for water and wastewater are based on ARUP's estimates.

5. Emission factor for the supply and conveyance of potable water is based on a CEC (2006) study. 85% of the water supply in San Francisco is supplied via gravity from the Hetch Hetchy basin. The CEC (2006) study suggests that Hetch Hetchy system is gravity-dominated and has minimal net carbon emissions.

6.Emission factor for water treatment is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

7.Emission factor for water distribution is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

8. Emission factor for wastewater treatment are from the energy requirements for the Southeast Pollution Control Center provided in a Request for Proposals. This information was provided in "SFPUC Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101".

9. All methane emissions from the wastewater at the Southeast Wastewater Treatment Plant is burned at the flare station or cogeneration plant, and no methane emissions are directly emitted from the wastewater as directed by the plant's air permit.

10. GHG emissions attributed to electricity use are calculated using the PG&E carbon-intensity factor, which is 0.574 lbs CO2 per kW-hr after adjustment to reflect 20% renewable energy in accordance with the Renewables Portfolio Standard.

11. Water demand for Hunter's Point was adjusted from Project Scenario in two ways: (1) water demand allocated for the stadium has been removed to reflect the "no stadium" scenario, and (2) residential water demand was increased to reflect the increase in dwelling units from 2,650 to 4,000.

12. Water demand for Candlestick Point was decreased to reflect a decrease in dwelling units from 7,594 to 6244.

13. The change in dwelling units at Hunter's Point and Candlestick Point caused proportional changes to energy use for municipal lighting and vehicles.

Abbreviations:

CEC - California Energy Commission
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
EPRI - Electric Power Research Institute
GHG - greenhouse gas
IB - India Basin
kW-hr - kilowatt hour
MMgal - million gallons
MW-hr - megawatt hour
NYSERDA - New York State Energy Research and Development Authority
PG&E - Pacific Gas and Electric
psi - pound per square inch
SFPUC - San Francisco Public Utility Commission
Tg - teragram
USEPA - United States Environmental Protection Agency

Sources:

California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.
City of Medford. 2001. Climate Action Plan. October. http://www.massclimateaction.org/pdf/MedfordPlan2001.pdf
City of Northampton. 2006. Greenhouse Gas Emissions Inventory. Cities for Climate Protection Campaign. June. http://www.northamptonma.gov/uploads/listWidget/3208/NorthamptonInventoryClimateProtection.pdf
City of Santa Rosa. Cities for Climate Protection: Santa Rosa. http://ci.santa-rosa.ca.us/City_Hall/City_Manager/CCPFinalReport.pdf
EPRI. 2001. Summary Report for California Energy Commission Energy Efficiency Studies. Http://www.energy.ca.gov/pier/iaw/reports/2003_09_26_Appendix_2_7.pdf
New York State Energy Research and Development Authority (NYSERDA), 2002. *How-to Guide to Effective Energy-Efficient Street Lighting for Municipal Elected/Appointed Officials.* October.
San Francisco Public Utilities Commission. 2003. Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101.
Skoog., C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives.
U.S. Census Bureau. http://www.census.gov/main/www/cen2000.html
USEPA. 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. #430-R-07-002. April. http://epa.gov/climatechange/emissions/downloads06/07Waste.pdf

Table 3-31
GHG Emissions from Area Sources-Hearth Fuel Combustion
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Natural Gas Fireplace Dwelling Unit Type[1]	Quantity[2]	Quantity[2]	Average Energy Use[3]	Usage Rate[4]	Energy Use per Year (Mbtu/year)	Energy Use per Year (Mbtu/year)	CO_2 Emission Factor[5]	Annual CO_2 Emission (tonnes/year)	
	CP	HPS	(Btu/hour/unit)	(hours/year)	CP	HPS	(lb CO_2/Mbtu)	CP	HPS
Multi-family	759	265	20,000	200	3,038	1,060	117	161	56
							Natural Gas Fireplaces Total:	**161**	**56**

Notes:
1. There will be no wood-burning stoves or fireplaces at Candlestick Point-Hunters Point Shipyard Phase II Development Plan.
2. Lennar anticipates 10% of the multi-family residences to have a natural gas fireplace.
3. Average energy use values are URBEMIS default values.
4. Usage rate of 200 hours/year is the URBEMIS default value.
5. Emission factor based on AP-42 value for natural gas combustion.

Abbreviations:
CO2 - Carbon Dioxide
CP - Candlestick Point
HPS - Hunter's Point
lb - pound
Mbtu - Million British
USEPA - United States Environmental

Sources:
USEPA. 1995. AP-42, Fifth Edition. Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. January. Available at: http://www.epa.gov/ttn/chief/ap42/
South Coast Air Quality Management District. Software User's Guide: URBEMIS2007 for Windows. Prepared by Jones & Stokes Associates. November. Available at: http://www.aqmd.gov/CEQA/urbemis.html

Table 3-32
GHG Emissions from Area Sources-Hearth Fuel Combustion: Variant 2
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Natural Gas Fireplace Dwelling Unit Type[1]	Quantity[2]	Quantity[2]	Average Energy Use[3]	Usage Rate[4]	Energy Use per Year (Mbtu/year)	Energy Use per Year (Mbtu/year)	CO_2 Emission Factor[5]	Annual CO_2 Emission (tonnes/year)	
	CP	HPS	(Btu/hour/unit)	(hours/year)	CP	HPS	(lb CO_2/Mbtu)	CP	HPS
Multi-family	624	400	20,000	200	2,498	1,600	117	132	85
							Natural Gas Fireplaces Total:	**132**	**85**

Notes:
1. There will be no wood-burning stoves or fireplaces at Candlestick Point-Hunters Point Shipyard Phase II Development Plan.
2. Lennar anticipates 10% of the multi-family residences to have a natural gas fireplace.
3. Average energy use values are URBEMIS default values.
4. Usage rate of 200 hours/year is the URBEMIS default value.
5. Emission factor based on AP-42 value for natural gas combustion.

Abbreviations:
CO2 - Carbon Dioxide
CP - Candlestick Point
HPS - Hunter's Point
lb - pound
Mbtu - Million British
USEPA - United States Environmental

Sources:
USEPA. 1995. AP-42, Fifth Edition. Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. January. Available at: http://www.epa.gov/ttn/chief/ap42/
South Coast Air Quality Management District. Software User's Guide: URBEMIS2007 for Windows. Prepared by Jones & Stokes Associates. November. Available at: http://www.aqmd.gov/CEQA/urbemis.html

Table 3-33
GHG Emissions from Waste Disposal: Project Scenario
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Land Use	Units		Units	Rate of Waste Disposal[1]		Waste Disposal[2]		Annual CO_2 Emissions[3]	
	CP	HPS		Value	Units	CP	HPS	CP	HPS
						(tonnes/year)		(tonnes CO_2e/year)	
Residential Units	7,594	2,650	dwelling units	1957	lb/unit/year	6,742	2,353	454	159
Retail	760,000	125,000	square feet	2.1	lb/sf/year	724	119	49	8
Office	150,000	0	square feet	1.87	lb/sf/year	127	0	9	0
Hotel	220	0	rooms	1840	lb/room/year	184	0	12	0
R&D	0	2,500,000	square feet	2.19	lb/sf/year	0	2,483	0	167
Stadium	0	69,000	seats	17.2	lb/seat/year	0	538	0	36
Community Center/Artist Studios	50,000	80,000	square feet	1.87	lb/sf/year	42	68	3	5
Music Venue	10,000	0	seats	17.2	lb/seat/year	78	0	5	0
Total								**532**	**375**

Notes:

1. Residential waste disposal rates for San Francisco of 0.42 lb/person/year which is based on CIWMB 2009 assuming 2.33 people per dwelling unit. R&D is based on industrial waste generation rate from CIWMB 2007. All other waste disposal rates are based on CIWMB 2006 Table 21 of Appendix A. The waste disposal rate for community center and artists studios is assumed to be the same as office space.
2. Waste Disposal amounts are based on project projections multiplied by waste disposal rates mulitplied by conversion factors.
3. CO_2 emissions are based on Altamont Landfill 2005 GHG non-biogenic emissions, which is 0.0674 metric tonnes of CO_2 emissions/ metric ton of waste/ year based on information from the BAAQMD. CO_2 emissions are calculated as follows: [tonnes of waste disposed] * 0.0674 [tonnes of CO_2 emissions/tonne of waste.

Abbreviations:

CIWMB-California Integrated Waste Management Board
CO_2-carbon dioxide
CO_2e-carbon dioxide equivalent
CP-Candlestick Point
HPS-Hunter's Point Shipyard
lb-pound
R&D-research and development

Sources:

CIWMB. 1999 Statewide Waste Characterization Study: Results and Final Report. 340-00-009. Available at http://www.ciwmb.ca.gov/wastechar/Resdisp.htm
CIWMB. 2007. Estimated Solid Waste Generation Rates for Industrial Establishments. Available at http://www.ciwmb.ca.gov/WasteChar/wasteGenRates/Industrial.htm
CIWMB. 2006. Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups. 341-06-006. Available at http://www.ciwmb.ca.gov/WasteChar/WasteStudies.htm#2006Industry

Table 3-34
GHG Emissions from Waste Disposal: Variant 1
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Land Use	Units		Units	Rate of Waste Disposal[1]		Waste Disposal[2]		Annual CO_2 Emissions[3]	
	CP	HPS		Value	Units	CP	HPS	CP	HPS
						(tonnes/year)		(tonnes CO_2e/year)	
Residential Units	7,594	2,650	dwelling units	1957	lb/unit/year	6742	2353	454	159
Retail	760,000	125,000	square feet	2.1	lb/sf/year	724	119	49	8
Office	150,000	-	square feet	1.87	lb/sf/year	127	--	9	--
Hotel	220	-	rooms	1840	lb/room/year	184	--	12	--
R&D	-	5,000,000	square feet	2.19	lb/sf/year	--	4967	--	335
Community Center/Artist Studios	50,000	80,000	square feet	1.87	lb/sf/year	42	68	3	5
Music Venue	10,000	-	Seats	17.2	lb/seat/year	78	0	5	0
Total								**532**	**506**

Notes:

1. Residential waste disposal rates for San Francisco of 0.42 lb/person/year which is based on CIWMB 2009 assuming 2.33 people per dwelling unit. R&D is based on industrial waste generation rate from CIWMB 2007. All other waste disposal rates are based on CIWMB 2006 Table 21 of Appendix A. The waste disposal rate for community center and artists studios is assumed to be the same as office space.
2. Waste Disposal amounts are based on project projections multiplied by waste disposal rates mulitplied by conversion factors.
3. CO_2 emissions are based on Altamont Landfill 2005 GHG non-biogenic emissions, which is 0.0674 metric tonnes of CO_2 emissions/ metric ton of waste/ year based on information from the BAAQMD. CO_2 emissions are calculated as follows: [tonnes of waste disposed] * 0.0674 [tonnes of CO_2 emissions/tonne of waste.

Abbreviations:

CIWMB-California Integrated Waste Management Board
CO_2-Carbon Dioxide
CO_2e-Carbon Dioxide Equivalent
CP-Candlestick Point
HPS-Hunter's Point Shipyard
lb-pound
R&D-Research and Development

Sources:

CIWMB. 1999 Statewide Waste Characterization Study: Results and Final Report. 340-00-009. Available at http://www.ciwmb.ca.gov/wastechar/Resdisp.htm
CIWMB. 2007. Estimated Solid Waste Generation Rates for Industrial Establishments. Available at http://www.ciwmb.ca.gov/WasteChar/wasteGenRates/Industrial.htm
CIWMB. 2006. Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups. 341-06-006. Available at http://www.ciwmb.ca.gov/WasteChar/WasteStudies.htm#2006Industry

Table 3-35
GHG Emissions from Waste Disposal: Variant 2
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Land Use	Units		Units	Rate of Waste Disposal[1]		Waste Disposal[2]		Annual CO_2 Emissions[3]	
	CP	HPS		Value	Units	CP	HPS	CP	HPS
						(tonnes/year)		(tonnes CO_2e/year)	
Residential Units	6,244	4,000	dwelling units	1957	lb/unit/year	5543	3551	374	239
Retail	760,000	125,000	square feet	2.1	lb/sf/year	724	119	49	8
Office	150,000	-	square feet	1.87	lb/sf/year	127	--	9	--
Hotel	220	-	rooms	1840	lb/room/year	184	--	12	--
R&D	-	5,000,000	square feet	2.19	lb/sf/year	--	4967	--	335
Community Center/Artist Studios	50,000	80,000	square feet	1.87	lb/sf/year	42	68	3	5
Music Venue	10,000	-	Seats	17.2	lb/seat/year	78	0	5	0
Total								**451**	**587**

Notes:

1. Residential waste disposal rates for San Francisco of 0.42 lb/person/year which is based on CIWMB 2009 assuming 2.33 people per dwelling unit. R&D is based on industrial waste generation rate from CIWMB 2007. All other waste disposal rates are based on CIWMB 2006 Table 21 of Appendix A. The waste disposal rate for community center and artists studios is assumed to be the same as office space.
2. Waste Disposal amounts are based on project projections multiplied by waste disposal rates mulitplied by conversion factors.
3. CO_2 emissions are based on Altamont Landfill 2005 GHG non-biogenic emissions, which is 0.0674 metric tonnes of CO_2 emissions/ metric ton of waste/ year based on information from the BAAQMD. CO_2 emissions are calculated as follows: [tonnes of waste disposed] * 0.0674 [tonnes of CO_2 emissions/tonne of waste.

Abbreviations:
CIWMB-California Integrated Waste Management Board
CO_2-Carbon Dioxide
CO_2e-Carbon Dioxide Equivalent
CP-Candlestick Point
HPS-Hunter's Point Shipyard
lb-pound
R&D-Research and Development

Sources:

CIWMB. 1999 Statewide Waste Characterization Study: Results and Final Report. 340-00-009. Available at http://www.ciwmb.ca.gov/wastechar/Resdisp.htm
CIWMB. 2007. Estimated Solid Waste Generation Rates for Industrial Establishments. Available at http://www.ciwmb.ca.gov/WasteChar/wasteGenRates/Industrial.htm
CIWMB. 2006. Targeted Statewide Waste Characterization Study: Waste Disposal and Diversion Findings for Selected Industry Groups. 341-06-006. Available at http://www.ciwmb.ca.gov/WasteChar/WasteStudies.htm#2006Industry

Table 3-36
Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan Project
San Francisco, California

Source	GHG Emissions				Percentage of Annual CO_2e Emissions (%)		
		HPS	CP	CP-HPS Plan	HP	CP	CP-HPS Plan
Vegetation[1]	tonnes CO_2e total	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]		46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)		**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	6,642	19,035	25,677	13%	19%	17%
Non-Residential[4]		13,766	4,263	18,028	26%	4%	12%
Mobile[5]		30,371	75,149	105,520	57%	74%	68%
Municipal[6]		766	1,793	2,559	1%	2%	2%
Area		56	161	217	0%	0%	0%
Waste		375	532	907	1%	1%	1%
Transit Area		865	865	1,730	2%	1%	1%
Total (annual emissions)		**52,842**	**101,798**	**154,639**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**53,906**	**103,198**	**157,104**	**NA**	**NA**	**NA**

Notes:

1. Vegetation emissions are one-time emissions resulting from the planting of new vegetation. Data for emissions calculations are primarily from the Intergovernmental Panel on Climate Change (IPCC) Guildelines for National Greenhouse Gas Inventories.

2. Construction emissions are one-time emissions reported in total metric tonnes during the construction period . Emissions are calculated using URBEMIS default values, EMFAC2007 and model inputs prepared by MacTech. Sources of emissions include construction equipment and vehicles associated with worker commuting and haul trucks.

3. Residential emissions for dwelling units include emissions associated with electricity and natural gas use. Emissions estimates were developed from the Residential Appliance Saturation Survey. As specified in the CP-HPS Plan, a total of 10244 dwelling units are considered.

4. Non-Residential emissions account for electricity and natural gas use. Emissions estimates for non-residential buildings except for the Stadium were developed from the California Commercial End-Use Survey (CEUS), published by the California Energy Commission in 2006. The Stadium was estimated on a 20% improvement over 1990 Stadium energy use.

5. Mobile source emissions were calculated using EMFAC and Bayview Waterfront Project Transportation Study. Mobile source emissions account for all residential and nonresidential trips. CO_2 emissions were scaled to reflect CO_2e emissions based on data from the US Environmental Protection Agency (USEPA).

6. Municipal emissions account for emissions due to energy production associated with water supply, public/street lighting, and municipal vehicles. Energy use estimates for water supply are based primarily on ARUP's Carbon Report. Emissions from street lighting and municipal vehicles were based upon studies of other cities.

7. Percentages only apply to annual CO_2e emissions; annual and one-time CO_2e emissions cannot be directly compared.

8. One-time emissions (vegetation and construction) are "annualized" in this Total row. This is done by dividing by an annualization factor, 40 years, effectively converting the one-time emission into an annual emission rate. One-time emissions are not annualized in their respective rows above.

Abbreviations:

CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
EIA - Energy Information Administration
EIR - Environmental Impact Report
EMFAC - Emission Factors Database
GHG - Greenhouse Gas
HPS -Hunter's Point Shipyard
N_2O - nitrous oxide
URBEMIS - Urban Emissions Model

Table 3-37
Alternative Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan Project
San Francisco, California

Source	**GHG Emissions**				**Percentage of Annual CO_2e Emissions (%)**		
		HPS	**CP**	**CP-HPS Plan**	**HP**	**CP**	**CP-HPS Plan**
Vegetation[1]	tonnes CO_2e total	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]		46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)		**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	6,642	19,035	25,677	20%	31%	27%
Non-Residential[4]		13,766	4,263	18,028	40%	7%	19%
Mobile[5]		11,592	35,458	47,049	34%	57%	49%
Municipal[6]		766	1,793	2,559	2%	3%	3%
Area		56	161	217	0%	0%	0%
Waste		375	532	907	1%	1%	1%
Transit Area		865	865	1,730	3%	1%	2%
Total (annual emissions)		**34,062**	**62,106**	**96,168**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**35,126**	**63,507**	**98,633**	**NA**	**NA**	**NA**

Notes:

1. Vegetation emissions are one-time emissions resulting from the planting of new vegetation. Data for emissions calculations are primarily from the Intergovernmental Panel on Climate Change (IPCC) Guildelines for National Greenhouse Gas Inventories.

2. Construction emissions are one-time emissions reported in total metric tonnes during the construction period . Emissions are calculated using URBEMIS default values, EMFAC2007 and model inputs prepared by MacTech. Sources of emissions include construction equipment and vehicles associated with worker commuting and haul trucks.

3. Residential emissions for dwelling units include emissions associated with electricity and natural gas use. Emissions estimates were developed from the Residential Appliance Saturation Survey. As specified in the CP-HPS Plan, a total of 10244 dwelling units are considered.

4. Non-Residential emissions account for electricity and natural gas use. Emissions estimates for non-residential buildings except for the Stadium were developed from the California Commercial End-Use Survey (CEUS), published by the California Energy Commission in 2006. The Stadium was estimated on a 20% improvement over 1990 Stadium energy use.

5. Mobile source emissions were calculated using URBEMIS and EMFAC. Mobile source emissions account for residential trips. CO_2 emissions were scaled to reflect CO_2e emissions based on data from the US Environmental Protection Agency (USEPA).

6. Municipal emissions account for emissions due to energy production associated with water supply, public/street lighting, and municipal vehicles. Energy use estimates for water supply are based primarily on ARUP's Carbon Report. Emissions from street lighting and municipal vehicles were based upon studies of other cities.

7. Percentages only apply to annual CO_2e emissions; annual and one-time CO_2e emissions cannot be directly compared.

8. One-time emissions (vegetation and construction) are "annualized" in this Total row. This is done by dividing by an annualization factor, 40 years, effectively converting the one-time emission into an annual emission rate. One-time emissions are not annualized in their respective rows above.

Abbreviations:

CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
EIA - Energy Information Administration
EIR - Environmental Impact Report
EMFAC - Emission Factors Database
GHG - Greenhouse Gas
HPS -Hunter's Point Shipyard
N_2O - nitrous oxide
URBEMIS - Urban Emissions Model

Table 3-38
Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 1
San Francisco, California

Source	GHG Emissions				Percentage of Annual CO_2e Emissions (%)		
		HPS	CP	CP-HPS Plan	HP	CP	CP-HPS Plan
Vegetation[1]	tonnes CO_2e total	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]		46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)		**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	6,642	19,035	25,677	9%	18%	14%
Non-Residential[4]		23,155	4,263	27,418	31%	4%	15%
Mobile[5]		42,332	77,586	119,918	57%	74%	67%
Municipal[6]		860	1,793	2,653	1%	2%	1%
Area		56	161	217	0%	0%	0%
Waste		506	532	1,038	1%	1%	1%
Transit Area		865	865	1,730	1%	1%	2%
Total (annual emissions)		**74,416**	**104,234**	**178,651**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**75,480**	**105,635**	**181,115**	**NA**	**NA**	**NA**

Notes:

1. Vegetation emissions are one-time emissions resulting from the planting of new vegetation. Data for emissions calculations are primarily from the Intergovernmental Panel on Climate Change (IPCC) Guildelines for National Greenhouse Gas Inventories.
2. Construction emissions are one-time emissions reported in total metric tonnes during the construction period . Emissions are calculated using URBEMIS default values, EMFAC2007 and model inputs prepared by MacTech. Sources of emissions include construction equipment and vehicles associated with worker commuting and haul trucks.
3. Residential emissions for dwelling units include emissions associated with electricity and natural gas use. Emissions estimates were developed from the Residential Appliance Saturation Survey. As specified in the CP-HPS Plan, a total of 10244 dwelling units are considered.
4. Non-Residential emissions account for electricity and natural gas use. Emissions estimates for non-residential buildings were developed from the California Commercial End-Use Survey (CEUS), published by the California Energy Commission in 2006.
5. Mobile source emissions were calculated using EMFAC and Bayview Waterfront Project Transportation Study. Mobile source emissions account for all residential and nonresidential trips. CO_2 emissions were scaled to reflect CO_2e emissions based on data from the US Environmental Protection Agency (USEPA).
6. Municipal emissions account for emissions due to energy production associated with water supply, public/street lighting, and municipal vehicles. Energy use estimates for water supply are based primarily on ARUP's Carbon Report. Emissions from street lighting and municipal vehicles were based upon studies of other cities.
7. Percentages only apply to annual CO_2e emissions; annual and one-time CO_2e emissions cannot be directly compared.
8. One-time emissions (vegetation and construction) are "annualized" in this Total row. This is done by dividing by an annualization factor, years, effectively converting the one-time emission into an annual emission rate. One-time emissions are not annualized in their respective rows above.

Abbreviations:

CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
EIA - Energy Information Administration
EIR - Environmental Impact Report
EMFAC - Emission Factors Database
GHG - Greenhouse Gas
HPS -Hunter's Point Shipyard
N_2O - nitrous oxide
URBEMIS - Urban Emissions Model

Table 3-39
Alternative Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 1
San Francisco, California

Source	**GHG Emissions**				**Percentage of Annual CO_2e Emissions (%)**		
		HPS	**CP**	**CP-HPS Plan**	**HP**	**CP**	**CP-HPS Plan**
Vegetation[1]	tonnes CO_2e total	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]	tonnes CO_2e total	46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)	tonnes CO_2e total	**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	6,642	19,035	25,677	15%	31%	24%
Non-Residential[4]	tonnes CO_2e / year	23,155	4,263	27,418	52%	7%	26%
Mobile[5]	tonnes CO_2e / year	12,429	35,458	47,886	28%	57%	45%
Municipal[6]	tonnes CO_2e / year	860	1,793	2,653	2%	3%	2%
Area	tonnes CO_2e / year	56	161	217	0%	0%	0%
Waste	tonnes CO_2e / year	506	532	1,038	1%	1%	2%
Transit Area	tonnes CO_2e / year	865	865	1,730	2%	2%	4%
Total (annual emissions)	tonnes CO_2e / year	**44,513**	**62,106**	**106,619**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**45,577**	**63,507**	**109,084**	**NA**	**NA**	**NA**

Notes:

1. Vegetation emissions are one-time emissions resulting from the planting of new vegetation. Data for emissions calculations are primarily from the Intergovernmental Panel on Climate Change (IPCC) Guildelines for National Greenhouse Gas Inventories.
2. Construction emissions are one-time emissions reported in total metric tonnes during the construction period . Emissions are calculated using URBEMIS default values, EMFAC2007 and model inputs prepared by MacTech. Sources of emissions include construction equipment and vehicles associated with worker commuting and haul trucks.
3. Residential emissions for dwelling units include emissions associated with electricity and natural gas use. Emissions estimates were developed from the Residential Appliance Saturation Survey. As specified in the CP-HPS Plan, a total of 10244 dwelling units are considered.
4. Non-Residential emissions account for electricity and natural gas use. Emissions estimates for non-residential buildings were developed from the California Commercial End-Use Survey (CEUS), published by the California Energy Commission in 2006.
5. Mobile source emissions were calculated using URBEMIS and EMFAC. Mobile source emissions account for residential trips. CO_2 emissions were scaled to reflect CO_2e emissions based on data from the US Environmental Protection Agency (USEPA).
6. Municipal emissions account for emissions due to energy production associated with water supply, public/street lighting, and municipal vehicles. Energy use estimates for water supply are based primarily on ARUP's Carbon Report. Emissions from street lighting and municipal vehicles were based upon studies of other cities.
7. Percentages only apply to annual CO_2e emissions; annual and one-time CO_2e emissions cannot be directly compared.
8. One-time emissions (vegetation and construction) are "annualized" in this Total row. This is done by dividing by an annualization factor, years, effectively converting the one-time emission into an annual emission rate. One-time emissions are not annualized in their respective rows above.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
EIA - Energy Information Administration
EIR - Environmental Impact Report
EMFAC - Emission Factors Database
GHG - Greenhouse Gas
HPS -Hunter's Point Shipyard
N_2O - nitrous oxide
URBEMIS - Urban Emissions Model

Table 3-40
Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 2
San Francisco, California

Source	GHG Emissions				Percentage of Annual CO_2e Emissions (%)		
		HPS	CP	Variant 2	HP	CP	Variant 2
Vegetation[1]	tonnes CO_2e total	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]		46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)		**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	10,026	15,651	25,677	17%	16%	16%
Non-Residential[4]		11,963	4,263	16,226	20%	4%	10%
Mobile[5]		34,888	75,180	110,068	58%	77%	70%
Municipal[6]		1,488	1,066	2,553	2%	1%	2%
Area		85	132	217	0%	0%	0%
Waste		587	451	1,038	1%	1%	2%
Transit Area		865	865	1,730	1%	1%	3%
Total (annual emissions)		**59,901**	**97,608**	**157,509**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**60,965**	**99,009**	**159,974**	**NA**	**NA**	**NA**

Notes:
1. Vegetation emissions are one-time emissions resulting from the planting of new vegetation. Data for emissions calculations are primarily from the Intergovernmental Panel on Climate Change (IPCC) Guildelines for National Greenhouse Gas Inventories.
2. Construction emissions are one-time emissions reported in total metric tonnes during the construction period . Emissions are calculated using URBEMIS default values, EMFAC2007 and model inputs prepared by MacTech. Sources of emissions include construction equipment and vehicles associated with worker commuting and haul trucks.
3. Residential emissions for dwelling units include emissions associated with electricity and natural gas use. Emissions estimates were developed from the Residential Appliance Saturation Survey. As specified in the CP-HPS Plan, a total of 10244 dwelling units are considered.
4. Non-Residential emissions account for electricity and natural gas use. Emissions estimates for non-residential buildings were developed from the California Commercial End-Use Survey (CEUS), published by the California Energy Commission in 2006.
5. Mobile source emissions were calculated using EMFAC and Bayview Waterfront Project Transportation Study. Mobile source emissions account for all residential and nonresidential trips. CO_2 emissions were scaled to reflect CO_2e emissions based on data from the US Environmental Protection Agency (USEPA).
6. Municipal emissions account for emissions due to energy production associated with water supply, public/street lighting, and municipal vehicles. Energy use estimates for water supply are based primarily on ARUP's Carbon Report. Emissions from street lighting and municipal vehicles were based upon studies of other cities.
7. Percentages only apply to annual CO_2e emissions; annual and one-time CO_2e emissions cannot be directly compared.
8. One-time emissions (vegetation and construction) are "annualized" in this Total row. This is done by dividing by an annualization factor, years, effectively converting the one-time emission into an annual emission rate. One-time emissions are not annualized in their respective rows above.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
EIA - Energy Information Administration
EIR - Environmental Impact Report
EMFAC - Emission Factors Database
GHG - Greenhouse Gas
HPS -Hunter's Point Shipyard
N_2O - nitrous oxide
URBEMIS - Urban Emissions Model

Table 3-41
Alternative Summary of Greenhouse Gas Emissions for Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 2
San Francisco, California

Source	**GHG Emissions**				**Percentage of Annual CO_2e Emissions (%)**		
		HPS	**CP**	**Variant 2**	**HP**	**CP**	**Variant 2**
Vegetation[1]	tonnes CO_2e total	-3,500	-3,500	-7,000	NA	NA	NA
Construction[2]		46,061	59,526	105,587	NA	NA	NA
Total (one time emissions)		**42,561**	**56,026**	**98,587**	NA	NA	NA
Residential[3]	tonnes CO_2e / year	10,026	15,651	25,677	24%	29%	27%
Non-Residential[4]		11,963	4,263	16,226	29%	8%	17%
Mobile[5]		16,434	30,913	47,347	40%	58%	50%
Municipal[6]		1,488	1,066	2,553	4%	2%	3%
Area		85	132	217	0%	0%	0%
Waste		587	451	1,038	1%	1%	3%
Transit Area		865	865	1,730	2%	2%	4%
Total (annual emissions)		**41,448**	**53,341**	**94,789**	NA	NA	NA
Annualized Total[8]	**tonnes CO_2e / year**	**42,512**	**54,742**	**97,254**	**NA**	**NA**	**NA**

Notes:
1. Vegetation emissions are one-time emissions resulting from the planting of new vegetation. Data for emissions calculations are primarily from the Intergovernmental Panel on Climate Change (IPCC) Guildelines for National Greenhouse Gas Inventories.
2. Construction emissions are one-time emissions reported in total metric tonnes during the construction period . Emissions are calculated using URBEMIS default values, EMFAC2007 and model inputs prepared by MacTech. Sources of emissions include construction equipment and vehicles associated with worker commuting and haul trucks.
3. Residential emissions for dwelling units include emissions associated with electricity and natural gas use. Emissions estimates were developed from the Residential Appliance Saturation Survey. As specified in the CP-HPS Plan, a total of 10244 dwelling units are considered.
4. Non-Residential emissions account for electricity and natural gas use. Emissions estimates for non-residential buildings were developed from the California Commercial End-Use Survey (CEUS), published by the California Energy Commission in 2006.
5. Mobile source emissions were calculated using URBEMIS and EMFAC. Mobile source emissions account for residential trips. CO_2 emissions were scaled to reflect CO_2e emissions based on data from the US Environmental Protection Agency (USEPA).
6. Municipal emissions account for emissions due to energy production associated with water supply, public/street lighting, and municipal vehicles. Energy use estimates for water supply are based primarily on ARUP's Carbon Report. Emissions from street lighting and municipal vehicles were based upon studies of other cities.
7. Percentages only apply to annual CO_2e emissions; annual and one-time CO_2e emissions cannot be directly compared.
8. One-time emissions (vegetation and construction) are "annualized" in this Total row. This is done by dividing by an annualization factor, years, effectively converting the one-time emission into an annual emission rate. One-time emissions are not annualized in their respective rows above.

Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
EIA - Energy Information Administration
EIR - Environmental Impact Report
EMFAC - Emission Factors Database
GHG - Greenhouse Gas
HPS -Hunter's Point Shipyard
N_2O - nitrous oxide
URBEMIS - Urban Emissions Model

Table 4-1
Candlestick Point-Hunters Point Shipyard Phase II Development Plan Context Supporting Calculations
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

	Tonnes / Year	%
2004 World Emissions	2.68E+10	0.00058%
2004 USA Emissions	7.00E+09	0.0022%
2004 CA Emissions	4.80E+08	0.0322%
Total Project Annual Emissions	1.55E+05	

No Action Taken Projected 2020 CO_2e emissions	5.96E+08	tonnes
CA 1990 CO_2e emissions	4.27E+08	tonnes
Difference	1.69E+08	tonnes
% reduction / increase	28%	%
CA 2020 population	4.22E+07	people
1990 emissions / 2020 population	10.1	tonnes / capita

Candlestick Point-Hunters Point Shipyard Phase II Development Plan Population	24,539

	Tonnes CO_2 / year	Tonnes / capita / year
Candlestick Point-Hunters Point Shipyard Phase II Development Plan Mobile Emissions	105,520	4.3
Candlestick Point-Hunters Point Shipyard Phase II Development Plan Residential Emissions	25,677	1.0
Candlestick Point-Hunters Point Shipyard Phase II Development Plan Mobile + Residential	131,197	5.3

Table 4-2
Greenhouse Gas Emissions from Vehicles for the Year 2020: No Action Taken for Project
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2] Unadjusted	Daily One-Way Trips[2] Weekend/Weekday Adjustment[3]	Trip Distance[4] (miles)	Daily Adjusted VMT (miles)	Annual Adjusted VMT (miles)	Emission Factor Running (g/mile)[5]	Emission Factor Starts (g/start)[6]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
Hunter's Point	Residential - Home Based Work	4,927	4,646	14.90	69,222	25,266,165	**465**	**108**	11,749	183	11,932	12,560
	Residential - Home Based Other	7,237	6,824	9.10	62,094	22,664,301			10,539	269	10,808	11,377
	Residential - Non-Home Based	3,234	3,049	9.50	28,964	10,571,728			4,916	120	5,036	5,301
	Nonresidential - Home Based Work	6,463	6,093	14.90	90,793	33,139,267			15,410	240	15,650	16,474
	Nonresidential - Home Based Other	12,073	11,383	9.10	103,587	37,809,136			17,581	449	18,030	18,979
	Nonresidential - Non-Home Based	6,796	6,408	9.50	60,875	22,219,216			10,332	253	10,585	11,142
Total Resident Trips		**40,730**	**38,403**		**415,534**	**151,669,813**			**70,526**	**1,514**	**72,041**	**75,832**
Candlestick Point	Residential - Home Based Work	14,119	13,312	14.90	198,352	72,398,605	**465**	**108**	33,665	525	34,190	35,990
	Residential - Home Based Other	20,737	19,552	9.10	177,926	64,943,128			30,199	771	30,970	32,600
	Residential - Non-Home Based	9,266	8,736	9.50	82,993	30,292,621			14,086	344	14,431	15,190
	Nonresidential - Home Based Work	13,376	12,612	14.90	187,915	68,588,812			31,894	497	32,391	34,096
	Nonresidential - Home Based Other	24,988	23,560	9.10	214,395	78,254,106			36,388	929	37,317	39,281
	Nonresidential - Non-Home Based	14,066	13,262	9.50	125,993	45,987,426			21,384	523	21,907	23,060
	Music Venue-Worker	400	400	14.90	5,960	894,000			416	16	431	454
	Music Venue-Customer	2,666	2,666	9.10	24,261	3,639,090			1,692	43	1,735	1,827
Total Resident Trips		**99,618**	**94,101**		**1,017,795**	**364,997,788**			**169,724**	**3,649**	**173,373**	**182,497**
Totals		**140,348**	**132,503**		**1,433,329**	**516,667,601**			**240,250**	**5,163**	**245,413**	**258,330**

Notes:

1. The trip type distribution is based on . The trip type distribution is consistent with Caltrans Household Travel Survey. This applies to everything except the Music Venue.

Trip Type	Residential Type Distribution	NonResidential Trip Type Distribution
Home Based Work	32%	26%
Home Based Other	47%	48%
Non-Home Based	21%	27%

2. The daily trips are based on assuming all trips are made by automobile, and no mitigation measures such as transit, biking, or walking are used. The daily trips are based on Bayview Waterfront Project Transporation Study trip generation rates for residential land use. A vehicle occupance of 1.6 persons was assumed for all trips.

3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies. No adjustment was made to the music venue trips since this is based on a per event calculation. It is assumed that there are 150 events per year.

4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.

5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco.

6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.

7. $CO_2e=CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4 N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:

ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study.
Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 4-3
Greenhouse Gas Emissions from Vehicles for the Year 2020: No Action Taken for Variant 1
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2] Unadjusted	Daily One-Way Trips[2] Weekend/Weekday Adjustment[3]	Trip Distance[4] (miles)	Daily Adjusted VMT (miles)	Annual Adjusted VMT (miles)	Emission Factor Running (g/mile)[5]	Emission Factor Starts (g/start)[6]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
Hunter's Point	Residential - Home Based Work	4,927	4,646	14.90	69,222	25,266,165	**465**	**108**	11,749	183	11,932	12,560
	Residential - Home Based Other	7,237	6,824	9.10	62,094	22,664,301			10,539	269	10,808	11,377
	Residential - Non-Home Based	3,234	3,049	9.50	28,964	10,571,728			4,916	120	5,036	5,301
	Nonresidential - Home Based Work	9,116	8,595	14.90	128,067	46,744,525			21,736	339	22,075	23,237
	Nonresidential - Home Based Other	17,030	16,056	9.10	146,114	53,331,599			24,799	633	25,432	26,771
	Nonresidential - Non-Home Based	9,586	9,039	9.50	85,866	31,341,269			14,574	356	14,930	15,716
Total Resident Trips		**51,130**	**48,208**		**520,328**	**189,919,585**			**88,313**	**1,901**	**90,214**	**94,962**
Candlestick Point	Residential - Home Based Work	14,119	13,312	14.90	198,352	72,398,605	**465**	**108**	33,665	525	34,190	35,990
	Residential - Home Based Other	20,737	19,552	9.10	177,926	64,943,128			30,199	771	30,970	32,600
	Residential - Non-Home Based	9,266	8,736	9.50	82,993	30,292,621			14,086	344	14,431	15,190
	Nonresidential - Home Based Work	13,376	12,612	14.90	187,915	68,588,812			31,894	497	32,391	34,096
	Nonresidential - Home Based Other	24,988	23,560	9.10	214,395	78,254,106			36,388	929	37,317	39,281
	Nonresidential - Non-Home Based	14,066	13,262	9.50	125,993	45,987,426			21,384	523	21,907	23,060
	Music Venue-Worker	400	400	14.90	5,960	894,000			416	16	431	454
	Music Venue-Customer	2,666	2,666	9.10	24,261	3,639,090			1,692	43	1,735	1,827
Total Resident Trips		**99,618**	**94,101**		**1,017,795**	**364,997,788**			**169,724**	**3,649**	**173,373**	**182,497**
Totals		**150,748**	**142,309**		**1,538,123**	**554,917,373**			**258,037**	**5,550**	**263,586**	**277,459**

Notes:

1. The trip type distribution is based on . The trip type distribution is consistent with Caltrans Household Travel Survey. This applies to everything except the Music Venue.

Trip Type	Residential Type Distribution	NonResidential Trip Type Distribution
Home Based Work	32%	26%
Home Based Other	47%	48%
Non-Home Based	21%	27%

2. The daily trips are based on assuming all trips are made by automobile, and no mitigation measures such as transit, biking, or walking are used. The daily trips are based on Bayview Waterfront Project Transporation Study trip generation rates for residential land use. A vehicle occupance of 1.6 persons was assumed for all trips.
3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies. No adjustment was made to the music venue trips since this is based on a per event calculation. It is assumed that there are 150 events per year.
4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.
5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco.
6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.
7. $CO_2e=CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:

ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study.
Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 4-4
Greenhouse Gas Emissions from Vehicles for the Year 2020: No Action Taken for Variant 2
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Trip Type[1]		Daily One-Way Trips[2]		Trip Distance[4]	Daily Adjusted VMT (miles)	Annual Adjusted VMT (miles)	Emission Factor Running (g/mile)[5]	Emission Factor Starts (g/start)[6]	Annual CO_2 Emissions Running (tonne)	Annual CO_2 Emissions Starts (tonne)	Total Annual CO_2 Emissions (tonne)	Total Annual CO_2e Emissions (tonne)[7]
		Unadjusted	Weekend/Weekday Adjustment[3]	(miles)								
Hunter's Point	Residential - Home Based Work	7,437	7,012	14.90	104,476	38,133,892	465	108	17,732	276	18,009	18,957
	Residential - Home Based Other	10,923	10,299	9.10	93,718	34,206,933			15,906	406	16,312	17,171
	Residential - Non-Home Based	4,880	4,602	9.50	43,714	15,955,771			7,419	181	7,601	8,001
	Nonresidential - Home Based Work	6,358	5,994	14.90	89,316	32,600,290			15,159	236	15,396	16,206
	Nonresidential - Home Based Other	11,877	11,198	9.10	101,902	37,194,208			17,295	442	17,737	18,670
	Nonresidential - Non-Home Based	6,686	6,304	9.50	59,884	21,857,842			10,164	249	10,412	10,960
Total Resident Trips		**48,160**	**45,408**		**493,011**	**179,948,935**			**83,676**	**1,791**	**85,467**	**89,965**
Candlestick Point	Residential - Home Based Work	11,609	10,946	14.90	163,089	59,527,596	465	108	27,680	432	28,112	29,592
	Residential - Home Based Other	17,051	16,076	9.10	146,295	53,397,552			24,830	634	25,464	26,804
	Residential - Non-Home Based	7,618	7,183	9.50	68,239	24,907,205			11,582	283	11,865	12,490
	Nonresidential - Home Based Work	13,376	12,612	14.90	187,915	68,588,812			31,894	497	32,391	34,096
	Nonresidential - Home Based Other	24,988	23,560	9.10	214,395	78,254,106			36,388	929	37,317	39,281
	Nonresidential - Non-Home Based	14,066	13,262	9.50	125,993	45,987,426			21,384	523	21,907	23,060
	Music Venue-Worker	400	400	14.90	5,960	894,000			416	16	431	454
	Music Venue-Customer	2,666	2,666	9.10	24,261	3,639,090			1,692	43	1,735	1,827
Total Resident Trips		**91,774**	**86,705**		**936,146**	**335,195,787**			**155,866**	**3,357**	**159,223**	**167,603**
Totals		**139,934**	**132,113**		**1,429,157**	**515,144,722**			**239,542**	**5,148**	**244,690**	**257,568**

Notes:

1. The trip type distribution is based on . The trip type distribution is consistent with Caltrans Household Travel Survey. This applies to everything except the Music Venue.

Trip Type	Residential Type Distribution	NonResidential Trip Type Distribution
Home Based Work	32%	26%
Home Based Other	47%	48%
Non-Home Based	21%	27%

2. The daily trips are based on assuming all trips are made by automobile, and no mitigation measures such as transit, biking, or walking are used. The daily trips are based on Bayview Waterfront Project Transporation Study trip generation rates for residential land use. A vehicle occupance of 1.6 persons was assumed for all trips.

3. Daily trips were adjusted to account for differences between the weekend and the weekday traffic based on a report by Sonoma Technologies. No adjustment was made to the music venue trips since this is based on a per event calculation. It is assumed that there are 150 events per year.

4. Trip distances were provided by Fehr and Peers . The trip length is based on CP-HPS Plan's street network and land use plan as well as the regional roadway network and land use distribution.

5. Emission factors for vehicles based on EMFAC files for 2020, based on LDA, LDT1, LDT2, MDV, and MCY for San Francisco.

6. Starting emission factors are based on the weighted average distribution of time between trip starts based on URBEMIS defaults.

7. $CO_2e=CO_2/0.95$: The United States Environmental Protection Agency (USEPA) recommends assuming that CH_4, N_2O, and HFCs are 5% of emissions on a CO_2e basis.

Abbreviations:

ADT - Average Daily Trip
CH_4 - Methane
CO_2 - Carbon Dioxide
CO_2e - Carbon Dioxide Equivalent
GHG - Greenhouse Gas
HFC - Hydro fluorocarbon
N_2O - Nitrous oxide
VMT - Vehicle Miles Traveled

Sources:

CHS Consulting Group, Fehr and Peers, and LCW Consulting. 2009. Candlestick Point-Hunters Point Shipyard Phase II Development Transportation Study.
Sonoma Technologies, Inc. 2004. Correction and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin. May.

Table 4-5
GHG Emission Factors for Municipal Sources: No Action Taken Project
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Source[1]	Energy Requirements	Units	Emission Factor[10]	Units	Source Quantity		Units	Total CO_2e		Units
					CP	HPS		CP	HPS	
Lighting										
Public Lighting[2]	149	kW-hr/capita/yr	0.043	tonne CO_2e/capita/year	17,694	6,175	residents (capita)	758	264.68	tonne CO_2e
							Public Lighting Total:	**758**	**265**	
Municipal Vehicles										
Municipal Vehicles[3]	--	--	0.05	tonne CO_2e/capita/year	17,694	6,175	residents (capita)	885	309	
							Municipal Vehicles Total:	**885**	**309**	
Water and Wastewater [9]										
Water Supply and Conveyance (Potable)[4]	0	kW-hr/Mgal	0.00	tonne CO_2e/Mgal	0.88	0.79	MM gallons/day	0	0	tonne CO_2e
Water Treatment (Potable)[5]	111	kW-hr/Mgal	0.03	tonne CO_2e/Mgal	0.88	0.79	MM gallons/day	10	9	tonne CO_2e
Water Distribution (Potable)[6]	1,272	kW-hr/Mgal	0.37	tonne CO_2e/Mgal	0.88	0.79	MM gallons/day	118	106	tonne CO_2e
Wastewater Treatment and Discharge (Indirect Emissions) [7]	1,688	kW-hr/Mgal	0.49	tonne CO_2e/Mgal	0.88	0.79	MM gallons/day	156	140	tonne CO_2e
Wastewater Treatment Plant (Direct Emissions) [8]	--	--	0.084	tonne CO_2e/capita/year	0.00	0.00	MM gallons/day	0	0	tonne CO_2e
							Water and Wastewater Total:	**284**	**255**	tonne CO_2e
							Municipal Sources Total:	**1,928**	**829**	tonne CO_2e

Notes:

1. Public lighting includes streetlights, traffic signals, area lighting and lighting municipal buildings. Emissions from the Water and Wastewater category are primarily due to the energy required for supply, treatment and distribution.

2. Emission factor for public lighting is based on a study of energy usage and GHG emissions from Duluth, MN (Skoog, 2001) and the electricity generation emission factor from PG&E.

3. Emission factors for municipal vehicles are based on the most conservative number from studies of GHG emissions for four cities of different sizes: Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, CA. Population data provided by the US Census (2000).

4. Emission factor for the supply and conveyance of potable water is based on a CEC (2006) study. 85% of the water supply in San Francisco is supplied via gravity from the Hetch Hetchy basin. The CEC (2006) study suggests that Hetch Hetchy system is gravity-dominated and has minimal net carbon emissions.

5.Emission factor for water treatment is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

6.Emission factor for water distribution is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

7. Emission factor for wastewater treatment are from the energy requirements for the Southeast Pollution Control Center provided in a Request for Proposals. This information was provided in "SFPUC Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101".

8. All methane emissions from the wastewater at the Southeast Wastewater Treatment Plant is burned at the flare station or cogeneration plant, and no methane emissions are directly emitted from the wastewater as directed by the plant's air permit.

9. Source quantities for water and wastewater are based on ARUP's estimates.

10. GHG emissions attributed to electricity use are calculated using the PG&E carbon-intensity factor, which is 0.636 lbs CO2 per kW-hr.

Abbreviations:

CEC - California Energy Commission
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
EPRI - Electric Power Research Institute
GHG - greenhouse gas
HPS - Hunter's Point Shipyard
kW-hr - kilowatt hour
MMgal - million gallons
MW-hr - megawatt hour
NYSERDA - New York State Energy Research and Development Authority
PG&E - Pacific Gas and Electric
psi - pound per square inch
SFPUC - San Francisco Public Utility Commission
Tg - teragram
USEPA - United States Environmental Protection Agency

Sources:

California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.
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City of Santa Rosa. Cities for Climate Protection: Santa Rosa. http://ci.santa-rosa.ca.us/City_Hall/City_Manager/CCPFinalReport.pdf
EPRI. 2001. Summary Report for California Energy Commission Energy Efficiency Studies. Http://www.energy.ca.gov/pier/iaw/reports/2003_09_26_Appendix_2_7.pdf
New York State Energy Research and Development Authority (NYSERDA), 2002. *How-to Guide to Effective Energy-Efficient Street Lighting for Municipal Elected/Appointed Officials.* October.
San Francisco Public Utilities Commission. 2003. Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101.
Skoog., C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives.
U.S. Census Bureau. http://www.census.gov/main/www/cen2000.html
USEPA. 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. #430-R-07-002. April. http://epa.gov/climatechange/emissions/downloads06/07Waste.pdf

Table 4-6
GHG Emission Factors for Municipal Sources: No Action Taken Variant 1
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Source[1]	Energy Requirements	Units	Emission Factor[10]	Units	Source Quantity[11]		Units	Total CO_2e		Units
					CP	HPS		CP	HPS	
Lighting										
Public Lighting[2]	149	kW-hr/capita/yr	0.043	tonne CO_2e/capita/year	17,694	6,175	residents (capita)	758	264.68	tonne CO_2e
Municipal Vehicles										
Municipal Vehicles[3]	--	--	0.05	tonne CO_2e/capita/year	17,694	6,175	residents (capita)	885	309	
Water and Wastewater [9]										
Water Supply and Conveyance (Potable)[4]	0	kW-hr/Mgal	0.00	tonne CO_2e/Mgal	0.88	1.11	MM gallons/day	0	0	tonne CO_2e
Water Treatment (Potable)[5]	111	kW-hr/Mgal	0.03	tonne CO_2e/Mgal	0.88	1.11	MM gallons/day	10	13	tonne CO_2e
Water Distribution (Potable)[6]	1,272	kW-hr/Mgal	0.37	tonne CO_2e/Mgal	0.88	1.11	MM gallons/day	118	149	tonne CO_2e
Wastewater Treatment and Discharge (Indirect Emissions)[7]	1,688	kW-hr/Mgal	0.49	tonne CO_2e/Mgal	0.88	1.11	MM gallons/day	156	197	tonne CO_2e
Wastewater Treatment Plant (Direct Emissions)[8]	--	--	0.084	tonne CO_2e/capita/year	0.00	0.00	MM gallons/day	0	0	tonne CO_2e
							Water and Wastewater Total:	**284**	**359**	tonne CO_2e
							Municipal Sources Total:	**1,928**	**932**	tonne CO_2e

Notes:

1. Public lighting includes streetlights, traffic signals, area lighting and lighting municipal buildings. Emissions from the Water and Wastewater category are primarily due to the energy required for supply, treatment and distribution.

2. Emission factor for public lighting is based on a study of energy usage and GHG emissions from Duluth, MN (Skoog, 2001) and the electricity generation emission factor from PG&E.

3. Emission factors for municipal vehicles are based on the most conservative number from studies of GHG emissions for four cities of different sizes: Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, CA. Population data provided by the US Census (2000).

4. Emission factor for the supply and conveyance of potable water is based on a CEC (2006) study. 85% of the water supply in San Francisco is supplied via gravity from the Hetch Hetchy basin. The CEC (2006) study suggests that H Hetchy system is gravity-dominated and has minimal net carbon emissions.

5.Emission factor for water treatment is based on information provided i

6.Emission factor for water distribution is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

7. Emission factor for wastewater treatment are from the energy requirements for the Southeast Pollution Control Center provided in a Request for Proposals. This information was provided in "SFPUC Hetch Hetchy Water and Power I Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101".

8. All methane emissions from the wastewater at the Southeast Wastewater Treatment Plant is burned at the flare station or cogeneration plant, and no methane emissions are directly emitted from the wastewater as directed by the plant' permit.

9. Source quantities for water and wastewater are based on ARUP's estimates.

10. GHG emissions attributed to electricity use are calculated using the PG&E carbon-intensity factor, which is 0.636 lbs CO2 per kW-hr.

11. Water demand for Hunter's Point has been adjusted from Project Scenario in two ways: (1) water demand allocated for the stadium has been removed to reflect the "no stadium" scenario, and (2) the water demand allocated for research & development bas been doubled to reflect the corresponding increase in square footage. No changes were made to water demand for Candlestick Point.

Abbreviations:

CEC - California Energy Commission
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
EPRI - Electric Power Research Institute
GHG - greenhouse gas
IB - India Basin
kW-hr - kilowatt hour
MMgal - million gallons
MW-hr - megawatt hour
NYSERDA - New York State Energy Research and Development Authority
PG&E - Pacific Gas and Electric
psi - pound per square inch
SFPUC - San Francisco Public Utility Commission
Tg - teragram
USEPA - United States Environmental Protection Agency

Sources:

California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.
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New York State Energy Research and Development Authority (NYSERDA), 2002.*How-to Guide to Effective Energy-Efficient Street Lighting for Municipal Elected/Appointed Officials.* October.
San Francisco Public Utilities Commission. 2003. Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101.
Skoog., C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives.
U.S. Census Bureau. http://www.census.gov/main/www/cen2000.html
USEPA. 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. #430-R-07-002. April. http://epa.gov/climatechange/emissions/downloads06/07Waste.pdf

Table 4-7
GHG Emission Factors for Municipal Sources: No Action Taken Variant 2
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, CA

Source[1]	Energy Requirements	Units	Emission Factor[10]	Units	Source Quantity CP	Source Quantity HPS	Units	Total CO_2e CP	Total CO_2e HPS	Units
Lighting										
Public Lighting[2]	149	kW-hr/capita/yr	0.043	tonne CO_2e/capita/year	14,549	9,320	residents (capita)	624	400	tonne CO_2e
Municipal Vehicles										
Municipal Vehicles[3]	--	--	0.05	tonne CO_2e/capita/year	14,549	9,320	residents (capita)	727	466	
Water and Wastewater[9]										
Water Supply and Conveyance (Potable)[4]	0	kW-hr/Mgal	0.00	tonne CO_2e/Mgal	0.77	0.88	MM gallons/day	0	0	tonne CO_2e
Water Treatment (Potable)[5]	111	kW-hr/Mgal	0.03	tonne CO_2e/Mgal	0.77	0.88	MM gallons/day	9	10	tonne CO_2e
Water Distribution (Potable)[6]	1,272	kW-hr/Mgal	0.37	tonne CO_2e/Mgal	0.77	0.88	MM gallons/day	103	118	tonne CO_2e
Wastewater Treatment and Discharge (Indirect Emissions)[7]	1,688	kW-hr/Mgal	0.49	tonne CO_2e/Mgal	0.77	0.88	MM gallons/day	137	156	tonne CO_2e
Wastewater Treatment Plant (Direct Emissions)[8]	--	--	0.084	tonne CO_2e/capita/year	0.00	0.00	MM gallons/day	0	0	tonne CO_2e
							Water and Wastewater Total:	**249**	**284**	tonne CO_2e
							Municipal Sources Total:	**1,600**	**1,150**	tonne CO_2e

Notes:

1. Public lighting includes streetlights, traffic signals, area lighting and lighting municipal buildings. Emissions from the Water and Wastewater category are primarily due to the energy required for supply, treatment and distribution.

2. Emission factor for public lighting is based on a study of energy usage and GHG emissions from Duluth, MN (Skoog, 2001) and the electricity generation emission factor from PG&E.

3. Emission factors for municipal vehicles are based on the most conservative number from studies of GHG emissions for four cities of different sizes: Medford, MA; Duluth, MN; Northampton, MA; and Santa Rosa, CA. Population data provided by the US Census (2000).

4. Emission factor for the supply and conveyance of potable water is based on a CEC (2006) study. 85% of the water supply in San Francisco is supplied via gravity from the Hetch Hetchy basin. The CEC (2006) study suggests that Hetch Hetchy system is gravity-dominated and has minimal net carbon emissions.

5.Emission factor for water treatment is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

6.Emission factor for water distribution is based on information provided in CEC 2006 and the electricity generation emission factor from Pacific Gas and Electric. This factor is applied to potable water demand.

7. Emission factor for wastewater treatment are from the energy requirements for the Southeast Pollution Control Center provided in a Request for Proposals. This information was provided in "SFPUC Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101".

8. All methane emissions from the wastewater at the Southeast Wastewater Treatment Plant is burned at the flare station or cogeneration plant, and no methane emissions are directly emitted from the wastewater as directed by the plant's air permit.

9. Source quantities for water and wastewater are based on ARUP's estimates.

10. GHG emissions attributed to electricity use are calculated using the PG&E carbon-intensity factor, which is 0.636 lbs CO2 per kW-hr.

11. Water demand for Hunter's Point was adjusted from Project Scenario in two ways: (1) water demand allocated for the stadium has been removed to reflect the "no stadium" scenario, and (2) residential water demand was increased to reflect

12. Water demand for Candlestick Point was decreased to reflect a decrease in dwelling units from 7,594 to 6244.

13. The change in dwelling units at Hunter's Point and Candlestick Point caused proportional changes to energy use for municipal lighting and vehicles.

Abbreviations:

CEC - California Energy Commission
CO_2e - carbon dioxide equivalent
CP - Candlestick Point
CP-HPS Plan - Candlestick Point-Hunters Point Shipyard Phase II Development Plan
GHG - greenhouse gas
HPS - Hunter's Point Shipyard
IB - India Basin
kW-hr - kilowatt hour
MMgal - million gallons
MW-hr - megawatt hour
NYSERDA - New York State Energy Research and Development Authority
PG&E - Pacific Gas and Electric
psi - pound per square inch
SFPUC - San Francisco Public Utility Commission
Tg - teragram
USEPA - United States Environmental Protection Agency

Sources:

California Energy Commission. 2006. Refining Estimates of Water-Related Energy Use in California. PIER Final Project Report. Prepared by Navigant Consulting, Inc. CEC-500-2006-118. December.
City of Medford. 2001. Climate Action Plan. October. http://www.massclimateaction.org/pdf/MedfordPlan2001.pdf
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City of Santa Rosa. Cities for Climate Protection: Santa Rosa. http://ci.santa-rosa.ca.us/City_Hall/City_Manager/CCPFinalReport.pdf
EPRI. 2001. Summary Report for California Energy Commission Energy Efficiency Studies. Http://www.energy.ca.gov/pier/iaw/reports/2003_09_26_Appendix_2_7.pdf
New York State Energy Research and Development Authority (NYSERDA), 2002. *How-to Guide to Effective Energy-Efficient Street Lighting for Municipal Elected/Appointed Officials.* October.
San Francisco Public Utilities Commission. 2003. Hetch Hetchy Water and Power RFP - Solar Photovoltaic Renewable Energy Plant at the Southeast Water Pollution Control Plant Agreement No. DB-101.
Skoog., C. 2001. Greenhouse Gas Inventory and Forecast Report. City of Duluth Facilities Management and The International Council for Local Environmental Initiatives.
U.S. Census Bureau. http://www.census.gov/main/www/cen2000.html
USEPA. 2007. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005. #430-R-07-002. April. http://epa.gov/climatechange/emissions/downloads06/07Waste.pdf

Table 4-8
GHG Emissions Comparison of No Action Taken to Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Source	**Candlestick Point**			**Hunter's Point**			**Total**		
	GHG Emissions (tonnes CO_2e / year)		**Percentage Improvement over No Action Taken**[1]	**GHG Emissions (tonnes CO_2e / year)**		**Percentage Improvement over No Action Taken**[1]	**GHG Emissions (tonnes CO_2e / year)**		**Improvement over No Action Taken**[1]
	No Action Taken[2]	**CP**[2]	**(%)**	**No Action Taken**[2]	**HPS**[2]	**(%)**	**No Action Taken**[2]	**Project**[2]	**(%)**
Vegetation[3]	0	-3,500	--	0	-3,500	--	0	-7,000	--
Construction	59,526	59,526	0%	46,061	46,061	0%	105,587	105,587	0%
Total (one-time emissions)	**59,526**	**56,026**	6%	**46,061**	**42,561**	8%	**105,587**	**98,587**	7%
Residential[4]	23,934	19,035	20%	8,352	6,642	20%	32,286	25,677	20%
Non-Residential[5]	5,023	4,263	15%	16,840	13,766	18%	21,863	18,028	18%
Mobile[6]	182,497	75,149	59%	75,832	30,371	60%	258,330	105,520	59%
Municipal[7]	1,928	1,793	7%	829	766	8%	2,756	2,559	7%
Area	161	161	0%	56	56	0%	217	217	0%
Waste	532	532	0%	375	375	0%	907	907	0%
Transit Area	1,442	865	40%	1,442	865	40%	2,884	1,730	40%
Total (annual emissions)	**215,517**	**101,798**	**53%**	**103,726**	**52,842**	**49%**	**319,242**	**154,639**	**52%**
Annualized Total[8]	**217,005**	**103,198**	**52%**	**104,877**	**53,906**	**49%**	**321,882**	**157,104**	**51%**

Notes:
1. The percentage improvement over No Action Taken is an estimate. There are some source categories where appropriate comparisons are available. It is estimated that this value is on the conservative side.
2. The carbon intensity from indirect energy use is based on PG&E's 2007 carbon intensity for all No Action Taken categories. The 20% Renewable Portfolio Standard has been used to adjust the carbon intensity value for indirect electricity use for all Project categor
3. No Action Taken vegetation emissions are based on no net trees being planted.
4. No Action Taken residential emissions reflect minimally Title-24 (2005) compliant homes without Energy Star appliances.
5. No Action Taken non-residential emissions reflect minimally Title-24 (2005) compliant buildings.
6. No Action Taken mobile emissions is based on a comparison of trip rates adjusted for average San Francisco trip rates and no Pavley Vehicle Emission Standards.
7. Municipal emissions included here are related to water treatment, waste water treatment, street lighting, and municipal vehicles.
8. One-time emissions are annualized over 40 years and then added to the total annual emissions.

Abbreviations:
CP - Candlestick Point
CO_2e - Carbon Dioxide Equivalent
HPS -Hunter's Point Shipyard

Table 4-9
GHG Emissions Comparison of No Action Taken to Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 1
San Francisco, California

Source	Candlestick Point			Hunter's Point			Total		
	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over No Action Taken[1]	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over No Action Taken[1]	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over No Action Taken[1]
	No Action Taken[2]	CP[2]	(%)	No Action Taken[2]	HPS[2]	(%)	No Action Taken[2]	Variant 1[2]	(%)
Vegetation[3]	0	-3,500	--	0	-3,500	--	0	-7,000	--
Construction	59,526	59,526	0%	46,061	46,061	0%	105,587	105,587	0%
Total (one-time emissions)	**59,526**	**56,026**	6%	**46,061**	**42,561**	8%	**105,587**	**98,587**	7%
Residential[4]	23,934	19,035	20%	8,352	6,642	20%	32,286	25,677	20%
Non-Residential[5]	5,023	4,263	15%	28,002	23,155	17%	33,025	27,418	17%
Mobile[6]	182,497	77,586	57%	94,962	42,332	55%	277,459	119,918	57%
Municipal[7]	1,928	1,793	7%	932	860	8%	2,860	2,653	7%
Area	161	161	0%	56	56	0%	217	217	0%
Waste	532	532	0%	506	506	0%	1,038	1,038	0%
Transit Area	1,442	865	40%	1,442	865	40%	2,884	1,730	40%
Total (annual emissions)	**215,517**	**104,234**	**52%**	**134,252**	**74,416**	**45%**	**349,768**	**178,651**	**49%**
Annualized Total[8]	**217,005**	**105,635**	**51%**	**135,403**	**75,480**	**44%**	**352,408**	**181,115**	**49%**

Notes:
1. The percentage improvement over No Action Taken is an estimate. There are some source categories where appropriate comparisons are available. It is estimated that this value is on the conservative side.
2. The carbon intensity from indirect energy use is based on PG&E's 2007 carbon intensity for all No Action Taken categories. The 20% Renewable Portfolio Standard has been used to adjust the carbon intensity value for indirect electricity use for all Project categories
3. No Action Taken vegetation emissions are based on no net trees being planted.
4. No Action Taken residential emissions reflect minimally Title-24 (2005) compliant homes without Energy Star appliances.
5. No Action Taken non-residential emissions reflect minimally Title-24 (2005) compliant buildings.
6. No Action Taken mobile emissions is based on a comparison of trip rates adjusted for average San Francisco trip rates and no Pavley Vehicle Emission Standards.
7. Municipal emissions included here are related to water treatment, waste water treatment, street lighting, and municipal vehicles.
8. One-time emissions are annualized over 40 years and then added to the total annual emissions.

Abbreviations:
CP - Candlestick Point
CO_2e - Carbon Dioxide Equivalent
HPS -Hunter's Point Shipyard

Table 4-10
GHG Emissions Comparison of No Action Taken to Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
Variant 2
San Francisco, California

Source	Candlestick Point			Hunter's Point			Total		
	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over No Action Taken[1]	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over No Action Taken[1]	GHG Emissions (tonnes CO_2e / year)		Percentage Improvement over No Action Taken[1]
	No Action Taken[2]	CP[2]	(%)	No Action Taken[2]	HPS[2]	(%)	No Action Taken[2]	Variant 2[2]	(%)
Vegetation[3]	0	-3,500	--	0	-3,500	--	0	-7,000	--
Construction	59,526	59,526	0%	46,061	46,061	0%	105,587	105,587	0%
Total (one-time emissions)	**59,526**	**56,026**	6%	**46,061**	**42,561**	8%	**105,587**	**98,587**	7%
Residential[4]	19,679	15,651	20%	12,607	10,026	20%	32,286	25,677	20%
Non-Residential[5]	4,728	4,263	10%	14,458	11,963	17%	19,186	16,226	15%
Mobile[6]	167,603	75,180	55%	89,965	34,888	61%	257,568	110,068	57%
Municipal[7]	1,600	1,066	33%	1,150	1,488	-29%	2,750	2,553	7%
Area	132	132	0%	85	85	0%	217	217	0%
Waste	451	451	0%	587	587	0%	1,038	1,038	0%
Transit Area	1,442	865	40%	1,442	865	40%	2,884	1,730	40%
Total (annual emissions)	**195,636**	**97,608**	**50%**	**120,293**	**59,901**	**50%**	**315,929**	**157,509**	**50%**
Annualized Total[8]	**197,124**	**99,009**	**50%**	**121,445**	**60,965**	**50%**	**318,569**	**159,974**	**50%**

Notes:

1. The percentage improvement over No Action Taken is an estimate. There are some source categories where appropriate comparisons are available. It is estimated that this value is on the conservative side.
2. The carbon intensity from indirect energy use is based on PG&E's 2007 carbon intensity for all No Action Taken categories. The 20% Renewable Portfolio Standard has been used to adjust the carbon intensity value for indirect electricity use for all Project categories.
3. No Action Taken vegetation emissions are based on no net trees being planted.
4. No Action Taken residential emissions reflect minimally Title-24 (2005) compliant homes without Energy Star appliances.
5. No Action Taken non-residential emissions reflect minimally Title-24 (2005) compliant buildings.
6. No Action Taken mobile emissions is based on a comparison of trip rates adjusted for average San Francisco trip rates and no Pavley Vehicle Emission Standards.
7. Municipal emissions included here are related to water treatment, waste water treatment, street lighting, and municipal vehicles.
8. One-time emissions are annualized over 40 years and then added to the total annual emissions.

Abbreviations:
CP - Candlestick Point
CO_2e - Carbon Dioxide Equivalent
HPS -Hunter's Point Shipyard

Table 5-1
GHG Emissions from Renewable Power Standards
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Renewable Energy Source [1]	**Energy Delivered**[1] **[million kWh]**	**Percentage of Renewable Energy Delivered [%]**
Wind	1,357	15%
Small hydro	1,900	21%
Biogas	0	0%
Solar	0	<1
Biomass	3,076	34%
Geothermal	2,714	30%
Total[2]	9,047	100%
% of Total Energy From Renewables[1]	11%	
% of Total Energy From Non-Renewables	89%	
Total Energy Delivery[2]	79,450,904	MWh
from renewables	9,047,125	MWh
from non-renewables	70,403,779	MWh
CO_2 Emissions per Total Energy Delivered	635.67	lbs CO_2/MWh delivered
Total CO_2 Emissions[3]	22,908,502	metric tonnes CO_2
CO_2 Emissions per Total Non-Renewable Energy[4]	717.36	lbs CO_2/MWh delivered
Estimated Emission Factors for Total Energy Delivered [5]		
2010 RPS (20%)	573.9	lbs CO_2/MWh delivered
2020 RPS (33%)	480.6	lbs CO_2/MWh delivered

Notes:

1. The renewable energy portfolio for Pacific Gas and Electric, the power utility that is most likely to provide power to the Candlestick Point-Hunters Point Shipyard Phase II Development Plan . The renewable energy distribution is based on 2007 data available at: http://www.pgecorp.com/corp_responsibility/reports/2007/environment/energy-future.html

2. Total energy value reported for 2007 by Pacific Gas and Electric in its 2008 Annual Entity Emissions: Electric Power Generation/Electric Utility Sector report. Available at: http://www.pge.com/mybusiness/edusafety/systemworks/electric/energymix/index.shtml

3. The amount of CO2 emissions is provided in Pacific Gas and Electric's 2008 Annual Entity Emissions: Electric Power Generation/Electric Utility Sector for 2007 report. Available at: http://www.pge.com/mybusiness/edusafety/systemworks/electric/energymix/index.shtml

4. The emissions metric presented here is calculated based on the total CO_2 emissions divided by the energy delivered from non-renewable sources.

5. The emission factors for total energy delivered are estimated by multiplying the percentage of energy delivered from non-renewable energy by the CO_2 emissions per total non-renewable energy metric calculated above. Two emission factors are presented here for the current 20% RPS goal for 2010 and the presumed 33% RPS for 2020. The estimate provided here and the 2006 PUP report issued by Southern California Edison assume that renewable energy sources do not result in any CO_2 emissions. This is not necessarily true for biogas- and biomass-sourced energy but some consider these sources to be "carbon neutral."

Abbreviations:
CO_2 = carbon dioxide
kWh = kilowatt-hour
lbs = pounds
MWh = Megawatt-hour
PUP = Power/Utility Protocol
RPS = Renewables Portfolio Standard
SCE = Southern California Edison

Table 5-2
Low Carbon Fuel Standard (LCFS) Effects on Vehicle Tailpipe Emissions[1]
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Baseline Scenario					
Fuel	**Emission Factor[2]**	**Fuel Economy[3]**		**VMT[4]**	**Emissions[5]**
	[kg CO_2/gal]	**[mpg]**	**[g CO_2/mile]**	**[miles/year]**	**[metric tonne CO_2/year]**
Gasoline	8.81	20.3	434	134,922,927	58,503
Diesel	10.15	7.9	1,283	2,897,118	3,717
					62,220
Scenario A: Replace California Diesel with 100% Biodiesel (B100)[6]					
Fuel	**Emission Factor**	**Fuel Economy**	**Emission Rate**	**VMT**	
	[kg CO_2/gal]	**[mpg]**	**[g CO_2/mile]**		**[metric tonne CO_2/year]**
Gasoline	8.81	20.3	434	134,922,927	58,503
Biodiesel	9.46	7.1	1,329	2,897,118	3,850
					62,353
			Percent Difference from Baseline		0.2%
Scenario B: Replace California Gasoline with 85% Ethanol Blend (E85)[7]					
Fuel	**Emission Factor**	**Fuel Economy**	**Emission Rate**	**VMT**	**Emissions**
	[kg CO_2/gal]	**[mpg]**	**[g CO_2/mile]**	**[miles/year]**	**[metric tonne CO_2/year]**
E85	6.10	15.2	400	134,922,927	54,010
Diesel	10.15	7.9	1,283	2,897,118	3,717
					57,727
			Percent Difference from Baseline		-7.2%
Scenario C: Replace California Gasoline with Compressed Natural Gas (CNG)[8]					
Fuel	**Emission Factor**	**Fuel Economy**	**Emission Rate**	**VMT**	**Emissions**
	[kg CO_2/gal]	**[mpg]**		**[miles/year]**	**[metric tonne CO_2/year]**
CNG	5.31	28.0	190	134,922,927	25,587
Diesel	10.15	7.9	1,283	2,897,118	3,717
					29,305
			Percent Difference from Baseline		-52.9%

Notes:

1. The Low Carbon Fuel Standard (LCFS) mandated under Governor Schwarzenegger's Executive Order S-01-07 and currently being developed by the California Air Resources Board (ARB) requires a reduction in carbon intensity of California's transportation fuels by at least 10% by 2020. At present, the ARB only has a "concept outline" of the LCFS regulation which proposes an Average Fuel Carbon Intensity (AFCI) of 83 g CO_2e/megajoule (MJ) of energy in the fuel for gasoline and 64 g CO_2e/MJ for diesel. However, one must consider that the LCFS considers the life cycle analysis (LCA) emissions for each fuel whereas the emissions presented in this inventory only account for vehicular tailpipe emissions. Thus, the impact on vehicle tailpipe emissions are only speculative.

In this table, ENVIRON presents the various extreme scenarios by which gasoline or diesel is replaced by various alternative fuels which have lower LCA emissions. This analysis assumes that engine technology will not change (i.e., emission factors and fuel economy are constant) and that the vehicle miles travelled (VMT) for the same population will also be similar in 2020. In reality, the fuel-specific emission factors and fuel economy are likely to improve with advanced technologies. However, overall VMT will likely increase for CP-HPS Plan if the population increases. For purposes of this analysis, the emission estimates presented here for future scenarios are attributable to the same population as in the baseline population.

2. Emission factors for various fuels from the California Climate Action Registry (CCAR) General Reporting Protocol (GRP) (2007).

3. Average fuel economy for California gasoline and diesel vehicles obtained from forecasts of fuel consumption and vehicle miles travelled for 2008 from the California Department of Transportation (2005).

4. Vehicle miles travelled (VMT) split between gasoline (or replacement) and diesel (or replacement) assumes 95% VMT by gasoline vehicles and 5% VMT by diesel vehicles.

5. These emissions only account for running CO_2 emissions and do not account for starting emissions. The emissions estimated here are derived differently compared to emissions calculated from the EMFAC model runs for the Cp-HPS Plan; the estimated emissions for the baseline scenario are roughly within 10% of the vehicle emissions developed using EMFAC. This difference is likely due to improvements in vehicle technology estimated for 2011. However, for purposes of this semi-quantitative analysis, this should be acceptable since the emissions presented in this table are only for comparative purposes and are not meant to represent actual emissions at CP-HPS Plan.

6. Scenario A assumes that California diesel would be replaced entirely by 100% biodiesel (B100). The fuel economy of biodiesel is assumed to be 10% lower than that for California diesel based on US Department of Energy estimates (2008) (http://www.fueleconomy.gov/feg/biodiesel.shtml). Some consider the CO_2 emissions from biological sources to be "carbon neutral". However for purposes of this analysis, the CO_2 from the combustion of biodiesel are accounted for.

7. Scenario B assumes that California gasoline would be replaced entirely by 85% ethanol blend (E85). The fuel economy of E85 is assumed to be 20-30% lower than that for gasoline based on US Department of Energy estimates (2008) (http://www.fueleconomy.gov/feg/ethanol.shtml).

8. Scenario C assumes that California gasoline would be replaced entirely by compressed natural gas (CNG). The fuel economy of CNG is assumed to be 28 mpg based on US Department of Energy estimates (2008) for a 2008 Honda Civic powered on CNG.

Abbreviations:

ARB = California Air Resources Board
B100 = 100% biodiesel
CNG = compressed natural gas
CO_2 = carbon dioxide
E85 = 85% ethanol blend
gal = gallon
LCA = life cycle analysis
LCFS = Low Carbon Fuel Standard
mpg = miles per gallon
VMT = vehicle miles travelled

Sources:

California Climate Action Registry (CCAR). 2007. General Reporting Protocol, Version 2.2, March. Available at: http://www.climateregistry.org/docs/PROTOCOLS/GRP%20V2-March2007.pdf
California Department of Transportation. 2005. California Motor Vehicle Stock, Travel, and Fuel Forecast. Available at: http://www.dot.ca.gov/hq/tsip/smb/documents/mvstaff/mvstaff05.pdf

Appendix A
ARUP Water Demand Memorandum

To	Lennar -	Reference number 131878/RRJ	
cc		File reference	
From	Rowan Roderick-Jones/Manish Dalia x 27222 (San Francisco)	Date September 25, 2009	
Subject	**Candlestick Point / Hunters Point Shipyard Phase II** **Water Demand Memorandum** **Revision # 15**		

1 Purpose

This Water Demand Memorandum (Memo) presents a summary approach, references, assumptions, and results of calculations undertaken by Arup to estimate a range of potential water demands and sanitary sewer flows for the Candlestick Point/Hunters Point Shipyard (CP/HPS) Development including the Proposed Project as well as the R&D and Housing Variants.

The Memo establishes a historical baseline condition and makes adjustments to account for current California building code requirements as well as the San Francisco Green Building Ordinance. The basis for these analyses and the results are presented herein.

Arup worked in conjunction with Winzler & Kelly to develop water demand and sanitary sewer flow values appropriate for use in engineering design.

2 Approach

To develop reasonable water demand estimates for the CP/HPS development the following steps were taken.

1) The Proposed Project was divided into land uses as identified in Table 1. Two project variants exclude the stadium. The R&D Variant also includes an additional 2,500,000 square feet of research and development space, as shown in Table 2. The Housing Variant does not include any additional program but shifts 1,350 housing units from Candlestick Point to Hunters Point, as shown in Table 3. The methodology for developing water demands was the same for the Proposed Project and Project Variants.

2) A **Historical Benchmark** demand was estimated for each land use based on a series of assumptions and references. Key references used were:

   a. The Urban Water Management Plan for the City of San Francisco

   b. The SFPUC Wholesale Customer Demand Projections Technical Report (URS, 2004)

   c. The City of Los Angeles CEQA Threshold Guide, 2006

   d. The EPA, Onsite Wastewater Treatment Systems Manual, 2002

A number of other references were also used and these are provided at the end of this memorandum. Arup collected information from a number of sources and selected a method of estimating demands that we believed to be appropriate and reasonable for the area. Assumptions and references are provided in Section 4.

3) The demands were then distributed between indoor and outdoor end uses which were estimated based on published data in the SFPUC Wholesale Customer Demand Projections Report (URS 2004). End use distributions for the stadium and performance venues were assumed rather than taken directly from the SFPUC's projections. The distribution ratios are provided in Table 21 and Table 22.

4) Next, the Historical Benchmark was adjusted to an **Adjusted to California Codes** scenario using new fixture flow rates from California and Federal Buildings standards as well as the International Plumbing Code.

5) The Adjusted to California Codes demand estimate does not include the requirements of the **San Francisco Green Building Ordinance (SFGBO)**. The SFGBO is based on LEED for New Construction (LEED NC) and requires a 50% reduction in landscape irrigation demands. The SFGBO does not specify what code is to be used as the baseline for irrigation demands. Therefore the current code was assumed to be equivalent to the irrigation amount allowed under the California Water Efficient Landscape Ordinance. This rule was assumed to be applicable to both private and public landscape irrigation. In addition, the SFGBO requires a 30% reduction in potable water demand. The SFGBO does not provide specific language as to which portions of demand are to be included in the 30% reduction. However, the intention of the similar LEED NC credit (Water Efficiency Credit 3) is to reduce building water demand by 30%. The total 30% reduction in building water efficiency may be achieved by any number of means including improved fixture efficiency, mechanical building efficiency, or by providing an alternative water supply. The demand estimates, when adjusted for the SFGBO represent the final demands for the Proposed Project and Project Variants.

   The SFGBO demand was developed by using the California code as a baseline and using a trajectory or possible means of water saving strategies and/or alternative water supplies to achieve the SFGBO. The assumptions and references used to make these adjustments are provided in Table 23.

6) Potential reclaimed water demands as well as sewage generation were determined based on end use distributions.

The results of the study are presented at the beginning of this report. References and Assumptions used for making the demand estimations are provided after the results in Section 3.

Table 1: CP/HPS Land Use Program (Proposed Project)

		Hunters Point Shipyard	Candlestick Point	Project Total
Land Use				
Residential				
	Density, 15-75 units per acre (units)	680	1,325	2,005
	Density, 50-125 units per acre (units)	1,415	2,865	4,280
	Density, 100-175 units per acre (units)	265	2,000	2,265
	Density, 175-285 units per acre (units)	290	1,660	1,950
	Total Project (units)	**2,650**	**7,850**	**10,500**
Retail				
	Regional Retail (sqft))	0	635,000	635,000
	Neighborhood Retail (sqft)	125,000	125,000	250,000
	Total (sqft)	**125,000**	**760,000**	**885,000**
Office (sqft)		0	150,000	150,000
Community Uses (sqft)		50,000	50,000	100,000
Research & Development (sqft)		2,500,000	0	2,500,000
Hotel (sqft)		0	150,000	150,000
Artist's Studios				
	1:1 Studio Renovation & Replacement (sqft)	225,000	0	225,000
	New Artist Center (sqft)	30,000	0	30,000
	Total (sqft)	**255,000**	**0**	**255,000**
Parks & Open Space				
	New City Parks (acres)	138	11.8	149.8
	New Sports Fields & Active Recreation (acres)	101.5	0	101.5
	New Open Space and Restored State Parkland (acres)	0	84	84
	Total (acres)	**239.5**	**95.8**	**335.3**
Football Stadium (seats)		69,000	0	69,000
Performance Venue (seats)		0	10,000	10,000

Source: Lennar, August 2009.

Table 2: CP/HPS Land Use Program (R&D Variant)

		Hunters Point Shipyard	Candlestick Point	Project Total
Land Use				
Residential				
	Density, 15-75 units per acre (units)	680	1,325	2,005
	Density, 50-125 units per acre (units)	1,415	2,865	4,280
	Density, 100-175 units per acre (units)	265	2,000	2,265
	Density, 175-285 units per acre (units)	290	1,660	1,950
	Total Project (units)	**2,650**	**7,850**	**10,500**
Retail				
	Regional Retail (sqft))	0	635,000	635,000
	Neighborhood Retail (sqft)	125,000	125,000	250,000
	Total (sqft)	**125,000**	**760,000**	**885,000**
Office (sqft)		0	150,000	150,000
Community Uses (sqft)		50,000	50,000	100,000
Research & Development (sqft)		5,000,000	0	5,000,000
Hotel (sqft)		0	150,000	150,000
Artist's Studios				
	1:1 Studio Renovation & Replacement (sqft)	225,000	0	225,000
	New Artist Center (sqft)	30,000	0	30,000
	Total (sqft)	**255,000**	**0**	**255,000**
Parks & Open Space				
	New City Parks (acres)	138	11.8	149.8
	New Sports Fields & Active Recreation (acres)	101.5	0	101.5
	New Open Space and Restored State Parkland (acres)	0	84	84
	Total (acres)	**239.5**	**95.8**	**335.3**
Football Stadium (seats)		0	0	0
Performance Venue (seats)		0	10,000	10,000

Source: Lennar, August 2009.

Table 3: CP/HPS Land Use Program (Housing Variant)

		Hunters Point Shipyard	Candlestick Point	Project Total
Land Use				
Residential				
	Density, 15-75 units per acre (units)	1,540	1,395	2,935
	Density, 50-125 units per acre (units)	1,905	3,270	5,175
	Density, 100-175 units per acre (units)	265	1,250	1,515
	Density, 175-285 units per acre (units)	290	585	875
	Total Project (units)	**4,000**	**6,500**	**10,500**
Retail				
	Regional Retail (sqft))	0	635,000	635,000
	Neighborhood Retail (sqft)	125,000	125,000	250,000
	Total (sqft)	**125,000**	**760,000**	**885,000**
Office (sqft)		0	150,000	150,000
Community Uses (sqft)		50,000	50,000	100,000
Research & Development (sqft)		2,500,000	0	2,500,000
Hotel (sqft)		0	150,000	150,000
Artist's Studios				
	1:1 Studio Renovation & Replacement (sqft)	225,000	0	225,000
	New Artist Center (sqft)	30,000	0	30,000
	Total (sqft)	**255,000**	**0**	**255,000**
Parks & Open Space				
	New City Parks (acres)	138	11.8	149.8
	New Sports Fields & Active Recreation (acres)	101.5	0	101.5
	New Open Space and Restored State Parkland (acres)	0	84	84
	Total (acres)	**239.5**	**95.8**	**335.3**
Football Stadium (seats)		69,000	0	69,000
Performance Venue (seats)		0	10,000	10,000

Source: Lennar, August 2009.

3 Results

This section provides the results of the water demand assessment. The results are provided by land use as well as by end use (fixture type). The overall results for the proposed project are summarized by Figure 1. Similar summaries for the two project variants are provided in Figure 2and Figure 3.

Table 4: Potable water demands for Proposed Project and Project Variants.

	Proposed Project Demand (MGD)	R&D Variant Demand (MGD)	Housing Variant Demand (MGD)
Historical Baseline	2.95	3.47	2.92
Adjusted to California Codes	2.46	2.92	2.44
Adjusted to San Francisco Green Building Ordinance	1.67	1.99	1.66

T**he above table in**dicates that the R&D Variant will have the highest potable water demands under the requirements of the SFGBO of 1.99 MGD.

Figures 1 through 3 provide the Proposed Project and Project Variant demands for the Historical Benchmark, the Adjusted to California Codes and the San Francisco Green Building Ordinance cases. They also illustrate the Sustainable Case trajectory defined by the step down line. The first five steps in the “sustainable Case” step-down graph are demand reduction strategies while the later five steps are achieved by utilizing alternative water supplies. Additional demand breakdowns by land use and end use are provided in Table 5 through Table 13 for the Proposed Project and Project Variants. Reclaimed water demands and sanitary flows by end use for the Proposed Project are provided in Table 14 through Table 19.

Please note that in all reported annual water demand and sanitary flow data in Table 5 through Table 19 are in million gallons per day (MGD) and are rounded to the nearest 0.01 millionth gallon. When reporting the calculations within the tables slight rounding errors on the order of 0.01 MGD may occur.

Figure 1: Water demand results summary step down graph- Proposed Project

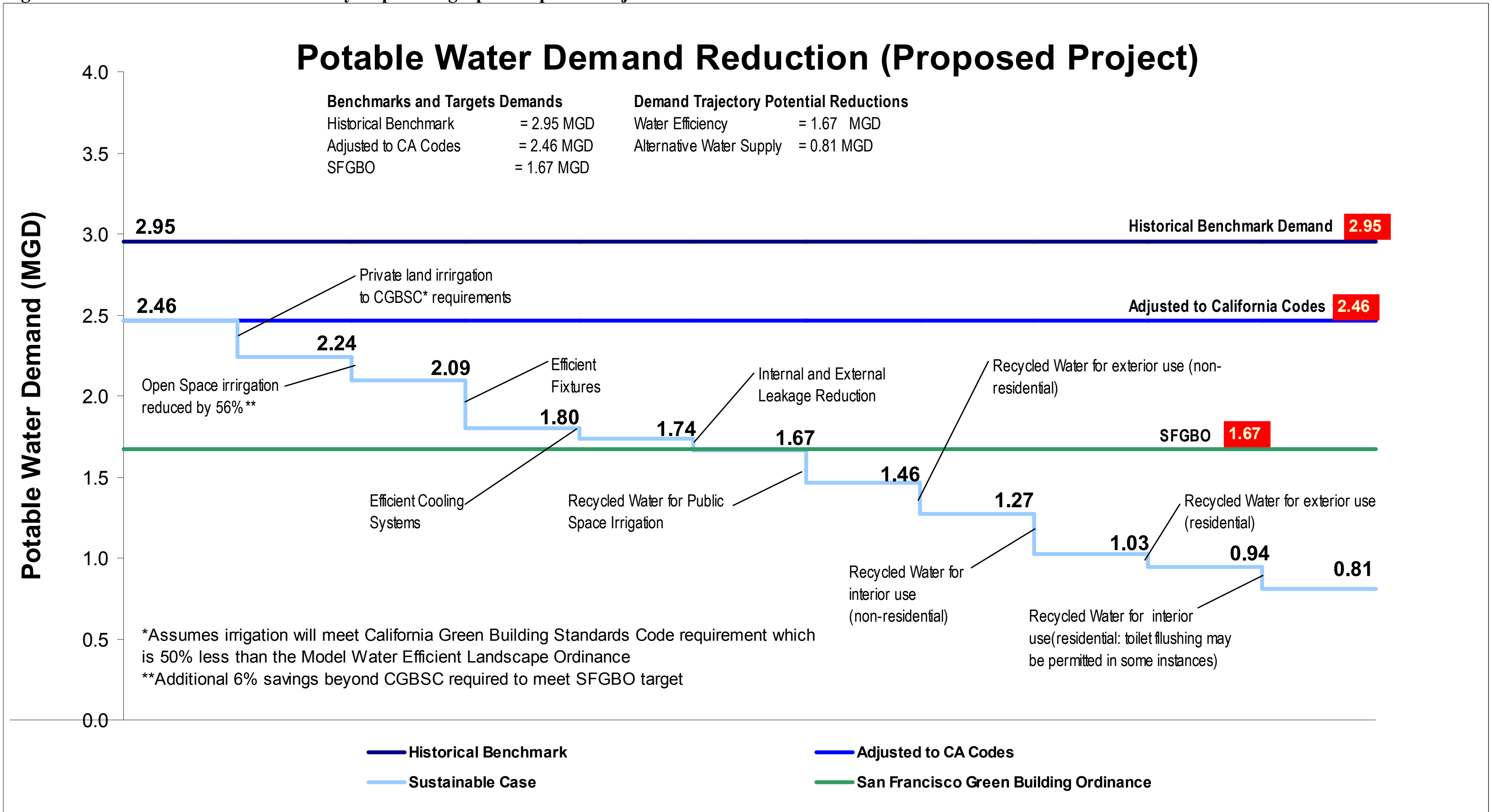

Figure 2: Water demand results summary (R&D Variant)

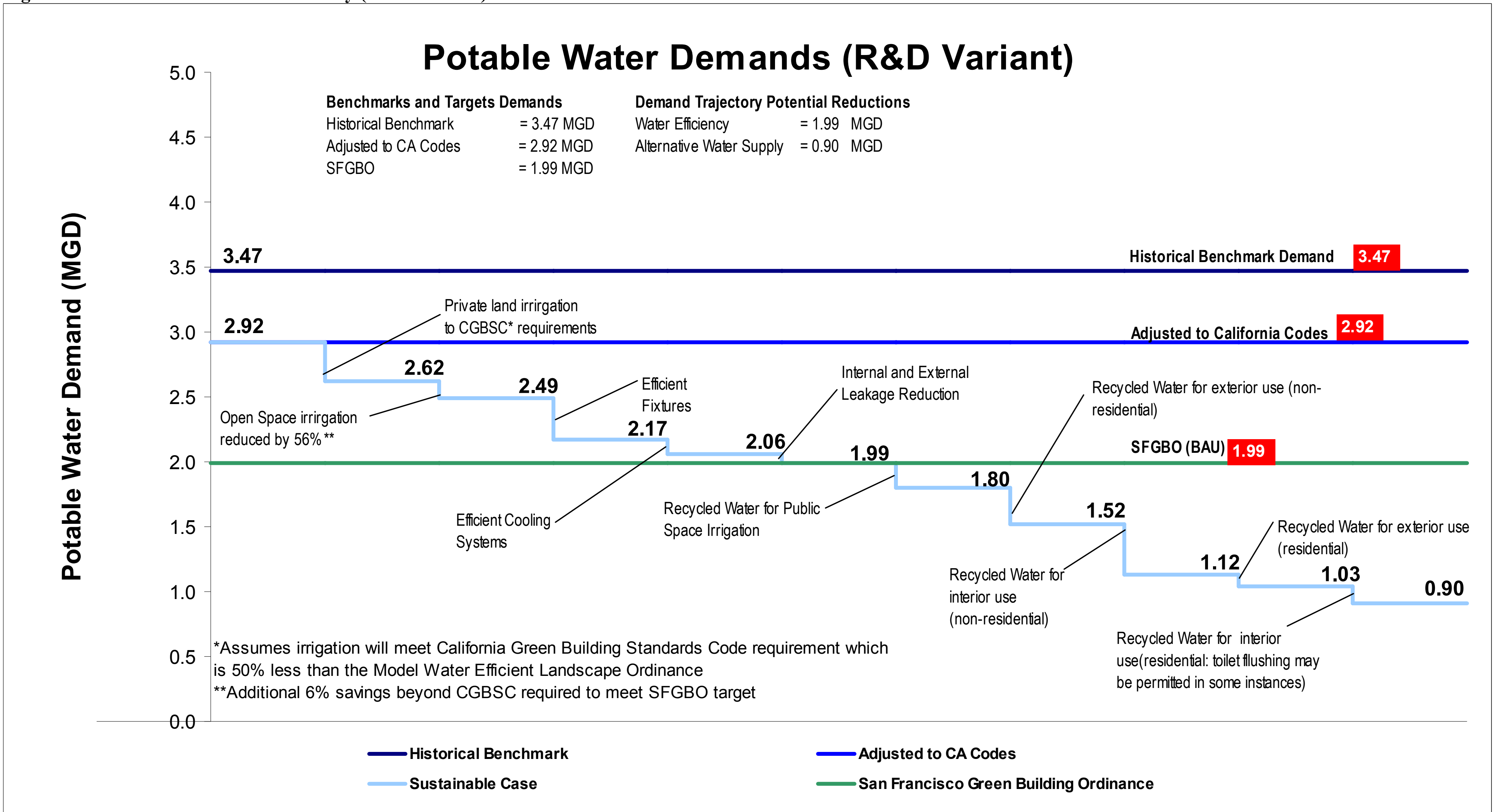

Figure 3: Water demand results summary (Housing Variant)

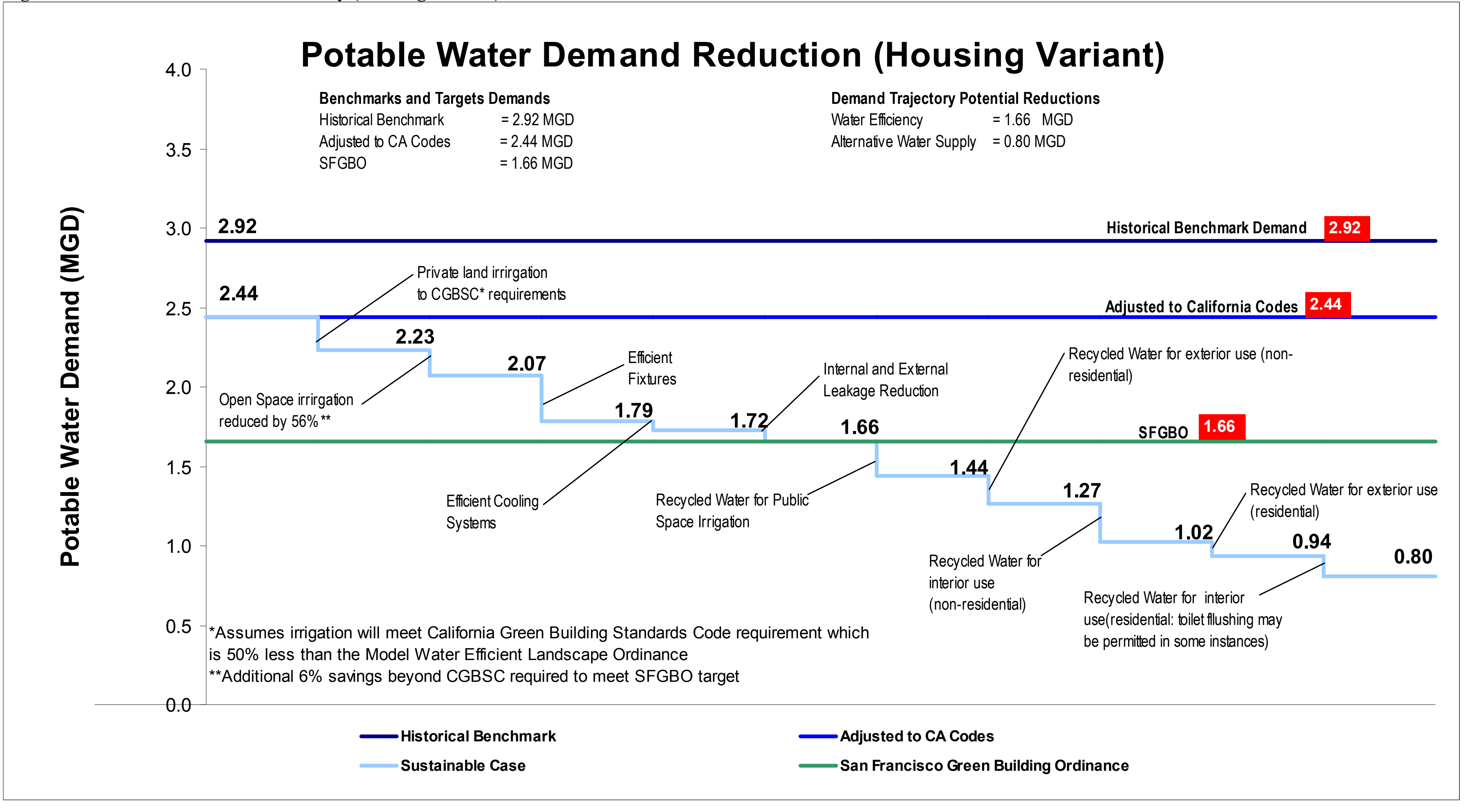

Table 5: Historical Benchmark demand by land use and end use – Proposed Project

Land Use	Historical Benchmark Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	1.13	0.38	1.52
Hotel	0.08	0.00	0.08
Office	0.07	0.03	0.10
Research and Development	0.00	0.61	0.61
Neighborhood Retail	0.03	0.03	0.06
Regional Retail	0.13	0.00	0.13
Community Uses	0.02	0.02	0.03
Football Stadium	0.00	0.05	0.05
Performance Venue	0.03	0.00	0.03
Total demand excluding Parks and Open Space	**1.49**	**1.11**	**2.60**
Parks and Open Space	0.10	0.25	0.35
Total Demand	**1.59**	**1.36**	**2.95**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.03	0.01	0.04
Toilets (med-high density Residential)	0.25	0.08	0.32
Toilets (all other uses)	0.05	0.10	0.15
Urinals	0.01	0.02	0.02
Laundry (low density residential)	0.02	0.01	0.03
Laundry (medium and high density residential)	0.20	0.06	0.26
Laundry (all other uses)	0.02	0.03	0.04
Shower	0.19	0.08	0.27
Bath	0.02	0.01	0.02
Faucets	0.19	0.10	0.29
Process Water	0.05	0.13	0.18
Dishwashers	0.03	0.03	0.06
Internal Leakage	0.16	0.09	0.25
Other domestic	0.03	0.01	0.04
Subtotal	**1.24**	**0.75**	**2.00**
Outdoor Uses			
Irrigation and landscaping	0.18	0.26	0.45
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.02	0.05	0.07
External Leakage	0.01	0.02	0.03
Subtotal	**0.24**	**0.36**	**0.60**
Total excluding Parks and Open Space	**1.49**	**1.11**	**2.60**
Parks and Open Space	0.10	0.25	0.35
Total Demand	**1.59**	**1.36**	**2.95**

Table 6: Adjusted to CA Codes demand by land use and end use- Proposed Project

Land Use	Adjusted to CA Codes Demand (MGD) Candlestick Point	Hunters Point	Total Development
Residential	0.87	0.29	1.16
Hotel	0.07	0.00	0.07
Office	0.06	0.03	0.09
Research and Development	0.00	0.54	0.54
Neighborhood Retail	0.02	0.02	0.05
Regional Retail	0.12	0.00	0.12
Community Uses	0.01	0.01	0.03
Football Stadium	0.00	0.04	0.04
Performance Venue	0.02	0.00	0.02
Total demand excluding Parks and Open Space	**1.18**	**0.94**	**2.11**
Parks and Open Space	0.10	0.25	0.35
Total Demand	**1.28**	**1.19**	**2.46**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.11	0.04	0.15
Toilets (all other uses)	0.02	0.05	0.07
Urinals	0.00	0.01	0.01
Laundry (low density residential)	0.02	0.01	0.02
Laundry (medium and high density residential)	0.14	0.05	0.19
Laundry (all other uses)	0.01	0.02	0.03
Shower	0.15	0.06	0.21
Bath	0.02	0.01	0.02
Faucets	0.16	0.09	0.25
Process Water	0.05	0.13	0.18
Dishwashers	0.03	0.03	0.06
Internal Leakage	0.16	0.09	0.25
Other domestic	0.03	0.01	0.04
Subtotal	**0.93**	**0.58**	**1.51**
Outdoor Uses			
Irrigation and landscaping	0.18	0.26	0.45
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.02	0.05	0.07
External Leakage	0.01	0.02	0.03
Subtotal	**0.24**	**0.36**	**0.60**
Total excluding Parks and Open Space	**1.18**	**0.94**	**2.11**
Parks and Open Space	0.10	0.25	0.35
Total Demand	**1.28**	**1.19**	**2.46**

Table 7: SFGBO demands by land use and end use – Proposed Project

Land Use	SFGBO Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.61	0.22	0.83
Hotel	0.05	0.00	0.05
Office	0.04	0.02	0.06
Research and Development	0.00	0.36	0.36
Neighborhood Retail	0.02	0.02	0.03
Regional Retail	0.08	0.00	0.08
Community Uses	0.01	0.01	0.02
Football Stadium	0.00	0.02	0.02
Performance Venue	0.01	0.00	0.01
Total demand excluding Parks and Open Space	**0.82**	**0.64**	**1.47**
Parks and Open Space	0.06	0.15	0.21
Total Demand	**0.88**	**0.79**	**1.67**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
	Indoor Uses		
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.09	0.03	0.12
Toilets (all other uses)	0.02	0.04	0.06
Urinals	0.00	0.00	0.00
Laundry (low density residential)	0.01	0.01	0.02
Laundry (medium and high density residential)	0.10	0.03	0.13
Laundry (all other uses)	0.01	0.01	0.02
Shower	0.10	0.04	0.15
Bath	0.02	0.01	0.02
Faucets	0.11	0.06	0.18
Process Water	0.04	0.10	0.14
Dishwashers	0.02	0.02	0.04
Internal Leakage	0.12	0.07	0.19
Other domestic	0.02	0.01	0.03
Subtotal	**0.68**	**0.42**	**1.11**
	Outdoor Uses		
Irrigation and landscaping	0.09	0.14	0.23
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.01	0.04	0.05
External Leakage	0.01	0.01	0.02
Subtotal	**0.14**	**0.22**	**0.36**
Total excluding Parks and Open Space	**0.82**	**0.64**	**1.47**
Parks and Open Space	0.06	0.15	0.21
Total Demand	**0.88**	**0.79**	**1.67**

Table 8: Historical Benchmark demand by land use and end use – R&D Variant

Land Use	Historical Benchmark Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	1.13	0.38	1.52
Hotel	0.08	0.00	0.08
Office	0.07	0.03	0.10
Research and Development	0.00	1.21	1.21
Neighborhood Retail	0.03	0.03	0.06
Regional Retail	0.13	0.00	0.13
Community Uses	0.02	0.02	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.03	0.00	0.03
Total demand excluding Parks and Open Space	**1.49**	**1.67**	**3.16**
Parks and Open Space	0.09	0.22	0.31
Total Demand	**1.58**	**1.89**	**3.47**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.03	0.01	0.04
Toilets (med-high density Residential)	0.25	0.08	0.32
Toilets (all other uses)	0.05	0.18	0.23
Urinals	0.01	0.02	0.03
Laundry (low density residential)	0.02	0.01	0.03
Laundry (medium and high density residential)	0.20	0.06	0.26
Laundry (all other uses)	0.02	0.05	0.07
Shower	0.19	0.09	0.28
Bath	0.02	0.01	0.02
Faucets	0.19	0.14	0.33
Process Water	0.05	0.24	0.29
Dishwashers	0.03	0.06	0.09
Internal Leakage	0.16	0.12	0.28
Other domestic	0.03	0.01	0.04
Subtotal	**1.24**	**1.08**	**2.32**
Outdoor Uses			
Irrigation and landscaping	0.18	0.43	0.61
Pools and Fountains	0.01	0.02	0.03
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.02	0.10	0.12
External Leakage	0.01	0.03	0.04
Subtotal	**0.24**	**0.59**	**0.83**
Total excluding Parks and Open Space	**1.49**	**1.67**	**3.16**
Parks and Open Space	0.09	0.22	0.31
Total Demand	**1.58**	**1.89**	**3.47**

Table 9: Adjusted to CA Codes demand by land use and end use- R&D Variant

Land Use	Adjusted to Codes BAU Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.87	0.29	1.16
Hotel	0.07	0.00	0.07
Office	0.06	0.03	0.09
Research and Development	0.00	1.08	1.08
Neighborhood Retail	0.02	0.02	0.05
Regional Retail	0.12	0.00	0.12
Community Uses	0.01	0.01	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.02	0.00	0.02
Total demand excluding Parks and Open Space	**1.18**	**1.43**	**2.61**
Parks and Open Space	0.09	0.22	0.31
Total Demand	**1.27**	**1.66**	**2.92**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.11	0.04	0.15
Toilets (all other uses)	0.02	0.08	0.11
Urinals	0.00	0.01	0.01
Laundry (low density residential)	0.02	0.01	0.02
Laundry (medium and high density residential)	0.14	0.05	0.19
Laundry (all other uses)	0.01	0.04	0.05
Shower	0.15	0.08	0.23
Bath	0.02	0.01	0.02
Faucets	0.16	0.12	0.29
Process Water	0.05	0.24	0.29
Dishwashers	0.03	0.05	0.08
Internal Leakage	0.16	0.12	0.28
Other domestic	0.03	0.01	0.04
Subtotal	**0.93**	**0.84**	**1.77**
Outdoor Uses			
Irrigation and landscaping	0.18	0.43	0.61
Pools and Fountains	0.01	0.02	0.03
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.02	0.10	0.12
External Leakage	0.01	0.03	0.04
Subtotal	**0.24**	**0.59**	**0.83**
Total excluding Parks and Open Space	**1.18**	**1.43**	**2.61**
Parks and Open Space	0.09	0.22	0.31
Total Demand	**1.27**	**1.66**	**2.92**

Table 10: SFGBO demands by land use and end use – R&D Variant

Land Use	SFGBO (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.61	0.22	0.83
Hotel	0.05	0.00	0.05
Office	0.04	0.02	0.06
Research and Development	0.00	0.71	0.71
Neighborhood Retail	0.02	0.02	0.03
Regional Retail	0.08	0.00	0.08
Community Uses	0.01	0.01	0.02
Football Stadium	0.00	0.00	0.00
Performance Venue	0.01	0.00	0.01
Total demand excluding Parks and Open Space	**0.82**	**0.97**	**1.80**
Parks and Open Space	0.05	0.14	0.19
Total Demand	**0.88**	**1.11**	**1.99**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
	Indoor Uses		
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.09	0.03	0.12
Toilets (all other uses)	0.02	0.07	0.08
Urinals	0.00	0.00	0.00
Laundry (low density residential)	0.01	0.01	0.02
Laundry (medium and high density residential)	0.10	0.03	0.13
Laundry (all other uses)	0.01	0.03	0.03
Shower	0.10	0.05	0.16
Bath	0.02	0.01	0.02
Faucets	0.11	0.08	0.20
Process Water	0.04	0.18	0.22
Dishwashers	0.02	0.03	0.05
Internal Leakage	0.12	0.09	0.21
Other domestic	0.02	0.01	0.03
Subtotal	**0.68**	**0.62**	**1.30**
	Outdoor Uses		
Irrigation and landscaping	0.09	0.22	0.32
Pools and Fountains	0.01	0.02	0.03
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.01	0.00	0.01
Cooling	0.01	0.08	0.09
External Leakage	0.01	0.02	0.03
Subtotal	**0.14**	**0.36**	**0.50**
Total excluding Parks and Open Space	**0.82**	**0.97**	**1.80**
Parks and Open Space	0.05	0.14	0.19
Total Demand	**0.88**	**1.11**	**1.99**

Table 11: Historical Benchmark demand by land use and end use – Housing Variant

Land Use	Historical Benchmark Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.94	0.58	1.52
Hotel	0.08	0.00	0.08
Office	0.07	0.04	0.10
Research and Development	0.00	0.61	0.61
Neighborhood Retail	0.03	0.03	0.06
Regional Retail	0.13	0.00	0.13
Community Uses	0.02	0.02	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.03	0.00	0.03
Total demand excluding Parks and Open Space	**1.29**	**1.26**	**2.55**
Parks and Open Space	0.11	0.26	0.37
Total Demand	**1.39**	**1.53**	**2.92**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.03	0.01	0.04
Toilets (med-high density Residential)	0.20	0.12	0.32
Toilets (all other uses)	0.05	0.10	0.15
Urinals	0.01	0.01	0.02
Laundry (low density residential)	0.02	0.01	0.03
Laundry (medium and high density residential)	0.16	0.10	0.26
Laundry (all other uses)	0.02	0.03	0.04
Shower	0.16	0.11	0.26
Bath	0.01	0.01	0.02
Faucets	0.16	0.13	0.29
Process Water	0.05	0.13	0.18
Dishwashers	0.03	0.03	0.06
Internal Leakage	0.14	0.11	0.25
Other domestic	0.03	0.01	0.04
Subtotal	**1.07**	**0.91**	**1.98**
Outdoor Uses			
Irrigation and landscaping	0.17	0.26	0.43
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.02	0.05	0.07
External Leakage	0.01	0.02	0.03
Subtotal	**0.22**	**0.35**	**0.57**
Total excluding Parks and Open Space	**1.29**	**1.26**	**2.55**
Parks and Open Space	0.11	0.26	0.37
Total Demand	**1.39**	**1.53**	**2.92**

Table 12: Adjusted to CA Codes demand by land use and end use- Housing Variant

Land Use	Adjusted to Codes BAU Demand (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.72	0.44	1.16
Hotel	0.07	0.00	0.07
Office	0.06	0.03	0.09
Research and Development	0.00	0.54	0.54
Neighborhood Retail	0.02	0.02	0.05
Regional Retail	0.12	0.00	0.12
Community Uses	0.01	0.01	0.03
Football Stadium	0.00	0.00	0.00
Performance Venue	0.02	0.00	0.02
Total demand excluding Parks and Open Space	**1.02**	**1.05**	**2.07**
Parks and Open Space	0.11	0.26	0.37
Total Demand	**1.13**	**1.31**	**2.44**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.09	0.06	0.15
Toilets (all other uses)	0.02	0.04	0.07
Urinals	0.00	0.00	0.01
Laundry (low density residential)	0.02	0.01	0.02
Laundry (medium and high density residential)	0.12	0.07	0.19
Laundry (all other uses)	0.01	0.02	0.03
Shower	0.13	0.09	0.21
Bath	0.01	0.01	0.02
Faucets	0.14	0.11	0.25
Process Water	0.05	0.13	0.18
Dishwashers	0.03	0.03	0.06
Internal Leakage	0.14	0.11	0.25
Other domestic	0.03	0.01	0.04
Subtotal	**0.80**	**0.70**	**1.50**
Outdoor Uses			
Irrigation and landscaping	0.17	0.26	0.43
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.02	0.05	0.07
External Leakage	0.01	0.02	0.03
Subtotal	**0.22**	**0.35**	**0.57**
Total excluding Parks and Open Space	**1.02**	**1.05**	**2.07**
Parks and Open Space	0.11	0.26	0.37
Total Demand	**1.13**	**1.31**	**2.44**

Table 13: SFGBO demands by land use and end use – Housing Variant

Land Use	SFGBO (MGD)		
	Candlestick Point	Hunters Point	Total Development
Residential	0.51	0.33	0.83
Hotel	0.05	0.00	0.05
Office	0.04	0.02	0.06
Research and Development	0.00	0.36	0.36
Neighborhood Retail	0.02	0.02	0.03
Regional Retail	0.08	0.00	0.08
Community Uses	0.01	0.01	0.02
Football Stadium	0.00	0.00	0.00
Performance Venue	0.01	0.00	0.01
Total demand excluding Parks and Open Space	**0.71**	**0.73**	**1.45**
Parks and Open Space	0.06	0.15	0.22
Total Demand	**0.77**	**0.88**	**1.66**
End Use	**Candlestick Point**	**Hunters Point**	**Total Development**
Indoor Uses			
Toilets (low density residential)	0.01	0.01	0.02
Toilets (med-high density Residential)	0.07	0.05	0.12
Toilets (all other uses)	0.02	0.03	0.05
Urinals	0.00	0.00	0.00
Laundry (low density residential)	0.01	0.01	0.02
Laundry (medium and high density residential)	0.08	0.05	0.13
Laundry (all other uses)	0.01	0.01	0.02
Shower	0.09	0.06	0.15
Bath	0.01	0.01	0.02
Faucets	0.10	0.08	0.18
Process Water	0.04	0.10	0.14
Dishwashers	0.02	0.02	0.04
Internal Leakage	0.10	0.08	0.19
Other domestic	0.02	0.01	0.03
Subtotal	**0.58**	**0.51**	**1.10**
Outdoor Uses			
Irrigation and landscaping	0.08	0.14	0.22
Pools and Fountains	0.01	0.01	0.02
Wash down of houses and facilities	0.01	0.01	0.02
Car Washing	0.00	0.00	0.01
Cooling	0.01	0.04	0.05
External Leakage	0.01	0.01	0.02
Subtotal	**0.13**	**0.22**	**0.34**
Total excluding Parks and Open Space	**0.71**	**0.73**	**1.45**
Parks and Open Space	0.06	0.15	0.22
Total Demand	**0.77**	**0.88**	**1.66**

Potential reclaimed water demands and sanitary flows by end use were estimated for the Proposed Project and Project Variants. These are provided below in Table 14 through Table 19.

Table 14: Reclaimed water demands by end use – Proposed Project

End Use	Reclaimed Water Demands by End Use (MGD)		
	Historical Benchmark	Adjusted to CA Codes	SFGBO
Toilets (residential)	0.36	0.17	0.14
Toilets (non-residential))	0.15	0.07	0.06
Urinals	0.02	0.01	0.00
Process Water (non-residential)	0.18	0.18	0.14
Irrigation and landscaping (residential)	0.12	0.12	0.06
Irrigation and Landscaping (non-residential)	0.33	0.33	0.16
Pools and Fountains (residential)	0.01	0.01	0.01
Pools and Fountains (non-residential)	0.01	0.01	0.01
Wash down (residential)	0.01	0.01	0.01
Wash down (non-residential)	0.01	0.01	0.01
Car Washing (residential)	0.01	0.01	0.01
Car Washing (non-residential)	0.00	0.00	0.00
Cooling (non-residential)	0.07	0.07	0.05
Total flow excluding Parks and Open Space	**1.29**	**1.00**	**0.66**
Parks and Open Space	0.35	0.35	0.21
Total Demand	**1.64**	**1.35**	**0.86**

Table 15: Sanitary flows by end use – Proposed Project

End Use	Sanitary Flows by End Use (MGD)		
	Historical Benchmark	Adjusted to CA Codes	SFGBO
Toilets	0.52	0.24	0.19
Urinals	0.02	0.01	0.00
Laundry	0.34	0.24	0.17
Shower	0.27	0.21	0.15
Bath	0.02	0.02	0.02
Faucets	0.29	0.25	0.18
Process Water	0.18	0.18	0.14
Dishwashers	0.06	0.06	0.04
Other domestic	0.04	0.04	0.03
Cooling (non res)	0.07	0.07	0.05
Total	**1.82**	**1.33**	**0.98**

Table 16: Reclaimed water demands by end use – R&D Variant

End Use	Reclaimed Water Demands by End Use (MGD)		
	Historical Benchmark	Adjusted to Codes BAU	SFGBO
Toilets (residential)	0.36	0.17	0.14
Toilets (non-residential))	0.23	0.11	0.08
Urinals	0.03	0.01	0.00
Process Water (non-residential)	0.29	0.29	0.22
Irrigation and landscaping (residential)	0.12	0.12	0.06
Irrigation and Landscaping (non-residential)	0.49	0.49	0.25
Pools and Fountains (residential)	0.01	0.01	0.01
Pools and Fountains (non-residential)	0.02	0.02	0.02
Wash down (residential)	0.01	0.01	0.01
Wash down (non-residential)	0.02	0.02	0.02
Car Washing (residential)	0.01	0.01	0.01
Car Washing (non-residential)	0.00	0.00	0.00
Cooling (non-residential)	0.12	0.12	0.09
Total flow excluding Parks and Open Space	**1.71**	**1.37**	**0.90**
Parks and Open Space	0.31	0.31	0.19
Total Demand	**2.02**	**1.68**	**1.09**

Table 17: Sanitary flows by end use – R&D Variant

End Use	Sanitary Flows by End Use (MGD)		
	Historical Benchmark	Adjusted to Codes BAU	SFGBO
Toilets	0.60	0.27	0.22
Urinals	0.03	0.01	0.00
Laundry	0.36	0.26	0.18
Shower	0.28	0.23	0.16
Bath	0.02	0.02	0.02
Faucets	0.33	0.29	0.20
Process Water	0.29	0.29	0.22
Dishwashers	0.09	0.08	0.05
Other domestic	0.04	0.04	0.03
Cooling (non res)	0.12	0.12	0.09
Total	**2.16**	**1.61**	**1.18**

Table 18: Reclaimed water demands by end use – Housing Variant

End Use	Reclaimed Water Demands by End Use (MGD)		
	Historical Benchmark	Adjusted to Codes BAU	SFGBO
Toilets (residential)	0.36	0.17	0.14
Toilets (non-residential))	0.15	0.07	0.05
Urinals	0.02	0.01	0.00
Process Water (non-residential)	0.18	0.18	0.14
Irrigation and landscaping (residential)	0.12	0.12	0.06
Irrigation and Landscaping (non-residential)	0.30	0.30	0.15
Pools and Fountains (residential)	0.01	0.01	0.01
Pools and Fountains (non-residential)	0.01	0.01	0.01
Wash down (residential)	0.01	0.01	0.01
Wash down (non-residential)	0.01	0.01	0.01
Car Washing (residential)	0.01	0.01	0.01
Car Washing (non-residential)	0.00	0.00	0.00
Cooling (non-residential)	0.07	0.07	0.05
Total flow excluding Parks and Open Space	**1.25**	**0.97**	**0.64**
Parks and Open Space	0.37	0.37	0.22
Total Demand	**1.62**	**1.33**	**0.86**

Table 19: Sanitary flows by end use – Housing Variant

End Use	Sanitary Flows by End Use (MGD)		
	Historical Benchmark	Adjusted to Codes BAU	SFGBO
Toilets	0.51	0.23	0.19
Urinals	0.02	0.01	0.00
Laundry	0.34	0.24	0.17
Shower	0.26	0.21	0.15
Bath	0.02	0.02	0.02
Faucets	0.29	0.25	0.18
Process Water	0.18	0.18	0.14
Dishwashers	0.06	0.06	0.04
Other domestic	0.04	0.04	0.03
Cooling (non res)	0.07	0.07	0.05
Total	**1.80**	**1.32**	**0.97**

4 Assumptions and References

This section describes assumptions used to:

1) Estimate historical baseline demands;
2) Distribute the historical baseline demands to specific end uses such as toilets, showers, irrigation etc…;
3) Adjust the historical baseline demands to current California code; and
4) Adjust the to-code demands to a sustainable case wherein efficiency measures such as efficient fixturesare applied. The efficiency measures applied in the Sustainable Case have been tailored to meet the demand reduction requirements of the SFGBO.

Table 20: Assumptions for estimating business as usual water demands by land use.

Assumptions Summary for BAU Demand Estimation						
Land use	**ID#**	**Description**	**Value**	**Unit**	**Reference or Assumption**	**Notes**
Residential						
	1	No. of residents per unit - low density	2.33	residents	Mundie & Associates, 2009	
	2	No. of residents per unit - medium density	2.33	residents	Mundie & Associates, 2009	
	3	No. of residents per unit - high density	2.33	residents	Mundie & Associates, 2009	
	4	Average consumption per capita	62	gallons per day (gp)	SFPUC, 2005	
	5	Average outdoor water use for single family residences	10	%	SFPUC, 2005	Note reference states that average demand is less than 10%
Regional Retail						
	1	Regional Retail jobs creation	350	Square feet (sqft)/job	Economic and Planning Systems, 2009.	
	2	Area of retail space per customer	22	sqft/customer	British Standards Institution. 2006	
	3	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	4	Sewage generation per visitor	2	gpd	EPA, 2002	EPA sites 2 gpd / parking spot. Sewage generation is only a fraction of overall consumption
	5	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	
	6	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer

Neighborhood Retail						
	1	Neighborhood retail jobs creation	270	sqft/job	Economic and Planning Systems, 2009.	
	2	Area of retail space per customer	22	sqft/customer	British Standards Institution. 2006	
	3	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	4	Water generation per visitor	2	gpd	EPA, 2002	EPA sites 2 gpd / parking spot. Sewage generation is only a fraction of overall consumption
	5	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	6	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Office						
Office estimates also include jobs created by residential development and artist studios						
	1	Office job creation	276	sqft/job	Economic and Planning Systems, 2009.	
	2	Residential jobs creation	25	Units/job	Economic and Planning Systems, 2009.	
	3	Water consumption per employee	85	gpd	URS, 2004.	
	4	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	
	5	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Community Uses						

	1	Community use job creation	276	sqft/job	Assumed similar to office	Actual Community uses are not finalized therefore community use water demands have been estimated in a similar manner as office land use.
	2	Water consumption per employee	85	gpd	Assumed similar to office	
	3	Average outdoor water use for non-residential customers	43	percent	Assumed similar to office	
	4	Ratio of sewage generation to total water consumed on site	57	percent	Assumed similar to office	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Research and Development						
	1	R&D jobs creation (office)	267	sqft/job	Economic and Planning Systems, 2009.	
	2	Sewage generation per employee for office R&D space	85	gpd	URS, 2004.	Sewage generation is only a fraction of overall consumption
	3	Average outdoor water use for non-residential customers for all R&D	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	4	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Assumption is conservative in that some water consumed indoors would not go to sanitary sewer
	5	Type of R&D Spaces	1/3,1/3, and 1/3	Fraction	Email from Lennar	From email correspondence with Lennar it has been assumed that 1/3 of the R&D space will be office, 1/3 will be wet laboratory, and the remaining 1/3 will be light production which is similar to industrial.
	6	Water Usage for Wet Laboratory R&D Space	0.547	gpsfd	2020 UC Berkeley LRDP Draft EIR (http://www.cp.berkeley.edu/LRDP_2020 draft.htm) - Table 4.13-1	Source provided by Winzler & Kelly. The report states that 0.32 is for sustainable lab case with efficient fixtures built in, and calculations were worked backwards to calculate the BAU.
	7	Water usage profile for	Varies	%	URS, 2004	The water usage profile for wet lab

		Wet Lab Space				space has been assumed to be the average of the commercial and industrial usage profile.
	8	Water Usage for Light Projection R&D Space	0.1	gpsfd	City of Los Angeles, L.A. CEQA Threshold Guide, 2006, Exhibit M.2. - 12 Sewage Generation Factors	
Hotel						
	1	Hotel job creation	700	sqft/job	Economic and Planning Systems, 2009	
	2	Average guest room size	600	sqft	Assumed	This includes the space for reception, kitchens and conference facilities
	3	Average guests / room	1.9	guests	Assumed	
	4	Sewage generation per guest	50	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	5	Sewage generation per employee	10	gpd	EPA, 2002	Sewage generation is only a fraction of overall consumption
	6	Average outdoor water use for non-residential customers	43	percent	URS, 2004.	Sewage generation is only a fraction of overall consumption
	7	Ratio of sewage generation to total water consumed on site	57	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Artist Studios						
	1	# of artists	252	people	Lennar, 2009	
	2	Consumption per artist	85	gpd	URS, 2004.	
Parks and Open Space						
	1	Total irrigation demand from landscape architect	350,180	gpd	Per landscape irrigation prepared by RHAA 7/31/08	
Football Stadium						
	1	Football games / year	10	Home games	Economic and Planning Systems, 2009.	
	2	Attendance at football games	69000	people	Economic and Planning Systems, 2009.	

	3	Other venues per year	20	Other venues	Economic and Planning Systems, 2009.	
	4	Attendance at other venues	37500	people	Lennar, 2009	
	5	Employees (football day)	3625	people	Stadium Staffing Numbers from SF 49ers, (Lennar, 2009)	Includes 2900 employees and 725 media personnel
	6	Employees (event day)	1,922	people	Pro-rated using football day attendance and employees on football days	
	7	Employee (nonevent days)	48	people	Stadium Staffing Numbers from SF 49ers, (Lennar, 2009)	
	8	No. of players/performers (event day)	200	people	Assumed	100 people per team for players and staff. Assumed same number for other event days
	9	Stadium average daily irrigation	23979	gpd	Marty Laporte, 2009	
	10	Sewage generation per seat and employee on game days	4	gpd	EPA, 2002.	EPA value is for "auditorium" Sewage generation is only a fraction of overall consumption
	11	Ratio of sewage generation to total water consumed on site	95	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
	12	Water consumption per permanent employee per day	85	gpd	URS, 2004.	
Performance Venue						
	1	Performance venue job creation	40	seats/job	Economic and Planning Systems, 2009.	
	2	Performance events per year	250	events	Economic and Planning Systems, 2009.	
	3	Employees - typical day	7	people	Assumed	Prorated to be similar to stadium
	4	Visitors per performance	10,000	people	Per CP/HPS development program, 2009	

	6	Water consumption per permanent employee per day	85	gpd	URS, 2004.	
	7	Sewage generation per seat and employee on event days	4	gpd	EPA, 2002.	EPA value is for "auditorium". Sewage generation is only a fraction of overall consumption
	12	Ratio of sewage generation to total water consumed on site	95	percent	Assumed based on URS 2004.	Required to convert sewage generation to total water consumption. Conservative in that a small portion of water consumed indoors would not go to sanitary sewer
Sanitary Sewer						
	1	Ratio of sewage generation to indoor water consumption	100%	Percent	Assumed per URS 2004 and conversations with W&K	
	2	Amount of Losses for Process Water	100%	Percent	Assumed per URS 2004 and conversations with W&K.	
	3	Amount of Losses for Cooling Tower (Non Res)	50%	Percent	Assumed per conversations with W&K	

Table 21: End use demand distributions by land use (URS 2004)

Table 3-3
End-Use Data - Initial Percentage Assumptions

End Use	Initial Percentages by Customer-Billing Category				
	Single-Family Residential	Multi-Family Residential	Commercial	Industrial	Institutional
Indoor Usage					
Toilets (indoor)	26.7%	26.7%	25%	23%	20%
Urinals (indoor)	NA	NA	0%	7%	0%
Laundry (indoor)	21.7%	21.7%	8%	5%	10%
Showers (indoor)	16.8%	16.8%	5%	5%	16%
Bath (indoor)	1.7%	1.7%	NA	NA	NA
Faucets (indoor)	15.7%	15.7%	10%	15%	19%
Process (indoor)	NA	NA	34%	30%	5%
Dishwashers (indoor)	1.4%	1.4%	8%	5%	15%
Internal Leakage (indoor)	13.7%	13.7%	10%	10%	15%
Other Domestic (indoor)	2.2%	2.2%	NA	NA	NA
Outdoor Usage					
Irrigation and Landscaping (outdoor)	80%	80%	75%	65%	70%
Pools and Fountains (outdoor)	5%	5%	2%	5%	5%
Wash-down of house/facilities (outdoor)	5%	5%	3%	0%	5%
Car Washing (outdoor)	5%	5%	0%	0%	0%
Cooling (outdoor)	0%	0%	15%	25%	15%
External Leakage (outdoor)	5%	5%	5%	5%	5%

NA – Not Applicable

Sources: AWWARF, Konen (1986), Behling et al. (1992)

Table 22: Assumed end use distributions for the stadium and performance venue

Indoor Usage	%	95%
Outdoor Usage	%	5%
Indoor Uses		
Toilets	%	30%
Urinals	%	30%
Laundry	%	0%
Shower	%	5%
Bath	%	0%
Faucets	%	15%
Process Water	%	10%
Dishwashers	%	0%
Internal Leakage	%	10%
Other domestic	%	0%
Outdoor Uses		
Irrigation and landscaping	%	20%
Pools and Fountains	%	0%
Wash down of houses and facilities	%	20%
Car Washing	%	0%
Cooling	%	50%
External Leakage	%	10%

Table 23: Assumptions used to adjust between water demand scenarios

	Historical Benchmark		Adjusted to CA Code		Sustainable Case		
	Max Flow or Quantity	Note / Reference	Max Flow or Quantity	Note / Reference	Max Flow or Quantity	Note/Reference	Unit
Plumbing Fixture							
Lavatory faucet, private	2.5		2.2	2007 California Plumbing Code	1.5	EPA WaterSense	gpm at 60 psi
Lavatory faucet, public, (metering)	0.25		0.25	2006 International Plumbing Code	0.2	CA Green Building Standard 2008	gallon per metering cycle
(not metering)	0.6		0.5	IPC	0.5	n.a.	gpm at 60 psi
Shower head	3.125	URS 2004*	2.5	2007 California Plumbing Code	1.75	EPA WaterSense	gpm at 80 psi
Sink faucet	2.5		2.2	Plumbing Code	1.5	EPA WaterSense	gpm at 60 psi
Urinal	2	URS 2004*	1	2007 California Plumbing Code	0.125	EPA Water Sense	gallon per flushing cycle
Water closet	3.5	URS 2004*	1.6	2007 California Plumbing Code	1.28	EPA Water Sense and CA Green Building Standard 2008	gallon per flushing cycle
Other Appliances							
Dishwasher (Residential)	7		6	US Department of Energy 2007	4	Energy Star	gallons/cy capacity
Dishwasher (Commercial)	1.75		1.46	Energy Star	0.92	Energy Star	gallons per rack
Laundry	36.4	URS 2004	26	(US Federal Standard by 2011)	18	n.a. (calc)	gal/load
Laundry	13.2		8.5	CA Green Building Standard 2008	6	EPA Water Sense	gal/load-cf (Water Factor)
Irrigation							
Private Lands		Based on water demand distribution		California Water Efficient Landscape Ordinance (CWELO)	50%	CA Green Building Standard 2008	Fractional reduction compared to CWELO
Public Open Space		Per Landscape Architect Estimates		Per Landscape Architect Estimates - Note that this is less than CWELO	50%	CA Green Building Standard 2008	Fractional reduction compared to CWELO

Table 24: Other assumptions used to adjust theCA code demand to the sustainable case

Improved Cooling Efficiency		
Total fraction demand reductiont due to building envelope improvement measures and improved cooling technologies	0.25	
Reduced Losses		
Fractional demand reduction due to new piping and metering	0.25	

5 References

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Appendix B
EMFAC and Pavley Adjustments

Table 5-3
Pavley Vehicle Standards[1]
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Model Year[2, 3]	Greenhouse Gas Emission Standards	
	PC/LDT1[4]	LDT2[5]
	[g CO_2e/mile]	[g CO_2e/mile]
2009	323	439
2010	301	420
2011	267	390
2012	233	361
2013	227	355
2014	222	350
2015	213	341
2016	205	332
2017	195	310
2018	185	285
2019	180	270
2020	175	265

Notes:

1. The Pavley vehicle standards (Pavley Standards) presented here are pursuant to Assembly Bill 1493 (AB 1493) which requires that the California Air Resources Board (ARB) develop and adopt regulations that achieve the maximum feasible and cost-effective reduction of GHG emissions from motor vehicles. The vehicle GHG emission standards are codified in Title 13 of the California Code of Regulations Section 1961.1(a)(1)(A). Post-2016 and fleet average standards are based on assumptions of fleet mix and further GHG emission reductions from an ARB technical assessment (2008).
2. The Pavley Standards would go into effect starting with model year 2009 vehicles.
3. The Pavley Standards developed by the ARB mandate emission reductions up to 2016. The standards presented for years 2017 through 2020 represent a commitment by the ARB to further reduce vehicle emissions for the 2020 goals of AB 32.
4. The Passenger Car (PC) and Light-Duty Trucks 1 (LDT1) category covers all passenger cars and light-duty trucks up to 3,750 lbs.
5. The Light-Duty Trucks 2 (LDT2) category covers light-duty trucks between 3,751 - 8,500 lbs and all medium-duty passenger vehicles.

Abbreviations:
AB = Assembly Bill
ARB = California Air Resources Board
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
LDT = light duty truck
PC = passenger car

Source:
California Air Resources Board (ARB). 2008. Comparison of Greenhouse Gas Reductions For the United States and Canada Under U.S. CAFE Standards and California Air Resources Board Greenhouse Gas Regulations.

Table 5-4
Running Emission Factor Assuming Pavley Vehicle Standards
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Vehicle type (all model years)	VMT (miles)	Percent of Vehicles	EMFAC	PAVLEY
			grams CO_2/mile[1]	
LDA	8,746,676	65%	414	268
LDT1	1,592,169	12%	520	316
LDT2	2,248,496	17%	528	402
MDV	739,112	5%	719	479
MCY	130,784	1%	171	171
Weighted Average[2]			465	310

Notes:

1. The running emission factor for a vehicle type is calculated from EMFAC's burden mode. This weighted average in each vehicle type represents the emission factor from the population of model year vehicles present in 2020.
2. The overall average running emission factor takes into account the percentage of vehicle types used in San Francisco based on the estimated VMT used in EMFAC for 2020.

```
Title    : SF 2011 and 2020_BURDEN
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:04:08
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area     : San Francisco County
I/M Stat : Enhanced Interim (2005)
Emissions: Tons Per Day
********************************************************************************
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*************************************************
,LDA-NCAT,LDA-CAT,LDA-DSL,LDA-TOT,LDT1-NCAT,LDT1-CAT,LDT1-DSL,LDT1-TOT,LDT2-
NCAT,LDT2-CAT,LDT2-DSL,LDT2-TOT,MDV-NCAT,MDV-CAT,MDV-DSL,MDV-TOT,LHDT1-
NCAT,LHDT1-CAT,LHDT1-DSL,LHDT1-TOT,LHDT2-NCAT,LHDT2-CAT,LHDT2-DSL,LHDT2-
TOT,MHDT-NCAT,MHDT-CAT,MHDT-DSL,MHDT-TOT,HHDT-NCAT,HHDT-CAT,HHDT-DSL,HHDT-
TOT,OBUS-NCAT,OBUS-CAT,OBUS-DSL,OBUS-TOT,SBUS-NCAT,SBUS-CAT,SBUS-DSL,SBUS-
TOT,UB-NCAT,UB-CAT,UB-DSL,UB-TOT,MH-NCAT,MH-CAT,MH-DSL,MH-TOT,MCY-NCAT,MCY-
CAT,MCY-DSL,MCY-TOT,ALL-TOT
Vehicles,     2176.,   265294.,      783.,   268252.,      422.,    46721.,
709.,    47853.,      209.,    67125.,      168.,    67501.,       56.,
19208.,       83.,    19347.,        5.,     1472.,      389.,     1866.,
8.,     1064.,      884.,     1956.,       91.,     1349.,     5225.,     6665.,
28.,      132.,      186.,      346.,        3.,      244.,      230.,
477.,        1.,       57.,      227.,      285.,       25.,       52.,
1027.,     1105.,       67.,      620.,       46.,      733.,     9216.,
5260.,        0.,    14476.,   430862.,
VMT/1000,       31.,     7829.,       16.,     7875.,        7.,     1406.,
18.,     1432.,        4.,     2079.,        4.,     2087.,        1.,
683.,        2.,      687.,        0.,       58.,       16.,       74.,
0.,       36.,       30.,       66.,        1.,       54.,      301.,      356.,
0.,        9.,       32.,       42.,        0.,       11.,       13.,       24.,
0.,        2.,        9.,       12.,        3.,        6.,      125.,      135.,
1.,        7.,        1.,        8.,       64.,       51.,        0.,      115.,
12911.,
Trips   ,     8582.,  1666520.,     4246.,  1679350.,     1687.,   291234.,
4287.,   297208.,      840.,   423410.,     1007.,   425258.,      237.,
121344.,      503.,   122084.,      163.,    48671.,     4896.,    53730.,
264.,    35181.,    11117.,    46561.,     4155.,    61594.,   146520.,
212269.,     1278.,     6038.,      940.,     8257.,      128.,    11160.,
6441.,    17729.,        3.,      229.,      909.,     1142.,      100.,
209.,     4110.,     4419.,        7.,       62.,        5.,       73.,
18431.,    10519.,        0.,    28950.,  2897030.,
Total Organic Gas Emissions
Run Exh ,      0.26,      0.75,      0.00,      1.01,      0.06,      0.19,
0.00,      0.25,      0.03,      0.25,      0.00,      0.28,      0.01,
0.12,      0.00,      0.13,      0.00,      0.02,      0.00,      0.02,
0.00,      0.02,      0.01,      0.04,      0.01,      0.04,      0.08,
0.12,      0.01,      0.04,      0.03,      0.07,      0.00,      0.01,
0.00,      0.01,      0.00,      0.00,      0.00,      0.01,      0.03,
0.08,      0.13,      0.24,      0.00,      0.01,      0.00,      0.01,
0.30,      0.12,      0.00,      0.42,      2.62,
Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.01,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
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0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.02,
Start Ex,     0.06,     0.90,     0.00,     0.96,     0.01,     0.18,
0.00,     0.19,     0.01,     0.26,     0.00,     0.26,     0.00,
0.11,     0.00,     0.11,     0.00,     0.03,     0.00,     0.03,
0.00,     0.03,     0.00,     0.04,     0.05,     0.12,     0.00,
0.17,     0.03,     0.03,     0.00,     0.06,     0.00,     0.02,
0.00,     0.02,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.06,     0.03,     0.00,     0.09,     1.94,
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Total Ex,     0.31,     1.65,     0.00,     1.97,     0.07,     0.37,
0.00,     0.45,     0.04,     0.51,     0.00,     0.55,     0.01,
0.23,     0.00,     0.24,     0.00,     0.05,     0.00,     0.06,
0.00,     0.06,     0.01,     0.08,     0.06,     0.16,     0.08,
0.30,     0.03,     0.07,     0.04,     0.14,     0.00,     0.03,
0.00,     0.03,     0.00,     0.00,     0.00,     0.01,     0.04,
0.08,     0.13,     0.24,     0.00,     0.01,     0.00,     0.01,
0.36,     0.15,     0.00,     0.51,     4.58,

Diurnal ,     0.01,     0.14,     0.00,     0.14,     0.00,     0.03,
0.00,     0.03,     0.00,     0.03,     0.00,     0.03,     0.00,
0.01,     0.00,     0.01,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.01,     0.01,     0.00,     0.02,     0.23,
Hot Soak,     0.03,     0.34,     0.00,     0.37,     0.01,     0.07,
0.00,     0.08,     0.00,     0.08,     0.00,     0.08,     0.00,
0.02,     0.00,     0.02,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.01,     0.01,     0.00,     0.01,     0.57,
Running ,     0.17,     0.90,     0.00,     1.06,     0.02,     0.37,
0.00,     0.39,     0.01,     0.39,     0.00,     0.40,     0.00,
0.09,     0.00,     0.10,     0.00,     0.03,     0.00,     0.03,
0.00,     0.06,     0.00,     0.06,     0.02,     0.04,     0.00,
0.06,     0.01,     0.01,     0.00,     0.01,     0.00,     0.01,
0.00,     0.01,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.05,     0.03,     0.00,     0.08,     2.20,
Resting ,     0.01,     0.10,     0.00,     0.11,     0.00,     0.02,
0.00,     0.02,     0.00,     0.02,     0.00,     0.02,     0.00,
0.01,     0.00,     0.01,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.00,     0.00,     0.00,     0.00,     0.00,     0.00,
0.00,     0.01,     0.00,     0.01,     0.17,
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Total   ,      0.52,      3.13,      0.00,      3.65,      0.10,      0.86,
0.00,      0.96,      0.05,      1.03,      0.00,      1.08,      0.02,
0.36,      0.00,      0.37,      0.00,      0.08,      0.00,      0.09,
0.01,      0.13,      0.01,      0.14,      0.08,      0.20,      0.08,
0.36,      0.04,      0.08,      0.04,      0.15,      0.00,      0.03,
0.00,      0.04,      0.00,      0.00,      0.00,      0.01,      0.04,
0.08,      0.13,      0.25,      0.00,      0.01,      0.00,      0.01,
0.43,      0.21,      0.00,      0.64,      7.75,
Carbon Monoxide Emissions
Run Exh ,      2.70,     17.50,      0.02,     20.21,      0.65,      4.82,
0.02,      5.49,      0.32,      6.17,      0.00,      6.49,      0.17,
2.37,      0.00,      2.53,      0.02,      0.18,      0.02,      0.22,
0.02,      0.28,      0.04,      0.35,      0.12,      0.57,      0.64,
1.33,      0.19,      0.44,      0.11,      0.75,      0.00,      0.12,
0.03,      0.15,      0.01,      0.02,      0.03,      0.05,      0.65,
0.32,      0.64,      1.60,      0.10,      0.17,      0.00,      0.27,
3.19,      0.67,      0.00,      3.85,     43.29,
Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.01,      0.00,      0.01,
0.00,      0.01,      0.00,      0.01,      0.00,      0.02,      0.01,
0.03,      0.00,      0.00,      0.02,      0.02,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.01,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.09,
Start Ex,      0.28,     10.03,      0.00,     10.31,      0.06,      2.34,
0.00,      2.40,      0.03,      3.11,      0.00,      3.14,      0.01,
1.17,      0.00,      1.18,      0.01,      0.34,      0.00,      0.35,
0.01,      0.44,      0.00,      0.45,      0.28,      1.89,      0.00,
2.17,      0.35,      0.48,      0.00,      0.83,      0.01,      0.33,
0.00,      0.34,      0.00,      0.01,      0.00,      0.01,      0.01,
0.03,      0.00,      0.04,      0.00,      0.00,      0.00,      0.00,
0.17,      0.17,      0.00,      0.34,     21.56,
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Total Ex,      2.98,     27.53,      0.02,     30.52,      0.70,      7.16,
0.02,      7.88,      0.34,      9.28,      0.00,      9.63,      0.18,
3.54,      0.00,      3.72,      0.02,      0.54,      0.02,      0.58,
0.04,      0.73,      0.04,      0.81,      0.40,      2.48,      0.66,
3.53,      0.54,      0.92,      0.13,      1.60,      0.01,      0.45,
0.03,      0.49,      0.01,      0.03,      0.03,      0.07,      0.66,
0.35,      0.64,      1.64,      0.10,      0.17,      0.00,      0.27,
3.35,      0.84,      0.00,      4.19,     64.94,
Oxides of Nitrogen Emissions
Run Exh ,      0.15,      1.73,      0.02,      1.90,      0.04,      0.48,
0.03,      0.55,      0.02,      0.88,      0.01,      0.91,      0.01,
0.40,      0.00,      0.41,      0.00,      0.03,      0.07,      0.10,
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0.00,      0.04,      0.19,      0.23,      0.00,      0.14,      2.59,
2.73,      0.01,      0.14,      0.40,      0.55,      0.00,      0.04,
0.11,      0.15,      0.00,      0.00,      0.12,      0.13,      0.01,
0.06,      3.07,      3.15,      0.00,      0.02,      0.01,      0.03,
0.09,      0.06,      0.00,      0.15,     10.99,
Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.04,
0.04,      0.00,      0.00,      0.04,      0.04,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.01,      0.01,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.10,
Start Ex,      0.01,      0.63,      0.00,      0.64,      0.00,      0.13,
0.00,      0.13,      0.00,      0.28,      0.00,      0.28,      0.00,
0.11,      0.00,      0.11,      0.00,      0.09,      0.00,      0.09,
0.00,      0.08,      0.00,      0.08,      0.00,      0.19,      0.00,
0.19,      0.01,      0.06,      0.00,      0.06,      0.00,      0.04,
0.00,      0.04,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.01,      0.00,      0.00,      0.01,      1.63,
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Total Ex,      0.16,      2.36,      0.02,      2.54,      0.04,      0.61,
0.03,      0.68,      0.02,      1.16,      0.01,      1.19,      0.01,
0.51,      0.00,      0.52,      0.00,      0.12,      0.07,      0.19,
0.00,      0.12,      0.19,      0.31,      0.01,      0.32,      2.63,
2.96,      0.01,      0.20,      0.44,      0.65,      0.00,      0.08,
0.11,      0.19,      0.00,      0.01,      0.13,      0.14,      0.01,
0.06,      3.07,      3.15,      0.00,      0.02,      0.01,      0.03,
0.10,      0.06,      0.00,      0.17,     12.72,
Carbon Dioxide Emissions (000)
Run Exh ,      0.02,      3.55,      0.01,      3.58,      0.00,      0.79,
0.01,      0.81,      0.00,      1.18,      0.00,      1.18,      0.00,
0.53,      0.00,      0.53,      0.00,      0.06,      0.01,      0.07,
0.00,      0.04,      0.02,      0.06,      0.00,      0.04,      0.50,
0.54,      0.00,      0.01,      0.06,      0.07,      0.00,      0.01,
0.02,      0.03,      0.00,      0.00,      0.02,      0.02,      0.00,
0.01,      0.39,      0.39,      0.00,      0.00,      0.00,      0.01,
0.01,      0.01,      0.00,      0.02,      7.31,
Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.01,
Start Ex,      0.00,      0.13,      0.00,      0.13,      0.00,      0.03,
0.00,      0.03,      0.00,      0.04,      0.00,      0.04,      0.00,
0.02,      0.00,      0.02,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
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0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.23,
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Total Ex,      0.02,      3.69,      0.01,      3.71,      0.01,      0.82,
0.01,      0.84,      0.00,      1.22,      0.00,      1.23,      0.00,
0.55,      0.00,      0.55,      0.00,      0.06,      0.01,      0.07,
0.00,      0.04,      0.02,      0.06,      0.00,      0.04,      0.50,
0.55,      0.00,      0.01,      0.07,      0.07,      0.00,      0.01,
0.02,      0.03,      0.00,      0.00,      0.02,      0.02,      0.00,
0.01,      0.39,      0.39,      0.00,      0.00,      0.00,      0.01,
0.01,      0.01,      0.00,      0.02,      7.55,
PM10 Emissions
Run Exh ,      0.00,      0.11,      0.00,      0.11,      0.00,      0.02,
0.00,      0.02,      0.00,      0.07,      0.00,      0.07,      0.00,
0.03,      0.00,      0.03,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.08,
0.08,      0.00,      0.00,      0.01,      0.01,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.05,      0.05,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.39,
Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,
Start Ex,      0.00,      0.01,      0.00,      0.01,      0.00,      0.00,
0.00,      0.00,      0.00,      0.01,      0.00,      0.01,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.02,
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Total Ex,      0.00,      0.12,      0.00,      0.12,      0.00,      0.03,
0.00,      0.03,      0.00,      0.07,      0.00,      0.07,      0.00,
0.03,      0.00,      0.03,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.08,
0.08,      0.00,      0.00,      0.02,      0.02,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.05,      0.05,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.41,
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TireWear, 0.00, 0.07, 0.00, 0.07, 0.00, 0.01,
0.00, 0.01, 0.00, 0.02, 0.00, 0.02, 0.00,
0.01, 0.00, 0.01, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.12,
BrakeWr , 0.00, 0.11, 0.00, 0.11, 0.00, 0.02,
0.00, 0.02, 0.00, 0.03, 0.00, 0.03, 0.00,
0.01, 0.00, 0.01, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
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Total , 0.00, 0.30, 0.00, 0.30, 0.00, 0.06,
0.00, 0.06, 0.00, 0.12, 0.00, 0.12, 0.00,
0.04, 0.00, 0.04, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.09,
0.09, 0.00, 0.00, 0.02, 0.02, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.05, 0.05, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.01, 0.70,
Lead , 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00,
SOx , 0.00, 0.04, 0.00, 0.04, 0.00, 0.01,
0.00, 0.01, 0.00, 0.01, 0.00, 0.01, 0.00,
0.01, 0.00, 0.01, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.01, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.07,
Fuel Consumption (000 gallons)
Gasoline, 2.75, 382.36, 0.00, 385.11, 0.65, 85.56,
0.00, 86.21, 0.32, 126.74, 0.00, 127.06, 0.13,
56.55, 0.00, 56.68, 0.02, 6.69, 0.00, 6.71,
0.03, 4.21, 0.00, 4.24, 0.23, 4.97, 0.00,
5.20, 0.15, 0.81, 0.00, 0.96, 0.01, 0.97,
0.00, 0.98, 0.00, 0.22, 0.00, 0.23, 0.38,
0.62, 0.00, 0.99, 0.06, 0.54, 0.00, 0.60,
1.72, 1.25, 0.00, 2.97, 677.94,
Diesel , 0.00, 0.00, 0.56, 0.56, 0.00, 0.00,
0.64, 0.64, 0.00, 0.00, 0.15, 0.15, 0.00,

0.00, 0.08, 0.08, 0.00, 0.00, 0.83, 0.83,
0.00, 0.00, 1.60, 1.60, 0.00, 0.00, 45.08,
45.08, 0.00, 0.00, 6.04, 6.04, 0.00, 0.00,
1.93, 1.93, 0.00, 0.00, 1.44, 1.44, 0.00,
0.00, 34.84, 34.84, 0.00, 0.00, 0.08, 0.08,
0.00, 0.00, 0.00, 0.00, 93.28,
Title : SF 2011 and 2020_BURDEN
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:04:08
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season : Annual
Area : San Francisco County
I/M Stat : Enhanced Interim (2005)
Emissions: Tons Per Day
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,LDA-NCAT,LDA-CAT,LDA-DSL,LDA-TOT,LDT1-NCAT,LDT1-CAT,LDT1-DSL,LDT1-TOT,LDT2-
NCAT,LDT2-CAT,LDT2-DSL,LDT2-TOT,MDV-NCAT,MDV-CAT,MDV-DSL,MDV-TOT,LHDT1-
NCAT,LHDT1-CAT,LHDT1-DSL,LHDT1-TOT,LHDT2-NCAT,LHDT2-CAT,LHDT2-DSL,LHDT2-
TOT,MHDT-NCAT,MHDT-CAT,MHDT-DSL,MHDT-TOT,HHDT-NCAT,HHDT-CAT,HHDT-DSL,HHDT-
TOT,OBUS-NCAT,OBUS-CAT,OBUS-DSL,OBUS-TOT,SBUS-NCAT,SBUS-CAT,SBUS-DSL,SBUS-
TOT,UB-NCAT,UB-CAT,UB-DSL,UB-TOT,MH-NCAT,MH-CAT,MH-DSL,MH-TOT,MCY-NCAT,MCY-
CAT,MCY-DSL,MCY-TOT,ALL-TOT
Vehicles, 31., 299925., 255., 300211., 12., 52939.,
346., 53296., 8., 75433., 75., 75516., 10.,
21638., 46., 21694., 0., 1655., 430., 2085.,
0., 1193., 954., 2147., 11., 1522., 5984., 7517.,
0., 71., 224., 295., 0., 193., 334., 528.,
0., 55., 257., 311., 0., 88., 1117., 1205.,
2., 724., 72., 798., 6375., 9754., 0., 16129.,
481735.,
VMT/1000, 0., 8742., 5., 8747., 0., 1584.,
8., 1592., 0., 2247., 2., 2248., 0., 738.,
1., 739., 0., 61., 16., 77., 0., 44.,
34., 78., 0., 66., 320., 386., 0.,
3., 40., 43., 0., 7., 19., 26., 0.,
2., 11., 13., 0., 11., 136., 147., 0.,
8., 1., 9., 47., 84., 0., 131., 14235.,
Trips , 117., 1865720., 1311., 1867150., 45., 324932.,
1923., 326899., 32., 466133., 418., 466583., 39.,
133684., 258., 133980., 11., 54740., 5404., 60155.,
7., 39436., 12006., 51449., 501., 69523., 167791., 237815.,
18., 3238., 1135., 4390., 0., 8828., 9379.,
18207., 0., 218., 1028., 1246., 0., 352.,
4469., 4821., 0., 72., 7., 80., 12749.,
19507., 0., 32255., 3205030.,
Total Organic Gas Emissions
Run Exh , 0.00, 0.38, 0.00, 0.38, 0.00, 0.10,
0.00, 0.11, 0.00, 0.16, 0.00, 0.16, 0.00,
0.08, 0.00, 0.08, 0.00, 0.01, 0.00, 0.01,
0.00, 0.01, 0.01, 0.02, 0.00, 0.01, 0.05,
0.07, 0.00, 0.01, 0.02, 0.03, 0.00, 0.00,
0.00, 0.01, 0.00, 0.00, 0.01, 0.01, 0.00,
0.15, 0.14, 0.29, 0.00, 0.00, 0.00, 0.00,
0.22, 0.20, 0.00, 0.42, 1.58,

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Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.01,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.02,
Start Ex,      0.00,      0.38,      0.00,      0.38,      0.00,      0.09,
0.00,      0.09,      0.00,      0.15,      0.00,      0.15,      0.00,
0.07,      0.00,      0.07,      0.00,      0.02,      0.00,      0.02,
0.00,      0.02,      0.00,      0.02,      0.01,      0.07,      0.00,
0.08,      0.00,      0.02,      0.00,      0.02,      0.00,      0.01,
0.00,      0.01,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.04,      0.05,      0.00,      0.09,      0.93,
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Total Ex,      0.00,      0.75,      0.00,      0.76,      0.00,      0.19,
0.00,      0.20,      0.00,      0.31,      0.00,      0.31,      0.00,
0.14,      0.00,      0.15,      0.00,      0.03,      0.00,      0.04,
0.00,      0.03,      0.01,      0.04,      0.01,      0.09,      0.06,
0.15,      0.00,      0.03,      0.02,      0.05,      0.00,      0.02,
0.00,      0.02,      0.00,      0.00,      0.01,      0.01,      0.00,
0.15,      0.14,      0.29,      0.00,      0.00,      0.00,      0.00,
0.26,      0.25,      0.00,      0.51,      2.52,

Diurnal ,      0.00,      0.10,      0.00,      0.10,      0.00,      0.03,
0.00,      0.03,      0.00,      0.03,      0.00,      0.03,      0.00,
0.01,      0.00,      0.01,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.02,      0.00,      0.02,      0.19,
Hot Soak,      0.00,      0.29,      0.00,      0.29,      0.00,      0.07,
0.00,      0.07,      0.00,      0.09,      0.00,      0.09,      0.00,
0.03,      0.00,      0.03,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.01,      0.00,      0.01,      0.50,
Running ,      0.00,      0.62,      0.00,      0.62,      0.00,      0.30,
0.00,      0.30,      0.00,      0.37,      0.00,      0.37,      0.00,
0.10,      0.00,      0.10,      0.00,      0.04,      0.00,      0.04,
0.00,      0.04,      0.00,      0.04,      0.00,      0.03,      0.00,
0.03,      0.00,      0.00,      0.00,      0.00,      0.00,      0.01,
0.00,      0.01,      0.00,      0.00,      0.00,      0.00,      0.00,
0.01,      0.00,      0.01,      0.00,      0.00,      0.00,      0.00,
0.01,      0.04,      0.00,      0.05,      1.57,
Resting ,      0.00,      0.09,      0.00,      0.09,      0.00,      0.02,
0.00,      0.02,      0.00,      0.03,      0.00,      0.03,      0.00,
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0.01,      0.00,      0.01,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.01,      0.00,      0.01,      0.17,
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Total   ,      0.00,      1.86,      0.00,      1.87,      0.00,      0.61,
0.00,      0.61,      0.00,      0.84,      0.00,      0.84,      0.00,
0.29,      0.00,      0.29,      0.00,      0.07,      0.00,      0.08,
0.00,      0.08,      0.01,      0.08,      0.01,      0.12,      0.06,
0.19,      0.00,      0.03,      0.02,      0.06,      0.00,      0.02,
0.00,      0.02,      0.00,      0.00,      0.01,      0.01,      0.00,
0.16,      0.14,      0.30,      0.00,      0.00,      0.00,      0.00,
0.27,      0.33,      0.00,      0.60,      4.95,
Carbon Monoxide Emissions
Run Exh ,      0.02,      9.57,      0.00,      9.59,      0.01,      2.79,
0.01,      2.81,      0.01,      4.20,      0.00,      4.21,      0.04,
1.73,      0.00,      1.77,      0.00,      0.09,      0.02,      0.11,
0.00,      0.09,      0.04,      0.13,      0.01,      0.18,      0.53,
0.72,      0.00,      0.13,      0.07,      0.21,      0.00,      0.05,
0.03,      0.07,      0.00,      0.02,      0.04,      0.06,      0.00,
0.50,      0.53,      1.03,      0.00,      0.05,      0.00,      0.06,
2.23,      0.91,      0.00,      3.14,     23.89,
Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.01,      0.00,      0.01,
0.00,      0.01,      0.00,      0.01,      0.00,      0.02,      0.02,
0.04,      0.00,      0.00,      0.02,      0.02,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.01,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.09,
Start Ex,      0.00,      4.86,      0.00,      4.86,      0.00,      1.26,
0.00,      1.27,      0.00,      1.98,      0.00,      1.98,      0.00,
0.80,      0.00,      0.80,      0.00,      0.25,      0.00,      0.25,
0.00,      0.24,      0.00,      0.24,      0.03,      1.17,      0.00,
1.20,      0.00,      0.25,      0.00,      0.26,      0.00,      0.22,
0.00,      0.22,      0.00,      0.01,      0.00,      0.01,      0.00,
0.05,      0.00,      0.05,      0.00,      0.00,      0.00,      0.00,
0.11,      0.29,      0.00,      0.41,     11.54,
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Total Ex,      0.02,     14.42,      0.00,     14.44,      0.01,      4.06,
0.01,      4.08,      0.01,      6.18,      0.00,      6.19,      0.04,
2.53,      0.00,      2.57,      0.00,      0.36,      0.02,      0.38,
0.00,      0.33,      0.04,      0.37,      0.04,      1.37,      0.54,
1.96,      0.01,      0.39,      0.09,      0.48,      0.00,      0.27,
0.03,      0.30,      0.00,      0.03,      0.04,      0.07,      0.00,
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0.55,      0.53,      1.08,      0.00,      0.06,      0.00,      0.06,
2.34,      1.20,      0.00,      3.54,     35.52,
Oxides of Nitrogen Emissions
Run Exh ,      0.00,      0.83,      0.01,      0.84,      0.00,      0.26,
0.01,      0.27,      0.00,      0.49,      0.00,      0.49,      0.00,
0.22,      0.00,      0.23,      0.00,      0.02,      0.04,      0.06,
0.00,      0.02,      0.10,      0.12,      0.00,      0.05,      1.08,
1.13,      0.00,      0.04,      0.18,      0.22,      0.00,      0.02,
0.05,      0.07,      0.00,      0.01,      0.12,      0.12,      0.00,
0.11,      2.73,      2.85,      0.00,      0.01,      0.00,      0.01,
0.07,      0.10,      0.00,      0.17,      6.58,
Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.05,
0.05,      0.00,      0.00,      0.05,      0.05,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.01,      0.01,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.12,
Start Ex,      0.00,      0.27,      0.00,      0.27,      0.00,      0.07,
0.00,      0.07,      0.00,      0.16,      0.00,      0.16,      0.00,
0.07,      0.00,      0.07,      0.00,      0.09,      0.00,      0.09,
0.00,      0.07,      0.00,      0.07,      0.00,      0.12,      0.00,
0.12,      0.00,      0.03,      0.00,      0.03,      0.00,      0.03,
0.00,      0.03,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.01,      0.01,      0.00,      0.01,      0.91,
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Total Ex,      0.00,      1.10,      0.01,      1.11,      0.00,      0.32,
0.01,      0.34,      0.00,      0.65,      0.00,      0.65,      0.00,
0.29,      0.00,      0.29,      0.00,      0.11,      0.05,      0.16,
0.00,      0.08,      0.10,      0.19,      0.00,      0.17,      1.13,
1.30,      0.00,      0.07,      0.23,      0.30,      0.00,      0.04,
0.05,      0.10,      0.00,      0.01,      0.13,      0.14,      0.00,
0.12,      2.73,      2.85,      0.00,      0.01,      0.00,      0.01,
0.07,      0.10,      0.00,      0.18,      7.61,
Carbon Dioxide Emissions (000)
Run Exh ,      0.00,      3.99,      0.00,      3.99,      0.00,      0.91,
0.00,      0.91,      0.00,      1.31,      0.00,      1.31,      0.00,
0.58,      0.00,      0.59,      0.00,      0.07,      0.01,      0.07,
0.00,      0.05,      0.02,      0.07,      0.00,      0.05,      0.53,
0.58,      0.00,      0.00,      0.08,      0.08,      0.00,      0.01,
0.03,      0.04,      0.00,      0.00,      0.02,      0.02,      0.00,
0.01,      0.40,      0.41,      0.00,      0.01,      0.00,      0.01,
0.01,      0.02,      0.00,      0.02,      8.10,
Idle Exh,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
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0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.01,
Start Ex, 0.00, 0.15, 0.00, 0.15, 0.00, 0.03,
0.00, 0.03, 0.00, 0.05, 0.00, 0.05, 0.00,
0.02, 0.00, 0.02, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.25,
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Total Ex, 0.00, 4.14, 0.00, 4.14, 0.00, 0.94,
0.00, 0.94, 0.00, 1.35, 0.00, 1.35, 0.00,
0.60, 0.00, 0.60, 0.00, 0.07, 0.01, 0.08,
0.00, 0.05, 0.02, 0.07, 0.00, 0.05, 0.53,
0.59, 0.00, 0.00, 0.08, 0.09, 0.00, 0.01,
0.03, 0.04, 0.00, 0.00, 0.02, 0.02, 0.00,
0.01, 0.40, 0.41, 0.00, 0.01, 0.00, 0.01,
0.01, 0.02, 0.00, 0.03, 8.36,
PM10 Emissions
Run Exh , 0.00, 0.13, 0.00, 0.13, 0.00, 0.03,
0.00, 0.03, 0.00, 0.08, 0.00, 0.08, 0.00,
0.03, 0.00, 0.03, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.05,
0.06, 0.00, 0.00, 0.01, 0.01, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.01, 0.01, 0.00,
0.00, 0.04, 0.04, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.39,
Idle Exh, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00,
Start Ex, 0.00, 0.01, 0.00, 0.01, 0.00, 0.00,
0.00, 0.00, 0.00, 0.01, 0.00, 0.01, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00,
0.00, 0.00, 0.00, 0.00, 0.02,
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Total Ex, 0.00, 0.14, 0.00, 0.14, 0.00, 0.03,
0.00, 0.03, 0.00, 0.09, 0.00, 0.09, 0.00,

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0.04,      0.00,      0.04,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.05,
0.06,      0.00,      0.00,      0.01,      0.01,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.01,      0.01,      0.00,
0.00,      0.04,      0.04,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.42,

TireWear,      0.00,      0.08,      0.00,      0.08,      0.00,      0.01,
0.00,      0.01,      0.00,      0.02,      0.00,      0.02,      0.00,
0.01,      0.00,      0.01,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.01,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.13,
BrakeWr ,      0.00,      0.12,      0.00,      0.12,      0.00,      0.02,
0.00,      0.02,      0.00,      0.03,      0.00,      0.03,      0.00,
0.01,      0.00,      0.01,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.01,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.20,
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Total   ,      0.00,      0.34,      0.00,      0.34,      0.00,      0.07,
0.00,      0.07,      0.00,      0.14,      0.00,      0.14,      0.00,
0.05,      0.00,      0.05,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.06,
0.07,      0.00,      0.00,      0.01,      0.01,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.01,      0.01,      0.00,
0.00,      0.04,      0.04,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.75,
Lead    ,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,
SOx     ,      0.00,      0.04,      0.00,      0.04,      0.00,      0.01,
0.00,      0.01,      0.00,      0.01,      0.00,      0.01,      0.00,
0.01,      0.00,      0.01,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.01,
0.01,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.00,      0.00,      0.00,
0.00,      0.00,      0.00,      0.00,      0.08,
Fuel Consumption (000 gallons)
Gasoline,      0.03,    426.12,      0.00,    426.15,      0.02,     97.10,
0.00,     97.12,      0.01,    139.66,      0.00,    139.67,      0.03,
62.19,      0.00,     62.22,      0.00,      7.04,      0.00,      7.04,
```

0.00, 5.07, 0.00, 5.07, 0.03, 5.67, 0.00,
5.70, 0.00, 0.26, 0.00, 0.26, 0.00, 0.63,
0.00, 0.63, 0.00, 0.21, 0.00, 0.21, 0.00,
1.04, 0.00, 1.04, 0.00, 0.64, 0.00, 0.65,
1.26, 2.14, 0.00, 3.40, 749.15,
Diesel , 0.00, 0.00, 0.16, 0.16, 0.00, 0.00,
0.27, 0.27, 0.00, 0.00, 0.06, 0.06, 0.00,
0.00, 0.04, 0.04, 0.00, 0.00, 0.81, 0.81,
0.00, 0.00, 1.79, 1.79, 0.00, 0.00, 48.07,
48.07, 0.00, 0.00, 7.49, 7.49, 0.00, 0.00,
2.91, 2.91, 0.00, 0.00, 1.63, 1.63, 0.00,
0.00, 35.90, 35.90, 0.00, 0.00, 0.12, 0.12,
0.00, 0.00, 0.00, 0.00, 99.24,

Title   : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area   : San Francisco
****
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Total Organic Gases,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000, 23.300,
24.256,   3.612, 19.799, 23.300, 23.890,   3.612, 14.654, 23.300, 24.180,
3.612,   6.797,   0.000,   0.000, 12.951,   9.949, 23.300, 23.553,   3.612,
12.687,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
23.300, 23.456,   3.612,   7.651,   0.000,   0.000,   0.000,   0.000,   0.209,
0.317,   3.080,   0.438,
5, 20.833,   0.302,   0.502,   0.383, 20.968,   0.404,   0.274,   0.509,
20.484,   0.378,   0.282,   0.414, 26.650,   0.544,   0.245,   0.586, 22.053,
0.790,   0.487,   0.754, 22.053,   1.792,   0.784,   1.380, 33.073,   2.957,
0.640,   1.058, 94.927, 21.669,   8.969, 12.497, 33.073,   3.061,   0.615,
1.756, 40.707, 42.209,   2.685,   5.414,   6.821,   4.214,   0.000,   5.671,
33.073,   1.671,   0.943,   1.181, 33.073,   3.934,   0.404,   5.931, 13.793,
0.417,   1.550,   0.584,
10, 14.839,   0.201,   0.394,   0.259, 14.935,   0.274,   0.215,   0.349,
14.591,   0.253,   0.221,   0.278, 18.981,   0.362,   0.193,   0.393, 14.454,
0.518,   0.382,   0.508, 14.454,   1.175,   0.615,   0.951, 21.675,   1.939,
0.502,   0.764, 62.204, 14.202,   4.983,   7.503, 21.675,   2.008,   0.483,
1.195, 26.677, 27.660,   1.948,   3.723,   5.390,   3.120,   0.000,   4.388,
21.675,   1.096,   0.741,   0.872, 21.675,   2.580,   0.318,   3.892, 10.023,
0.279,   1.065,   0.399,
15, 11.061,   0.141,   0.316,   0.184, 11.132,   0.195,   0.172,   0.251,
10.876,   0.178,   0.178,   0.197, 14.148,   0.254,   0.155,   0.277,   9.876,
0.354,   0.307,   0.357,   9.876,   0.804,   0.494,   0.684, 14.808,   1.326,
0.403,   0.573, 42.489,   9.704,   2.387,   4.345, 14.808,   1.374,   0.387,
0.849, 18.224, 18.894,   1.463,   2.667,   4.456,   2.436,   0.000,   3.565,
14.808,   0.750,   0.594,   0.666, 14.808,   1.764,   0.255,   2.663,   7.647,
0.197,   0.741,   0.286,
20,   8.628,   0.104,   0.259,   0.138,   8.684,   0.145,   0.141,   0.190,
8.484,   0.132,   0.146,   0.147, 11.035,   0.187,   0.127,   0.205,   7.034,

```
0.252,   0.252,   0.262,   7.034,   0.573,   0.405,   0.512,  10.546,   0.945,
0.331,   0.445,  30.254,   6.912,   1.285,   2.775,  10.546,   0.980,   0.318,
0.628,  12.978,  13.454,   1.138,   1.989,   3.855,   2.004,   0.000,   3.039,
10.546,   0.535,   0.488,   0.526,  10.546,   1.258,   0.209,   1.899,   6.126,
0.145,   0.556,   0.215,
   25,   7.043,   0.080,   0.217,   0.108,   7.088,   0.113,   0.119,   0.150,
6.925,   0.102,   0.122,   0.114,   9.007,   0.145,   0.106,   0.159,   5.223,
0.187,   0.211,   0.200,   5.223,   0.426,   0.340,   0.398,   7.829,   0.703,
0.277,   0.357,  22.455,   5.132,   1.048,   2.132,   7.829,   0.729,   0.267,
0.484,   9.634,   9.986,   0.917,   1.543,   3.490,   1.738,   0.000,   2.717,
7.829,   0.398,   0.409,   0.428,   7.829,   0.935,   0.175,   1.412,   5.154,
0.113,   0.457,   0.172,
   30,   6.016,   0.065,   0.186,   0.089,   6.054,   0.093,   0.102,   0.124,
5.915,   0.083,   0.105,   0.093,   7.693,   0.118,   0.091,   0.130,   4.043,
0.145,   0.181,   0.158,   4.043,   0.330,   0.291,   0.321,   6.059,   0.544,
0.238,   0.296,  17.373,   3.972,   0.857,   1.686,   6.059,   0.565,   0.229,
0.387,   7.455,   7.726,   0.765,   1.246,   3.306,   1.588,   0.000,   2.548,
6.059,   0.309,   0.351,   0.358,   6.059,   0.724,   0.150,   1.095,   4.553,
0.092,   0.385,   0.144,
   35,   5.377,   0.056,   0.163,   0.077,   5.411,   0.080,   0.089,   0.107,
5.287,   0.071,   0.092,   0.080,   6.876,   0.100,   0.080,   0.111,   3.262,
0.117,   0.159,   0.130,   3.262,   0.266,   0.255,   0.268,   4.887,   0.440,
0.208,   0.253,  14.010,   3.205,   0.714,   1.378,   4.887,   0.457,   0.200,
0.321,   6.013,   6.231,   0.661,   1.046,   3.277,   1.527,   0.000,   2.505,
4.887,   0.250,   0.307,   0.309,   4.887,   0.585,   0.132,   0.884,   4.224,
0.078,   0.333,   0.126,
   40,   5.028,   0.050,   0.146,   0.070,   5.061,   0.071,   0.080,   0.097,
4.944,   0.063,   0.082,   0.072,   6.430,   0.089,   0.072,   0.100,   2.743,
0.099,   0.142,   0.112,   2.743,   0.224,   0.229,   0.232,   4.110,   0.370,
0.187,   0.222,  11.778,   2.696,   0.619,   1.173,   4.110,   0.385,   0.179,
0.276,   5.056,   5.239,   0.592,   0.913,   3.398,   1.547,   0.000,   2.581,
4.110,   0.210,   0.275,   0.273,   4.110,   0.492,   0.118,   0.744,   4.115,
0.070,   0.297,   0.116,
   45,   4.921,   0.047,   0.134,   0.066,   4.952,   0.067,   0.073,   0.092,
4.838,   0.059,   0.075,   0.068,   6.292,   0.084,   0.066,   0.094,   2.405,
0.086,   0.130,   0.099,   2.405,   0.197,   0.209,   0.208,   3.602,   0.325,
0.171,   0.201,  10.320,   2.363,   0.570,   1.049,   3.602,   0.338,   0.164,
0.246,   4.431,   4.590,   0.549,   0.828,   3.686,   1.650,   0.000,   2.788,
3.602,   0.185,   0.252,   0.248,   3.602,   0.432,   0.108,   0.653,   4.210,
0.066,   0.273,   0.112,
   50,   5.039,   0.046,   0.125,   0.066,   5.071,   0.066,   0.068,   0.092,
4.954,   0.058,   0.070,   0.067,   6.443,   0.082,   0.061,   0.093,   2.197,
0.079,   0.122,   0.091,   2.197,   0.180,   0.196,   0.192,   3.290,   0.297,
0.160,   0.187,   9.426,   2.159,   0.569,   0.995,   3.290,   0.309,   0.154,
0.227,   4.048,   4.193,   0.527,   0.780,   4.185,   1.853,   0.000,   3.156,
3.290,   0.169,   0.236,   0.231,   3.290,   0.395,   0.101,   0.597,   4.523,
0.066,   0.261,   0.113,
   55,   5.398,   0.048,   0.120,   0.069,   5.433,   0.067,   0.065,   0.095,
5.308,   0.060,   0.067,   0.069,   6.903,   0.085,   0.059,   0.096,   2.092,
0.075,   0.117,   0.087,   2.092,   0.171,   0.188,   0.183,   3.133,   0.283,
0.153,   0.179,   8.973,   2.055,   0.615,   1.004,   3.133,   0.294,   0.147,
0.217,   3.854,   3.992,   0.523,   0.763,   4.972,   2.190,   0.000,   3.744,
3.133,   0.161,   0.226,   0.221,   3.133,   0.376,   0.097,   0.568,   5.103,
0.068,   0.258,   0.121,
   60,   6.052,   0.052,   0.117,   0.075,   6.091,   0.073,   0.064,   0.104,
5.950,   0.065,   0.066,   0.075,   7.739,   0.092,   0.057,   0.105,   2.076,
0.075,   0.114,   0.086,   2.076,   0.170,   0.184,   0.181,   3.109,   0.280,
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0.150,   0.176,   8.904,   2.040,   0.708,   1.071,   3.109,   0.292,   0.144,
0.214,   3.824,   3.961,   0.539,   0.775,   6.180,   2.726,   0.000,   4.656,
3.109,   0.160,   0.221,   0.217,   3.109,   0.373,   0.095,   0.564,   6.045,
0.075,   0.264,   0.135,
   65,   7.099,   0.059,   0.117,   0.087,   7.145,   0.082,   0.064,   0.119,
6.980,   0.074,   0.066,   0.086,   9.079,   0.105,   0.057,   0.120,   2.147,
0.077,   0.114,   0.088,   2.147,   0.176,   0.184,   0.184,   3.215,   0.290,
0.150,   0.177,   9.209,   2.109,   0.848,   1.197,   3.215,   0.302,   0.144,
0.218,   3.955,   4.097,   0.574,   0.817,   8.039,   3.573,   0.000,   6.068,
3.215,   0.165,   0.221,   0.218,   3.215,   0.386,   0.095,   0.583,   7.519,
0.087,   0.280,   0.160,
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Pollutant Name: Carbon Monoxide,,,,Temperature: 57F,,Relative Humidity: 65%

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Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LH
D1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,
OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,AL
L,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000, 136.515,
139.843,  26.300, 115.330, 136.515, 138.570,  26.300,  87.433, 136.515, 139.579,
26.300,  43.844,   0.000,   0.000,  49.102,  37.722, 136.515, 137.395,  26.300,
76.860,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
136.515, 137.058,  26.300,  48.845,   0.000,   0.000,   0.000,   0.000,   1.224,
1.833,  19.868,   2.620,
    5, 176.881,   3.289,   2.864,   3.971, 176.652,   5.260,   2.323,   6.116,
173.656,   4.397,   2.350,   4.694, 293.828,   5.086,   2.247,   5.557, 391.137,
7.412,   3.032,   7.000, 391.137,  18.274,   3.709,  12.511, 586.706,  34.325,
7.042,  12.354,2334.887, 183.966,  13.028,  69.819, 586.706,  35.700,   6.829,
20.470, 667.140, 151.610,  18.503,  39.498,  48.466,  15.108,   0.000,  33.747,
586.706,  19.538,   9.353,  13.045, 586.706,  83.799,   4.819, 117.053, 129.661,
4.345,   9.326,   5.657,
   10, 128.922,   2.919,   1.975,   3.413, 128.756,   4.570,   1.601,   5.179,
126.572,   3.893,   1.620,   4.106, 214.162,   4.518,   1.550,   4.856, 260.228,
4.931,   2.090,   4.673, 260.228,  12.158,   2.558,   8.364, 390.342,  22.837,
4.855,   8.364,1553.427, 122.395,   9.264,  46.910, 390.342,  23.751,   4.709,
13.709, 443.856, 100.868,  11.645,  25.660,  39.749,  13.285,   0.000,  28.072,
390.342,  12.999,   6.449,   8.859, 390.342,  55.752,   3.323,  77.884,  94.941,
3.723,   6.201,   4.627,
   15,  98.958,   2.617,   1.425,   2.993,  98.830,   4.031,   1.156,   4.488,
97.154,   3.482,   1.169,   3.644, 164.386,   4.052,   1.118,   4.309, 182.922,
3.466,   1.508,   3.293, 182.922,   8.546,   1.846,   5.901, 274.383,  16.053,
3.504,   5.956,1091.948,  86.035,   6.511,  32.974, 274.383,  16.696,   3.398,
9.685, 311.999,  70.903,   7.783,  17.663,  34.331,  11.949,   0.000,  24.455,
274.383,   9.137,   4.654,   6.323, 274.383,  39.190,   2.398,  54.751,  73.642,
3.259,   4.328,   3.920,
   20,  79.992,   2.365,   1.076,   2.668,  79.889,   3.601,   0.873,   3.964,
78.534,   3.142,   0.883,   3.272, 132.881,   3.665,   0.844,   3.870, 135.851,
2.574,   1.139,   2.450, 135.851,   6.347,   1.394,   4.393, 203.777,  11.922,
2.646,   4.460, 810.960,  63.896,   4.869,  24.515, 203.777,  12.399,   2.566,
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7.216, 231.713,  52.658,   5.523,  12.878,  31.227,  10.969,   0.000,  22.288,
203.777,   6.786,   3.515,   4.743, 203.777,  29.105,   1.811,  40.664,  60.503,
2.900,   3.188,   3.415,
   25,  68.096,   2.154,   0.851,   2.411,  68.008,   3.254,   0.690,   3.559,
66.854,   2.858,   0.698,   2.968, 113.119,   3.339,   0.667,   3.512, 106.597,
2.020,   0.900,   1.924, 106.597,   4.980,   1.102,   3.451, 159.896,   9.355,
2.091,   3.513, 636.331,  50.137,   4.175,  19.508, 159.896,   9.729,   2.028,
5.670, 181.817,  41.319,   4.162,   9.945,  29.912,  10.272,   0.000,  21.246,
159.896,   5.325,   2.778,   3.737, 159.896,  22.838,   1.431,  31.909,  52.646,
2.615,   2.493,   3.046,
   30,  61.047,   1.976,   0.704,   2.206,  60.968,   2.972,   0.571,   3.243,
59.934,   2.619,   0.577,   2.717, 101.410,   3.063,   0.552,   3.218,  88.372,
1.675,   0.745,   1.594,  88.372,   4.129,   0.911,   2.860, 132.559,   7.755,
1.730,   2.909, 527.537,  41.565,   3.595,  16.275, 132.559,   8.066,   1.678,
4.698, 150.731,  34.254,   3.330,   8.133,  30.174,   9.825,   0.000,  21.195,
132.559,   4.414,   2.298,   3.094, 132.559,  18.933,   1.184,  26.453,  48.510,
2.386,   2.045,   2.773,
   35,  57.635,   1.824,   0.609,   2.041,  57.561,   2.741,   0.494,   2.998,
56.585,   2.417,   0.500,   2.509,  95.742,   2.828,   0.478,   2.974,  77.406,
1.467,   0.645,   1.395,  77.406,   3.616,   0.789,   2.501, 116.108,   6.793,
1.498,   2.533, 462.071,  36.407,   3.128,  14.239, 116.108,   7.065,   1.452,
4.106, 132.026,  30.003,   2.829,   7.042,  32.055,   9.626,   0.000,  22.158,
116.108,   3.867,   1.989,   2.692, 116.108,  16.584,   1.025,  23.169,  47.329,
2.199,   1.760,   2.573,
   40,  57.304,   1.696,   0.552,   1.912,  57.230,   2.555,   0.447,   2.813,
56.259,   2.246,   0.453,   2.339,  95.192,   2.628,   0.433,   2.775,  71.633,
1.357,   0.584,   1.288,  71.633,   3.347,   0.715,   2.307, 107.450,   6.286,
1.357,   2.319, 427.613,  33.692,   2.774,  13.085, 107.450,   6.538,   1.316,
3.784, 122.181,  27.766,   2.552,   6.456,  35.862,   9.707,   0.000,  24.321,
107.450,   3.578,   1.802,   2.460, 107.450,  15.347,   0.929,  21.440,  48.889,
2.047,   1.588,   2.436,
   45,  60.001,   1.588,   0.523,   1.815,  59.923,   2.408,   0.424,   2.682,
58.907,   2.104,   0.429,   2.201,  99.671,   2.460,   0.411,   2.614,  70.039,
1.327,   0.554,   1.256,  70.039,   3.272,   0.678,   2.246, 105.059,   6.147,
1.286,   2.234, 418.099,  32.942,   2.533,  12.656, 105.059,   6.393,   1.247,
3.679, 119.462,  27.148,   2.445,   6.265,  42.252,  10.144,   0.000,  28.085,
105.059,   3.499,   1.709,   2.363, 105.059,  15.006,   0.880,  20.961,  53.459,
1.927,   1.506,   2.358,
   50,  66.161,   1.498,   0.519,   1.751,  66.075,   2.297,   0.421,   2.605,
64.955,   1.986,   0.426,   2.095, 109.904,   2.320,   0.407,   2.492,  72.353,
1.371,   0.550,   1.292,  72.353,   3.380,   0.672,   2.308, 108.530,   6.350,
1.276,   2.263, 431.911,  34.030,   2.405,  12.912, 108.530,   6.604,   1.238,
3.773, 123.408,  28.045,   2.487,   6.436,  52.425,  11.079,   0.000,  34.181,
108.530,   3.614,   1.695,   2.385, 108.530,  15.501,   0.874,  21.651,  61.870,
1.836,   1.502,   2.345,
   55,  76.829,   1.427,   0.539,   1.722,  76.729,   2.223,   0.437,   2.589,
75.428,   1.893,   0.442,   2.021, 127.625,   2.208,   0.423,   2.411,  78.969,
1.496,   0.571,   1.404,  78.969,   3.689,   0.698,   2.503, 118.454,   6.930,
1.326,   2.413, 471.406,  37.142,   2.391,  13.913, 118.454,   7.208,   1.285,
4.082, 134.693,  30.610,   2.686,   6.998,  68.502,  12.767,   0.000,  43.909,
118.454,   3.945,   1.761,   2.532, 118.454,  16.919,   0.907,  23.628,  75.776,
1.776,   1.576,   2.413,
   60,  93.955,   1.375,   0.586,   1.738,  93.833,   2.191,   0.475,   2.647,
92.242,   1.826,   0.481,   1.984, 156.074,   2.125,   0.460,   2.376,  91.064,
1.726,   0.620,   1.611,  91.064,   4.254,   0.759,   2.865, 136.596,   7.992,
1.441,   2.708, 543.603,  42.830,   2.490,  15.838, 136.596,   8.312,   1.397,
4.661, 155.322,  35.298,   3.080,   8.054,  94.263,  15.668,   0.000,  59.583,
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136.596,   4.549,   1.913,   2.827, 136.596, 19.510,   0.986, 27.243, 98.197,
1.752,   1.743,   2.593,
   65, 121.001,   1.345,   0.667,   1.815, 120.844,   2.210,   0.540,   2.807,
118.795,   1.788,   0.547,   1.993, 201.002,   2.075,   0.523,   2.401, 110.948,
2.102,   0.705,   1.952, 110.948,   5.183,   0.863,   3.463, 166.422,   9.737,
1.639,   3.201, 662.300, 52.183,   2.703, 19.042, 166.422, 10.126,   1.589,
5.617, 189.237, 43.005,   3.751,   9.811, 136.601, 20.623,   0.000, 85.425,
166.422,   5.542,   2.176,   3.321, 166.422, 23.770,   1.121, 33.186, 134.617,
1.774,   2.029,   2.944,

Pollutant Name: Oxides of Nitrogen,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   1.436,
1.499, 75.051, 17.375,   1.436,   1.475, 75.051, 34.984,   1.436,   1.494,
75.051, 63.655,   0.000,   0.000, 112.860, 86.704,   1.436,   1.453, 75.051,
41.556,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
1.436,   1.446, 75.051, 60.067,   0.000,   0.000,   0.000,   0.000,   0.013,
0.020, 55.152,   2.442,
    5,   3.453,   0.326,   2.058,   0.341,   3.376,   0.517,   2.087,   0.552,
3.330,   0.638,   2.083,   0.645,   5.137,   0.884,   2.094,   0.895,   1.780,
0.419,   6.354,   1.702,   1.780,   0.925,   8.851,   4.537,   2.670,   1.778,
11.581, 10.064, 16.398, 10.460, 29.597, 25.209,   2.670,   2.764, 11.067,
7.288,   3.327,   7.345, 43.815, 41.174,   1.070,   1.275,   0.000,   1.161,
2.670,   1.560, 19.229, 15.635,   2.670,   1.999, 14.654,   2.906,   2.122,
0.459, 18.853,   1.282,
   10,   3.631,   0.281,   1.707,   0.297,   3.550,   0.440,   1.731,   0.473,
3.501,   0.547,   1.728,   0.555,   5.401,   0.756,   1.737,   0.767,   1.870,
0.440,   5.272,   1.485,   1.870,   0.971,   7.344,   3.876,   2.805,   1.868,
9.608,   8.411, 17.229, 10.990, 20.658, 18.467,   2.805,   2.904,   9.182,
6.325,   3.496,   7.718, 33.515, 31.615,   1.122,   1.193,   0.000,   1.153,
2.805,   1.639, 15.953, 13.043,   2.805,   2.100, 12.158,   2.834,   2.229,
0.400, 14.795,   1.049,
   15,   3.813,   0.248,   1.468,   0.265,   3.727,   0.384,   1.488,   0.416,
3.676,   0.480,   1.485,   0.487,   5.672,   0.661,   1.493,   0.672,   1.960,
0.462,   4.532,   1.342,   1.960,   1.018,   6.313,   3.432,   2.940,   1.958,
8.259,   7.285, 18.060, 11.520, 15.050, 14.284,   2.940,   3.044,   7.893,
5.686,   3.665,   8.090, 26.950, 25.531,   1.174,   1.134,   0.000,   1.157,
2.940,   1.718, 13.714, 11.275,   2.940,   2.202, 10.451,   2.816,   2.338,
0.357, 12.154,   0.893,
   20,   3.998,   0.223,   1.307,   0.240,   3.909,   0.343,   1.326,   0.374,
3.855,   0.429,   1.323,   0.437,   5.948,   0.591,   1.330,   0.602,   2.050,
0.483,   4.037,   1.252,   2.050,   1.065,   5.623,   3.143,   3.076,   2.048,
7.356,   6.536, 18.892, 12.050, 12.756, 12.647,   3.076,   3.184,   7.030,
5.280,   3.833,   8.462, 22.782, 21.676,   1.228,   1.093,   0.000,   1.168,

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0.325,  10.520,   0.792,
   25,   4.187,   0.205,   1.206,   0.223,   4.093,   0.314,   1.223,   0.345,
4.037,   0.392,   1.221,   0.401,   6.229,   0.539,   1.227,   0.551,   2.141,
0.504,   3.725,   1.202,   2.141,   1.112,   5.189,   2.971,   3.211,   2.138,
6.789,   6.071,  19.723,  12.580,  12.073,  12.247,   3.211,   3.324,   6.488,
5.048,   4.002,   8.835,  20.246,  19.339,   1.282,   1.068,   0.000,   1.188,
3.211,   1.876,  11.273,   9.364,   3.211,   2.404,   8.591,   2.885,   2.562,
0.302,   9.554,   0.729,
   30,   4.379,   0.192,   1.154,   0.210,   4.281,   0.293,   1.170,   0.325,
4.222,   0.366,   1.168,   0.374,   6.514,   0.503,   1.174,   0.515,   2.231,
0.525,   3.562,   1.183,   2.231,   1.159,   4.962,   2.893,   3.346,   2.228,
6.492,   5.834,  20.554,  13.111,  11.521,  11.949,   3.346,   3.464,   6.204,
4.957,   4.171,   9.207,  18.915,  18.123,   1.337,   1.057,   0.000,   1.213,
3.346,   1.955,  10.780,   8.987,   3.346,   2.506,   8.215,   2.956,   2.676,
0.286,   9.036,   0.692,
   35,   4.574,   0.183,   1.143,   0.202,   4.471,   0.280,   1.159,   0.313,
4.410,   0.348,   1.157,   0.357,   6.803,   0.478,   1.163,   0.491,   2.321,
0.547,   3.529,   1.193,   2.321,   1.206,   4.916,   2.898,   3.481,   2.318,
6.432,   5.797,  21.385,  13.641,  11.100,  11.751,   3.481,   3.604,   6.147,
4.990,   4.339,   9.579,  18.578,  17.830,   1.392,   1.058,   0.000,   1.244,
3.481,   2.034,  10.680,   8.924,   3.481,   2.607,   8.139,   3.048,   2.792,
0.276,   8.899,   0.677,
   40,   4.770,   0.177,   1.173,   0.197,   4.663,   0.273,   1.190,   0.307,
4.600,   0.338,   1.188,   0.347,   7.096,   0.464,   1.194,   0.478,   2.411,
0.568,   3.623,   1.230,   2.411,   1.253,   5.047,   2.983,   3.617,   2.408,
6.603,   5.956,  22.217,  14.171,  10.811,  11.654,   3.617,   3.745,   6.311,
5.143,   4.508,   9.952,  19.182,  18.413,   1.447,   1.071,   0.000,   1.281,
3.617,   2.113,  10.964,   9.167,   3.617,   2.708,   8.356,   3.160,   2.908,
0.271,   9.127,   0.683,
   45,   4.969,   0.175,   1.248,   0.196,   4.857,   0.272,   1.266,   0.308,
4.791,   0.334,   1.263,   0.344,   7.391,   0.460,   1.270,   0.474,   2.501,
0.589,   3.854,   1.297,   2.501,   1.299,   5.369,   3.156,   3.752,   2.499,
7.024,   6.325,  23.048,  14.701,  10.652,  11.657,   3.752,   3.885,   6.713,
5.425,   4.676,  10.324,  20.821,  19.959,   1.503,   1.096,   0.000,   1.323,
3.752,   2.192,  11.663,   9.739,   3.752,   2.810,   8.888,   3.293,   3.026,
0.270,   9.752,   0.711,
   50,   5.169,   0.177,   1.376,   0.199,   5.053,   0.276,   1.395,   0.316,
4.984,   0.338,   1.392,   0.348,   7.688,   0.465,   1.400,   0.481,   2.592,
0.610,   4.248,   1.398,   2.592,   1.346,   5.917,   3.431,   3.887,   2.589,
7.741,   6.946,  23.879,  15.231,  10.625,  11.762,   3.887,   4.025,   7.398,
5.863,   4.845,  10.696,  23.759,  22.714,   1.558,   1.133,   0.000,   1.371,
3.887,   2.271,  12.854,  10.704,   3.887,   2.911,   9.796,   3.451,   3.144,
0.274,  10.864,   0.765,
   55,   5.369,   0.182,   1.571,   0.205,   5.249,   0.288,   1.593,   0.330,
5.177,   0.348,   1.590,   0.360,   7.987,   0.481,   1.598,   0.498,   2.682,
0.632,   4.851,   1.545,   2.682,   1.393,   6.757,   3.839,   4.023,   2.679,
8.840,   7.888,  24.710,  15.762,  10.729,  11.967,   4.023,   4.165,   8.448,
6.499,   5.014,  11.069,  28.502,  27.146,   1.614,   1.184,   0.000,   1.424,
4.023,   2.350,  14.679,  12.174,   4.023,   3.012,  11.186,   3.643,   3.262,
0.283,  12.629,   0.851,
   60,   5.570,   0.190,   1.859,   0.215,   5.445,   0.306,   1.885,   0.353,
5.370,   0.367,   1.881,   0.379,   8.285,   0.508,   1.891,   0.526,   2.772,
0.653,   5.740,   1.754,   2.772,   1.440,   7.995,   4.429,   4.158,   2.769,
10.460,   9.271,  25.541,  16.292,  10.965,  12.273,   4.158,   4.305,   9.996,
7.406,   5.182,  11.441,  35.945,  34.090,   1.669,   1.250,   0.000,   1.484,
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4.158,   2.429,  17.369,  14.332,   4.158,   3.114,  13.236,   3.878,   3.380,
0.297,  15.335,   0.985,
   65,   5.770,   0.203,   2.279,   0.229,   5.641,   0.334,   2.311,   0.387,
5.564,   0.396,   2.307,   0.409,   8.583,   0.550,   2.319,   0.570,   2.862,
0.674,   7.037,   2.051,   2.862,   1.487,   9.802,   5.277,   4.293,   2.859,
12.824,  11.283,  26.373,  16.822,  11.331,  12.680,   4.293,   4.445,  12.255,
8.701,   5.351,  11.813,  47.655,  45.002,   1.724,   1.334,   0.000,   1.552,
4.293,   2.508,  21.294,  17.475,   4.293,   3.215,  16.227,   4.178,   3.497,
0.317,  19.472,   1.187,
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Pollutant Name: Carbon Dioxide,,,,Temperature: 57F,,Relative Humidity: 65%

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Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LH
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OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,AL
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Pollutant Name: Sulfur Dioxide,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LH
D1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,
OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,AL
L,ALL,ALL,ALL,

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0.007,   0.005,   0.003,   0.005,   0.009,   0.006,   0.003,   0.006,   0.009,
0.007,   0.005,   0.006,   0.009,   0.007,   0.005,   0.006,   0.009,   0.007,
0.014,   0.013,   0.017,   0.008,   0.016,   0.014,   0.009,   0.007,   0.014,
0.011,   0.010,   0.008,   0.027,   0.025,   0.003,   0.003,   0.000,   0.003,
0.009,   0.007,   0.014,   0.013,   0.009,   0.007,   0.014,   0.008,   0.005,
0.004,   0.016,   0.005,
```

Pollutant Name: PM10,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

```
    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.798,   0.172,   0.000,   0.000,   0.973,   0.443,   0.000,   0.000,
0.886,   0.748,   0.000,   0.000,   1.449,   1.113,   0.000,   0.000,   1.030,
0.561,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.801,   0.638,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.661,   0.029,
    5,   0.104,   0.046,   0.333,   0.047,   0.101,   0.054,   0.160,   0.055,
0.105,   0.106,   0.165,   0.106,   0.106,   0.123,   0.139,   0.123,   0.101,
0.039,   0.109,   0.054,   0.101,   0.052,   0.147,   0.096,   0.101,   0.052,
0.670,   0.574,   0.101,   0.108,   1.598,   1.253,   0.101,   0.062,   0.653,
0.384,   0.101,   0.103,   0.941,   0.882,   0.080,   0.005,   0.000,   0.047,
0.101,   0.043,   0.988,   0.796,   0.101,   0.023,   0.661,   0.072,   0.090,
0.062,   0.712,   0.090,
   10,   0.074,   0.030,   0.261,   0.031,   0.072,   0.035,   0.126,   0.037,
0.075,   0.069,   0.129,   0.069,   0.076,   0.081,   0.109,   0.081,   0.066,
0.025,   0.086,   0.038,   0.066,   0.034,   0.116,   0.071,   0.066,   0.034,
0.526,   0.450,   0.066,   0.071,   1.096,   0.858,   0.066,   0.041,   0.513,
0.298,   0.066,   0.068,   0.683,   0.640,   0.063,   0.004,   0.000,   0.037,
0.066,   0.028,   0.776,   0.624,   0.066,   0.015,   0.519,   0.053,   0.067,
0.040,   0.537,   0.062,
   15,   0.055,   0.021,   0.210,   0.021,   0.054,   0.024,   0.101,   0.026,
0.056,   0.047,   0.104,   0.048,   0.056,   0.055,   0.087,   0.056,   0.045,
0.017,   0.069,   0.028,   0.045,   0.023,   0.093,   0.055,   0.045,   0.023,
0.422,   0.360,   0.045,   0.048,   0.727,   0.570,   0.045,   0.028,   0.412,
0.237,   0.045,   0.046,   0.513,   0.480,   0.052,   0.003,   0.000,   0.031,
0.045,   0.019,   0.623,   0.500,   0.045,   0.010,   0.416,   0.041,   0.053,
0.028,   0.415,   0.045,
   20,   0.043,   0.015,   0.172,   0.015,   0.042,   0.018,   0.083,   0.019,
0.044,   0.034,   0.085,   0.035,   0.044,   0.040,   0.072,   0.040,   0.032,
0.012,   0.056,   0.022,   0.032,   0.017,   0.076,   0.044,   0.032,   0.017,
0.346,   0.295,   0.032,   0.034,   0.515,   0.404,   0.032,   0.020,   0.338,
0.193,   0.032,   0.033,   0.399,   0.373,   0.045,   0.003,   0.000,   0.026,
```

```
0.032,   0.014,   0.511,   0.410,   0.032,   0.007,   0.341,   0.032,   0.044,
0.020,   0.331,   0.034,
   25,   0.035,   0.011,   0.144,   0.012,   0.034,   0.014,   0.069,   0.014,
0.036,   0.026,   0.071,   0.026,   0.036,   0.031,   0.060,   0.031,   0.024,
0.009,   0.047,   0.017,   0.024,   0.012,   0.064,   0.036,   0.024,   0.012,
0.290,   0.247,   0.024,   0.026,   0.437,   0.342,   0.024,   0.015,   0.283,
0.161,   0.024,   0.024,   0.321,   0.301,   0.041,   0.002,   0.000,   0.024,
0.024,   0.010,   0.428,   0.343,   0.024,   0.006,   0.286,   0.026,   0.038,
0.015,   0.275,   0.027,
   30,   0.030,   0.009,   0.124,   0.010,   0.029,   0.011,   0.059,   0.012,
0.030,   0.021,   0.061,   0.021,   0.031,   0.025,   0.052,   0.025,   0.019,
0.007,   0.040,   0.014,   0.019,   0.010,   0.055,   0.030,   0.019,   0.010,
0.249,   0.212,   0.019,   0.020,   0.381,   0.297,   0.019,   0.011,   0.243,
0.137,   0.019,   0.019,   0.268,   0.251,   0.039,   0.002,   0.000,   0.023,
0.019,   0.008,   0.367,   0.294,   0.019,   0.004,   0.245,   0.022,   0.034,
0.012,   0.234,   0.022,
   35,   0.027,   0.008,   0.108,   0.008,   0.026,   0.009,   0.052,   0.010,
0.027,   0.018,   0.054,   0.018,   0.027,   0.021,   0.045,   0.021,   0.015,
0.006,   0.035,   0.012,   0.015,   0.008,   0.048,   0.026,   0.015,   0.008,
0.218,   0.186,   0.015,   0.016,   0.346,   0.269,   0.015,   0.009,   0.213,
0.120,   0.015,   0.015,   0.232,   0.217,   0.038,   0.002,   0.000,   0.022,
0.015,   0.006,   0.322,   0.258,   0.015,   0.003,   0.215,   0.019,   0.033,
0.010,   0.205,   0.019,
   40,   0.025,   0.007,   0.097,   0.007,   0.024,   0.008,   0.047,   0.009,
0.025,   0.016,   0.048,   0.016,   0.026,   0.019,   0.041,   0.019,   0.013,
0.005,   0.032,   0.011,   0.013,   0.006,   0.043,   0.023,   0.013,   0.007,
0.195,   0.166,   0.013,   0.013,   0.332,   0.258,   0.013,   0.008,   0.191,
0.107,   0.013,   0.013,   0.207,   0.194,   0.040,   0.002,   0.000,   0.023,
0.013,   0.005,   0.288,   0.231,   0.013,   0.003,   0.193,   0.016,   0.033,
0.009,   0.185,   0.017,
   45,   0.024,   0.007,   0.089,   0.007,   0.024,   0.008,   0.043,   0.008,
0.025,   0.015,   0.044,   0.015,   0.025,   0.017,   0.037,   0.018,   0.011,
0.004,   0.029,   0.010,   0.011,   0.006,   0.039,   0.021,   0.011,   0.006,
0.179,   0.152,   0.011,   0.012,   0.340,   0.264,   0.011,   0.007,   0.175,
0.098,   0.011,   0.011,   0.192,   0.180,   0.043,   0.002,   0.000,   0.025,
0.011,   0.005,   0.264,   0.211,   0.011,   0.003,   0.176,   0.015,   0.035,
0.009,   0.172,   0.016,
   50,   0.025,   0.006,   0.083,   0.007,   0.024,   0.008,   0.040,   0.008,
0.025,   0.015,   0.041,   0.015,   0.026,   0.017,   0.035,   0.017,   0.010,
0.004,   0.027,   0.009,   0.010,   0.005,   0.037,   0.020,   0.010,   0.005,
0.168,   0.142,   0.010,   0.011,   0.370,   0.287,   0.010,   0.006,   0.163,
0.092,   0.010,   0.010,   0.185,   0.172,   0.049,   0.002,   0.000,   0.029,
0.010,   0.004,   0.247,   0.198,   0.010,   0.002,   0.165,   0.014,   0.038,
0.009,   0.165,   0.016,
   55,   0.027,   0.007,   0.080,   0.007,   0.026,   0.008,   0.038,   0.008,
0.027,   0.015,   0.039,   0.015,   0.027,   0.018,   0.033,   0.018,   0.010,
0.004,   0.026,   0.008,   0.010,   0.005,   0.035,   0.019,   0.010,   0.005,
0.160,   0.136,   0.010,   0.010,   0.421,   0.326,   0.010,   0.006,   0.156,
0.088,   0.010,   0.010,   0.183,   0.171,   0.058,   0.003,   0.000,   0.034,
0.010,   0.004,   0.237,   0.189,   0.010,   0.002,   0.158,   0.013,   0.044,
0.009,   0.163,   0.016,
   60,   0.030,   0.007,   0.078,   0.008,   0.029,   0.009,   0.037,   0.009,
0.031,   0.017,   0.039,   0.017,   0.031,   0.020,   0.033,   0.020,   0.009,
0.004,   0.025,   0.008,   0.009,   0.005,   0.035,   0.018,   0.009,   0.005,
0.157,   0.133,   0.009,   0.010,   0.493,   0.381,   0.009,   0.006,   0.153,
0.086,   0.009,   0.010,   0.189,   0.176,   0.073,   0.004,   0.000,   0.042,
```

0.009,   0.004,   0.231,   0.185,   0.009,   0.002,   0.155,   0.013,   0.053,
0.010,   0.166,   0.017,
   65,   0.035,   0.009,   0.078,   0.009,   0.034,   0.010,   0.037,   0.010,
0.036,   0.019,   0.039,   0.019,   0.036,   0.023,   0.033,   0.023,   0.010,
0.004,   0.025,   0.008,   0.010,   0.005,   0.035,   0.018,   0.010,   0.005,
0.157,   0.133,   0.010,   0.010,   0.587,   0.454,   0.010,   0.006,   0.153,
0.086,   0.010,   0.010,   0.201,   0.188,   0.095,   0.005,   0.000,   0.055,
0.010,   0.004,   0.231,   0.185,   0.010,   0.002,   0.155,   0.013,   0.068,
0.011,   0.175,   0.019,

Pollutant Name: PM10 - Tire Wear,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,
    5,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   10,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   15,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   20,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,

```
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   25,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   30,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   35,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   40,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   45,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   50,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   55,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.006,
0.008,   0.012,   0.008,
   60,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.030,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
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0.008, 0.008, 0.008, 0.008, 0.008, 0.008, 0.008, 0.008, 0.012,
0.012, 0.012, 0.012, 0.012, 0.012, 0.012, 0.012, 0.012, 0.012,
0.012, 0.012, 0.012, 0.012, 0.036, 0.030, 0.012, 0.012, 0.012,
0.012, 0.012, 0.012, 0.008, 0.008, 0.004, 0.004, 0.000, 0.004,
0.012, 0.012, 0.012, 0.012, 0.012, 0.012, 0.012, 0.012, 0.006,
0.008, 0.012, 0.008,

Pollutant Name: PM10 - Brake Wear,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

0, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
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0.000, 0.000, 0.000,
5, 0.013, 0.013, 0.013, 0.013, 0.013, 0.013, 0.013, 0.013,
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0.013, 0.013, 0.013, 0.013, 0.013, 0.013, 0.013, 0.013, 0.013,
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0.013, 0.013, 0.028, 0.028, 0.028, 0.028, 0.013, 0.013, 0.013,
0.013, 0.013, 0.013, 0.013, 0.013, 0.006, 0.006, 0.000, 0.006,

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0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
   25,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
   30,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
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0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
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0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
   45,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
   50,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
   55,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
   60,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
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0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
   65,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.009,
0.013,   0.013,   0.013,
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Pollutant Name: Gasoline - mi/gal,,,,Temperature: 57F,,Relative Humidity: 65%

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Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LH
D1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,
OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,AL
L,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,
    5,   5.357,   9.267,   0.000,   9.251,   5.346,   7.431,   0.000,   7.420,
5.362,   7.410,   0.000,   7.406,   4.158,   5.429,   0.000,   5.427,   2.774,
3.506,   0.000,   3.505,   2.774,   3.478,   0.000,   3.475,   2.507,   3.440,
0.000,   3.428,   1.370,   3.090,   0.000,   3.031,   2.507,   3.436,   0.000,
3.434,   2.406,   3.079,   0.000,   2.860,  27.442,  28.576,   0.000,  27.943,
2.507,   3.476,   0.000,   3.463,   2.507,   3.335,   0.000,   3.267,  17.829,
8.518,   0.000,   8.603,
   10,   7.147,  12.253,   0.000,  12.233,   7.133,   9.825,   0.000,   9.810,
7.153,   9.797,   0.000,   9.792,   5.557,   7.179,   0.000,   7.177,   4.171,
5.270,   0.000,   5.268,   4.171,   5.228,   0.000,   5.224,   3.770,   5.170,
0.000,   5.152,   2.061,   4.646,   0.000,   4.557,   3.770,   5.165,   0.000,
5.162,   3.617,   4.631,   0.000,   4.302,  32.552,  34.476,   0.000,  33.401,
3.770,   5.225,   0.000,   5.205,   3.770,   5.013,   0.000,   4.911,  21.485,
11.259,   0.000,  11.352,
   15,   9.160,  15.610,   0.000,  15.585,   9.143,  12.515,   0.000,  12.498,
9.167,  12.481,   0.000,  12.475,   7.131,   9.147,   0.000,   9.144,   5.937,
7.497,   0.000,   7.494,   5.937,   7.438,   0.000,   7.432,   5.367,   7.356,
0.000,   7.331,   2.936,   6.614,   0.000,   6.488,   5.367,   7.349,   0.000,
7.345,   5.151,   6.596,   0.000,   6.127,  37.625,  40.215,   0.000,  38.768,
5.367,   7.434,   0.000,   7.405,   5.367,   7.133,   0.000,   6.988,  25.220,
14.340,   0.000,  14.439,
   20,  11.282,  19.163,   0.000,  19.131,  11.260,  15.362,   0.000,  15.341,
11.290,  15.320,   0.000,  15.313,   8.785,  11.230,   0.000,  11.226,   8.001,
10.095,   0.000,  10.091,   8.001,  10.016,   0.000,  10.008,   7.235,   9.906,
0.000,   9.872,   3.960,   8.914,   0.000,   8.743,   7.235,   9.897,   0.000,
9.891,   6.945,   8.897,   0.000,   8.264,  42.388,  45.386,   0.000,  43.711,
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7.235,  10.010,   0.000,   9.971,   7.235,   9.606,   0.000,   9.411,  28.830,
17.599,   0.000,  17.702,
   25,  13.353,  22.668,   0.000,  22.631,  13.327,  18.172,   0.000,  18.146,
13.362,  18.122,   0.000,  18.114,  10.393,  13.285,   0.000,  13.280,  10.207,
12.866,   0.000,  12.861,  10.207,  12.767,   0.000,  12.756,   9.233,  12.627,
0.000,  12.584,   5.057,  11.373,   0.000,  11.156,   9.233,  12.615,   0.000,
12.608,   8.865,  11.363,   0.000,  10.553,  46.524,  49.573,   0.000,  47.869,
9.233,  12.758,   0.000,  12.709,   9.233,  12.245,   0.000,  11.997,  32.068,
20.815,   0.000,  20.918,
   30,  15.185,  25.841,   0.000,  25.799,  15.156,  20.715,   0.000,  20.685,
15.196,  20.659,   0.000,  20.649,  11.807,  15.145,   0.000,  15.140,  12.327,
15.520,   0.000,  15.515,  12.327,  15.401,   0.000,  15.388,  11.156,  15.234,
0.000,  15.182,   6.116,  13.737,   0.000,  13.474,  11.156,  15.219,   0.000,
15.211,  10.714,  13.742,   0.000,  12.760,  49.681,  52.395,   0.000,  50.878,
11.156,  15.391,   0.000,  15.332,  11.156,  14.774,   0.000,  14.476,  34.652,
23.725,   0.000,  23.824,
   35,  16.592,  28.390,   0.000,  28.344,  16.561,  22.758,   0.000,  22.725,
16.606,  22.697,   0.000,  22.686,  12.878,  16.639,   0.000,  16.633,  14.093,
17.720,   0.000,  17.714,  14.093,  17.586,   0.000,  17.571,  12.760,  17.396,
0.000,  17.337,   7.002,  15.706,   0.000,  15.406,  12.760,  17.380,   0.000,
17.370,  12.259,  15.734,   0.000,  14.606,  51.501,  53.556,   0.000,  52.408,
12.760,  17.574,   0.000,  17.506,  12.760,  16.872,   0.000,  16.533,  36.297,
26.058,   0.000,  26.151,
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17.432,  24.032,   0.000,  24.020,  13.482,  17.618,   0.000,  17.611,  15.250,
19.149,   0.000,  19.142,  15.250,  19.006,   0.000,  18.990,  13.814,  18.802,
0.000,  18.739,   7.590,  16.998,   0.000,  16.674,  13.814,  18.785,   0.000,
18.775,  13.277,  17.053,   0.000,  15.828,  51.658,  52.892,   0.000,  52.202,
13.814,  18.993,   0.000,  18.920,  13.814,  18.237,   0.000,  17.873,  36.745,
27.580,   0.000,  27.664,
   45,  17.552,  30.673,   0.000,  30.622,  17.520,  24.589,   0.000,  24.551,
17.573,  24.523,   0.000,  24.511,  13.543,  17.977,   0.000,  17.969,  15.620,
19.586,   0.000,  19.579,  15.620,  19.441,   0.000,  19.425,  14.157,  19.234,
0.000,  19.170,   7.787,  17.413,   0.000,  17.081,  14.157,  19.217,   0.000,
19.207,  13.611,  17.496,   0.000,  16.236,  49.913,  50.406,   0.000,  50.131,
14.157,  19.427,   0.000,  19.354,  14.157,  18.658,   0.000,  18.287,  35.816,
28.129,   0.000,  28.199,
   50,  16.981,  30.163,   0.000,  30.111,  16.951,  24.180,   0.000,  24.142,
17.006,  24.116,   0.000,  24.103,  13.045,  17.677,   0.000,  17.669,  15.142,
18.961,   0.000,  18.954,  15.142,  18.822,   0.000,  18.806,  13.732,  18.624,
0.000,  18.562,   7.562,  16.883,   0.000,  16.562,  13.732,  18.607,   0.000,
18.597,  13.207,  16.990,   0.000,  15.763,  46.196,  46.285,   0.000,  46.235,
13.732,  18.809,   0.000,  18.738,  13.732,  18.067,   0.000,  17.710,  33.456,
27.643,   0.000,  27.696,
   55,  15.759,  28.582,   0.000,  28.531,  15.732,  22.914,   0.000,  22.876,
15.787,  22.853,   0.000,  22.840,  12.042,  16.749,   0.000,  16.741,  13.894,
17.374,   0.000,  17.368,  13.894,  17.248,   0.000,  17.233,  12.606,  17.068,
0.000,  17.011,   6.950,  15.493,   0.000,  15.199,  12.606,  17.052,   0.000,
17.043,  12.128,  15.615,   0.000,  14.484,  40.684,  40.883,   0.000,  40.772,
12.606,  17.235,   0.000,  17.170,  12.606,  16.558,   0.000,  16.233,  29.793,
26.174,   0.000,  26.207,
   60,  14.019,  26.097,   0.000,  26.050,  13.996,  20.923,   0.000,  20.886,
14.050,  20.867,   0.000,  20.855,  10.643,  15.292,   0.000,  15.284,  12.065,
15.067,   0.000,  15.062,  12.065,  14.959,   0.000,  14.947,  10.952,  14.804,
0.000,  14.755,   6.044,  13.455,   0.000,  13.200,  10.952,  14.791,   0.000,
14.783,  10.541,  13.581,   0.000,  12.595,  33.852,  34.678,   0.000,  34.217,
```

10.952, 14.948,   0.000, 14.892, 10.952, 14.363,   0.000, 14.082, 25.155,
23.876,   0.000, 23.887,
   65, 11.943, 22.959,   0.000, 22.915, 11.925, 18.407,   0.000, 18.373,
11.975, 18.358,   0.000, 18.347,   8.997, 13.452,   0.000, 13.444,   9.915,
12.368,   0.000, 12.363,   9.915, 12.280,   0.000, 12.269,   9.005, 12.153,
0.000, 12.113,   4.975, 11.059,   0.000, 10.850,   9.005, 12.143,   0.000,
12.136,   8.669, 11.177,   0.000, 10.364, 26.436, 28.200,   0.000, 27.215,
9.005, 12.271,   0.000, 12.225,   9.005, 11.792,   0.000, 11.563, 20.043,
20.982,   0.000, 20.973,

Pollutant Name: Diesel - mi/gal,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,
    5,   0.000,   0.000, 28.117, 28.117,   0.000,   0.000, 28.987, 28.987,
0.000,   0.000, 28.977, 28.977,   0.000,   0.000, 29.106, 29.106,   0.000,
0.000, 19.315, 19.315,   0.000,   0.000, 18.823, 18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   2.621,   2.621,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.360,   8.360,
   10,   0.000,   0.000, 28.117, 28.117,   0.000,   0.000, 28.987, 28.987,
0.000,   0.000, 28.977, 28.977,   0.000,   0.000, 29.106, 29.106,   0.000,
0.000, 19.315, 19.315,   0.000,   0.000, 18.823, 18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   3.184,   3.184,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.392,   8.392,
   15,   0.000,   0.000, 28.117, 28.117,   0.000,   0.000, 28.987, 28.987,
0.000,   0.000, 28.977, 28.977,   0.000,   0.000, 29.106, 29.106,   0.000,
0.000, 19.315, 19.315,   0.000,   0.000, 18.823, 18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   3.883,   3.883,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.432,   8.432,
   20,   0.000,   0.000, 28.117, 28.117,   0.000,   0.000, 28.987, 28.987,
0.000,   0.000, 28.977, 28.977,   0.000,   0.000, 29.106, 29.106,   0.000,
0.000, 19.315, 19.315,   0.000,   0.000, 18.823, 18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   4.617,   4.617,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,

```
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.473,   8.473,
   25,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   4.935,   4.935,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.491,   8.491,
   30,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.238,   5.238,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.508,   8.508,
   35,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.515,   5.515,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.524,   8.524,
   40,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.749,   5.749,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.537,   8.537,
   45,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.926,   5.926,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.547,   8.547,
   50,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   6.033,   6.033,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.553,   8.553,
   55,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   6.064,   6.064,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.555,   8.555,
   60,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   6.014,   6.014,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
```

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0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.552,   8.552,
   65,   0.000,   0.000,  28.117,  28.117,   0.000,   0.000,  28.987,  28.987,
0.000,   0.000,  28.977,  28.977,   0.000,   0.000,  29.106,  29.106,   0.000,
0.000,  19.315,  19.315,   0.000,   0.000,  18.823,  18.823,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.889,   5.889,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.593,   3.593,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   8.545,   8.545,
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Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area     : San Francisco
*********************************************************************************
*********
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,,  San Francisco,,,,,,County Average

,,,,Table  2:  Starting Emissions (grams/trip)

Pollutant Name: Total Organic Gases,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    5,   5.057,   0.069,   0.000,   0.094,   4.954,   0.081,   0.000,   0.108,
4.801,   0.074,   0.000,   0.083,   6.092,   0.109,   0.000,   0.120,   8.279,
0.232,   0.000,   0.235,   8.279,   0.388,   0.000,   0.340,  12.419,   0.740,
0.000,   0.458,  20.912,   2.198,   0.000,   4.846,  12.419,   0.647,   0.000,
0.497,  15.286,   1.628,   0.000,   0.423,   2.516,   0.400,   0.000,   1.747,
12.419,   0.401,   0.000,   0.116,  12.419,   0.834,   0.000,   1.835,   5.261,
0.104,   0.000,   0.162,
   10,   5.014,   0.135,   0.000,   0.160,   4.912,   0.159,   0.000,   0.183,
4.760,   0.146,   0.000,   0.154,   6.039,   0.213,   0.000,   0.223,   8.208,
0.454,   0.000,   0.436,   8.208,   0.756,   0.000,   0.618,  12.312,   1.443,
0.000,   0.660,  20.733,   4.285,   0.000,   6.344,  12.312,   1.262,   0.000,
0.883,  15.155,   3.173,   0.000,   0.493,   2.495,   0.779,   0.000,   1.871,
12.312,   0.783,   0.000,   0.192,  12.312,   1.625,   0.000,   2.495,   5.215,
0.204,   0.000,   0.253,
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   20,   5.062,   0.258,   0.000,   0.282,   4.959,   0.303,   0.000,   0.325,
4.805,   0.279,   0.000,   0.287,   6.097,   0.408,   0.000,   0.418,   8.286,
0.865,   0.000,   0.808,   8.286,   1.435,   0.000,   1.132,  12.430,   2.735,
0.000,   1.037,  20.931,   8.123,   0.000,   9.181,  12.430,   2.392,   0.000,
1.596,  15.300,   6.015,   0.000,   0.631,   2.518,   1.477,   0.000,   2.140,
12.430,   1.484,   0.000,   0.333,  12.430,   3.081,   0.000,   3.737,   5.265,
0.389,   0.000,   0.424,
   30,   5.289,   0.369,   0.000,   0.393,   5.181,   0.432,   0.000,   0.453,
5.021,   0.399,   0.000,   0.407,   6.371,   0.586,   0.000,   0.595,   8.659,
1.233,   0.000,   1.144,   8.659,   2.038,   0.000,   1.589,  12.988,   3.878,
0.000,   1.379,  21.872,  11.515,   0.000,  11.808,  12.988,   3.391,   0.000,
2.229,  15.987,   8.526,   0.000,   0.765,   2.632,   2.094,   0.000,   2.436,
12.988,   2.103,   0.000,   0.459,  12.988,   4.368,   0.000,   4.877,   5.502,
0.554,   0.000,   0.580,
   40,   5.696,   0.467,   0.000,   0.493,   5.580,   0.547,   0.000,   0.568,
5.407,   0.507,   0.000,   0.516,   6.861,   0.747,   0.000,   0.755,   9.325,
1.560,   0.000,   1.441,   9.325,   2.565,   0.000,   1.991,  13.988,   4.869,
0.000,   1.687,  23.555,  14.461,   0.000,  14.222,  13.988,   4.259,   0.000,
2.782,  17.217,  10.707,   0.000,   0.896,   2.834,   2.630,   0.000,   2.760,
13.988,   2.641,   0.000,   0.570,  13.988,   5.485,   0.000,   5.913,   5.925,
0.701,   0.000,   0.721,
   50,   6.283,   0.554,   0.000,   0.582,   6.155,   0.648,   0.000,   0.670,
5.964,   0.603,   0.000,   0.612,   7.568,   0.890,   0.000,   0.899,  10.285,
1.844,   0.000,   1.701,  10.286,   3.014,   0.000,   2.336,  15.428,   5.711,
0.000,   1.959,  25.980,  16.960,   0.000,  16.426,  15.428,   4.995,   0.000,
3.256,  18.990,  12.557,   0.000,   1.024,   3.126,   3.084,   0.000,   3.111,
15.428,   3.098,   0.000,   0.666,  15.428,   6.433,   0.000,   6.847,   6.536,
0.828,   0.000,   0.846,
   60,   6.532,   0.628,   0.000,   0.656,   6.399,   0.734,   0.000,   0.756,
6.201,   0.686,   0.000,   0.695,   7.868,   1.015,   0.000,   1.024,  10.693,
2.085,   0.000,   1.921,  10.693,   3.388,   0.000,   2.620,  16.040,   6.402,
0.000,   2.172,  27.010,  19.013,   0.000,  18.086,  16.040,   5.599,   0.000,
3.641,  19.743,  14.077,   0.000,   1.113,   3.250,   3.458,   0.000,   3.325,
16.040,   3.473,   0.000,   0.743,  16.040,   7.212,   0.000,   7.561,   6.795,
0.937,   0.000,   0.949,
  120,   4.931,   0.789,   0.000,   0.808,   4.831,   0.874,   0.000,   0.883,
4.681,   0.876,   0.000,   0.881,   5.940,   1.338,   0.000,   1.342,   8.072,
2.117,   0.000,   1.942,   8.072,   3.084,   0.000,   2.376,  12.109,   5.466,
0.000,   1.823,  20.390,  15.856,   0.000,  14.753,  12.109,   4.956,   0.000,
3.207,  14.904,   9.101,   0.000,   0.768,   2.453,   3.208,   0.000,   2.728,
12.109,   3.152,   0.000,   0.667,  12.109,   4.356,   0.000,   4.787,   5.129,
1.060,   0.000,   1.043,
  180,   5.368,   0.582,   0.000,   0.605,   5.258,   0.674,   0.000,   0.690,
5.096,   0.656,   0.000,   0.663,   6.466,   0.994,   0.000,   1.000,   8.787,
2.087,   0.000,   1.917,   8.787,   3.200,   0.000,   2.468,  13.181,   5.800,
0.000,   1.941,  22.196,  16.824,   0.000,  15.741,  13.181,   5.259,   0.000,
3.405,  16.224,   9.656,   0.000,   0.824,   2.671,   2.715,   0.000,   2.687,
13.181,   3.344,   0.000,   0.709,  13.181,   4.622,   0.000,   5.109,   5.584,
0.870,   0.000,   0.873,
  240,   5.804,   0.616,   0.000,   0.641,   5.686,   0.713,   0.000,   0.731,
5.510,   0.695,   0.000,   0.702,   6.992,   1.053,   0.000,   1.060,   9.502,
2.208,   0.000,   2.029,   9.502,   3.381,   0.000,   2.608,  14.253,   6.123,
0.000,   2.056,  24.002,  17.762,   0.000,  16.706,  14.253,   5.552,   0.000,
3.598,  17.544,  10.195,   0.000,   0.879,   2.888,   2.867,   0.000,   2.880,
14.253,   3.530,   0.000,   0.749,  14.253,   4.879,   0.000,   5.425,   6.038,
0.920,   0.000,   0.925,
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  300,   6.241,   0.649,   0.000,   0.676,   6.114,   0.752,   0.000,   0.771,
5.925,   0.733,   0.000,   0.741,   7.518,   1.111,   0.000,   1.119,  10.217,
2.326,   0.000,   2.138,  10.217,   3.556,   0.000,   2.744,  15.326,   6.436,
0.000,   2.168,  25.808,  18.669,   0.000,  17.649,  15.326,   5.835,   0.000,
3.784,  18.864,  10.715,   0.000,   0.934,   3.105,   3.013,   0.000,   3.072,
15.326,   3.711,   0.000,   0.789,  15.326,   5.128,   0.000,   5.733,   6.492,
0.969,   0.000,   0.976,
  360,   6.678,   0.682,   0.000,   0.711,   6.542,   0.789,   0.000,   0.810,
6.339,   0.770,   0.000,   0.779,   8.044,   1.168,   0.000,   1.177,  10.932,
2.441,   0.000,   2.244,  10.932,   3.725,   0.000,   2.877,  16.398,   6.738,
0.000,   2.276,  27.614,  19.545,   0.000,  18.569,  16.398,   6.109,   0.000,
3.964,  20.184,  11.218,   0.000,   0.988,   3.323,   3.154,   0.000,   3.261,
16.398,   3.885,   0.000,   0.827,  16.398,   5.369,   0.000,   6.034,   6.946,
1.017,   0.000,   1.025,
  420,   7.115,   0.713,   0.000,   0.744,   6.970,   0.826,   0.000,   0.849,
6.754,   0.806,   0.000,   0.816,   8.570,   1.224,   0.000,   1.234,  11.647,
2.553,   0.000,   2.348,  11.647,   3.889,   0.000,   3.005,  17.471,   7.030,
0.000,   2.382,  29.419,  20.390,   0.000,  19.467,  17.471,   6.373,   0.000,
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17.471,   4.053,   0.000,   0.863,  17.471,   5.601,   0.000,   6.328,   7.401,
1.063,   0.000,   1.074,
  480,   7.551,   0.744,   0.000,   0.777,   7.397,   0.861,   0.000,   0.886,
7.168,   0.842,   0.000,   0.852,   9.096,   1.279,   0.000,   1.289,  12.362,
2.662,   0.000,   2.449,  12.362,   4.048,   0.000,   3.128,  18.543,   7.310,
0.000,   2.484,  31.225,  21.205,   0.000,  20.342,  18.543,   6.628,   0.000,
4.306,  22.824,  12.171,   0.000,   1.092,   3.757,   3.422,   0.000,   3.635,
18.543,   4.215,   0.000,   0.899,  18.543,   5.825,   0.000,   6.615,   7.855,
1.109,   0.000,   1.121,
  540,   7.988,   0.774,   0.000,   0.809,   7.825,   0.896,   0.000,   0.922,
7.583,   0.877,   0.000,   0.888,   9.622,   1.333,   0.000,   1.344,  13.077,
2.768,   0.000,   2.547,  13.077,   4.201,   0.000,   3.248,  19.615,   7.581,
0.000,   2.584,  33.031,  21.989,   0.000,  21.195,  19.615,   6.873,   0.000,
4.468,  24.144,  12.621,   0.000,   1.144,   3.974,   3.549,   0.000,   3.820,
19.615,   4.370,   0.000,   0.933,  19.615,   6.040,   0.000,   6.895,   8.309,
1.153,   0.000,   1.168,
  600,   8.425,   0.804,   0.000,   0.841,   8.253,   0.930,   0.000,   0.958,
7.998,   0.911,   0.000,   0.923,  10.148,   1.386,   0.000,   1.397,  13.792,
2.871,   0.000,   2.643,  13.792,   4.349,   0.000,   3.364,  20.688,   7.840,
0.000,   2.680,  34.837,  22.742,   0.000,  22.025,  20.688,   7.108,   0.000,
4.624,  25.464,  13.053,   0.000,   1.194,   4.192,   3.670,   0.000,   4.002,
20.688,   4.520,   0.000,   0.966,  20.688,   6.247,   0.000,   7.167,   8.763,
1.195,   0.000,   1.213,
  660,   8.861,   0.832,   0.000,   0.871,   8.681,   0.963,   0.000,   0.993,
8.412,   0.944,   0.000,   0.957,  10.674,   1.438,   0.000,   1.450,  14.507,
2.972,   0.000,   2.736,  14.507,   4.491,   0.000,   3.475,  21.760,   8.089,
0.000,   2.773,  36.643,  23.464,   0.000,  22.833,  21.760,   7.334,   0.000,
4.774,  26.784,  13.468,   0.000,   1.243,   4.409,   3.787,   0.000,   4.183,
21.760,   4.664,   0.000,   0.998,  21.760,   6.446,   0.000,   7.433,   9.218,
1.237,   0.000,   1.257,
  720,   9.298,   0.860,   0.000,   0.901,   9.109,   0.995,   0.000,   1.026,
8.827,   0.977,   0.000,   0.990,  11.200,   1.488,   0.000,   1.501,  15.222,
3.069,   0.000,   2.826,  15.222,   4.628,   0.000,   3.583,  22.832,   8.328,
0.000,   2.863,  38.449,  24.156,   0.000,  23.619,  22.832,   7.551,   0.000,
4.918,  28.104,  13.865,   0.000,   1.292,   4.626,   3.899,   0.000,   4.362,
22.832,   4.801,   0.000,   1.029,  22.832,   6.636,   0.000,   7.691,   9.672,
1.277,   0.000,   1.300,
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Pollutant Name: Carbon Monoxide,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

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    5,  23.770,   0.723,   0.000,   0.839,  23.914,   0.996,   0.000,   1.112,
23.545,   0.862,   0.000,   0.905,  41.689,   1.149,   0.000,   1.222,  42.016,
2.711,   0.000,   2.583,  42.016,   4.997,   0.000,   4.013,  63.024,  12.087,
0.000,   4.741, 260.302,  31.683,   0.000,  63.475,  63.024,  11.608,   0.000,
7.762,  71.664,  25.193,   0.000,   2.815,   6.484,   2.425,   0.000,   5.009,
63.024,   6.667,   0.000,   1.518,  63.024,  16.008,   0.000,  19.276,  28.487,
1.273,   0.000,   1.529,
   10,  21.049,   1.422,   0.000,   1.519,  21.176,   1.957,   0.000,   2.038,
20.850,   1.697,   0.000,   1.731,  36.917,   2.259,   0.000,   2.317,  37.206,
5.323,   0.000,   4.934,  37.206,   9.796,   0.000,   7.612,  55.809,  23.683,
0.000,   7.965, 230.504,  62.078,   0.000,  81.089,  55.809,  22.744,   0.000,
14.720,  63.460,  49.362,   0.000,   3.771,   5.742,   4.751,   0.000,   5.382,
55.809,  13.064,   0.000,   2.781,  55.809,  31.366,   0.000,  31.617,  25.225,
2.499,   0.000,   2.621,
   20,  16.249,   2.746,   0.000,   2.808,  16.347,   3.775,   0.000,   3.792,
16.095,   3.281,   0.000,   3.299,  28.497,   4.365,   0.000,   4.393,  28.721,
10.247,   0.000,   9.369,  28.721,  18.800,   0.000,  14.367,  43.081,  45.402,
0.000,  14.018, 177.935, 119.007,   0.000, 114.582,  43.081,  43.602,   0.000,
27.757,  48.987,  94.630,   0.000,   5.580,   4.432,   9.108,   0.000,   6.131,
43.081,  25.044,   0.000,   5.150,  43.081,  60.131,   0.000,  54.800,  19.473,
4.813,   0.000,   4.688,
   30,  12.304,   3.972,   0.000,   4.005,  12.378,   5.453,   0.000,   5.414,
12.188,   4.753,   0.000,   4.756,  21.579,   6.317,   0.000,   6.321,  21.748,
14.773,   0.000,  13.448,  21.748,  27.012,   0.000,  20.533,  32.623,  65.156,
0.000,  19.545, 134.739, 170.787,   0.000, 145.760,  32.623,  62.573,   0.000,
39.622,  37.095, 135.803,   0.000,   7.255,   3.356,  13.071,   0.000,   6.886,
32.623,  35.941,   0.000,   7.307,  32.623,  86.294,   0.000,  75.989,  14.745,
6.942,   0.000,   6.596,
   40,   9.215,   5.101,   0.000,   5.109,   9.271,   6.991,   0.000,   6.903,
9.128,   6.112,   0.000,   6.104,  16.162,   8.117,   0.000,   8.099,  16.289,
18.902,   0.000,  17.171,  16.289,  34.432,   0.000,  26.109,  24.433,  82.946,
0.000,  24.547, 100.915, 217.418,   0.000, 174.624,  24.433,  79.657,   0.000,
50.317,  27.783, 172.882,   0.000,   8.796,   2.514,  16.640,   0.000,   7.647,
24.433,  45.754,   0.000,   9.253,  24.433, 109.855,   0.000,  95.182,  11.044,
8.886,   0.000,   8.345,
   50,   6.983,   6.131,   0.000,   6.120,   7.025,   8.389,   0.000,   8.261,
6.916,   7.359,   0.000,   7.341,  12.246,   9.763,   0.000,   9.727,  12.342,
22.632,   0.000,  20.538,  12.342,  41.061,   0.000,  31.095,  18.513,  98.771,
0.000,  29.023,  76.464, 258.899,   0.000, 201.173,  18.513,  94.855,   0.000,
59.840,  21.051, 205.866,   0.000,  10.201,   1.905,  19.815,   0.000,   8.413,
18.513,  54.483,   0.000,  10.988,  18.513, 130.814,   0.000, 112.379,   8.368,
10.644,   0.000,   9.936,
   60,   5.605,   7.064,   0.000,   7.039,   5.639,   9.648,   0.000,   9.486,
5.552,   8.493,   0.000,   8.468,   9.831,  11.256,   0.000,  11.206,   9.908,
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25.964,   0.000,  23.549,   9.908,  46.898,   0.000,  35.492,  14.862, 112.632,
0.000,  32.973,  61.384, 295.230,   0.000, 225.407,  14.862, 108.166,   0.000,
68.193,  16.900, 234.756,   0.000,  11.471,   1.529,  22.596,   0.000,   9.184,
14.862,  62.129,   0.000,  12.513,  14.862, 149.171,   0.000, 127.582,   6.718,
12.217,   0.000,  11.369,
  120,  18.544,   9.555,   0.000,   9.577,  18.656,  12.106,   0.000,  11.968,
18.369,  11.520,   0.000,  11.506,  32.524,  15.300,   0.000,  15.270,  32.779,
23.527,   0.000,  21.411,  32.779,  36.511,   0.000,  27.773,  49.168,  81.742,
0.000,  24.681, 203.075, 203.882,   0.000, 180.543,  49.168,  81.439,   0.000,
51.617,  55.908, 134.124,   0.000,   7.603,   5.059,  22.563,   0.000,  11.419,
49.168,  47.814,   0.000,   9.737,  49.168,  82.850,   0.000,  74.579,  22.224,
13.478,   0.000,  12.726,
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29.024,   7.891,   0.000,   7.914,  51.390,  10.358,   0.000,  10.395,  51.793,
20.711,   0.000,  18.918,  51.793,  35.899,   0.000,  27.418,  77.689,  84.131,
0.000,  25.933, 320.874, 209.842,   0.000, 203.142,  77.689,  83.820,   0.000,
53.322,  88.340, 138.045,   0.000,   8.523,   7.993,  15.087,   0.000,  10.571,
77.689,  49.212,   0.000,  10.099,  77.689,  85.272,   0.000,  79.221,  35.115,
10.359,   0.000,  10.004,
  240,  38.919,   6.818,   0.000,   6.965,  39.154,   9.083,   0.000,   9.122,
38.551,   8.372,   0.000,   8.412,  68.257,  10.964,   0.000,  11.030,  68.792,
21.687,   0.000,  19.854,  68.792,  37.129,   0.000,  28.444, 103.188,  86.600,
0.000,  27.148, 426.189, 215.998,   0.000, 223.951, 103.188,  86.279,   0.000,
55.054, 117.334, 142.095,   0.000,   9.372,  10.616,  15.529,   0.000,  12.402,
103.188,  50.656,   0.000,  10.462, 103.188,  87.773,   0.000,  83.656,  46.641,
10.858,   0.000,  10.607,
  300,  47.396,   7.157,   0.000,   7.344,  47.682,   9.505,   0.000,   9.584,
46.947,   8.812,   0.000,   8.866,  83.124,  11.521,   0.000,  11.612,  83.775,
22.611,   0.000,  20.736,  83.775,  38.358,   0.000,  29.457, 125.663,  89.147,
0.000,  28.327, 519.019, 222.351,   0.000, 242.970, 125.663,  88.816,   0.000,
56.814, 142.891, 146.274,   0.000,  10.149,  12.929,  15.986,   0.000,  14.040,
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11.328,   0.000,  11.167,
  360,  54.733,   7.466,   0.000,   7.689,  55.063,   9.896,   0.000,  10.009,
54.215,   9.210,   0.000,   9.277,  95.992,  12.028,   0.000,  12.142,  96.744,
23.481,   0.000,  21.564,  96.744,  39.586,   0.000,  30.458, 145.116,  91.772,
0.000,  29.470, 599.364, 228.901,   0.000, 260.200, 145.116,  91.432,   0.000,
58.601, 165.011, 150.583,   0.000,  10.854,  14.930,  16.457,   0.000,  15.485,
145.116,  53.682,   0.000,  11.189, 145.116,  93.016,   0.000,  91.905,  65.592,
11.769,   0.000,  11.684,
  420,  60.930,   7.747,   0.000,   7.999,  61.297,  10.256,   0.000,  10.397,
60.353,   9.567,   0.000,   9.645, 106.860,  12.486,   0.000,  12.618, 107.698,
24.299,   0.000,  22.338, 107.698,  40.813,   0.000,  31.447, 161.546,  94.477,
0.000,  30.576, 667.224, 235.647,   0.000, 275.641, 161.546,  94.127,   0.000,
60.416, 183.693, 155.021,   0.000,  11.487,  16.620,  16.942,   0.000,  16.737,
161.546,  55.264,   0.000,  11.553, 161.546,  95.757,   0.000,  95.718,  73.019,
12.183,   0.000,  12.158,
  480,  65.986,   7.999,   0.000,   8.275,  66.384,  10.585,   0.000,  10.749,
65.362,   9.882,   0.000,   9.968, 115.729,  12.894,   0.000,  13.041, 116.636,
25.064,   0.000,  23.058, 116.636,  42.039,   0.000,  32.424, 174.954,  97.260,
0.000,  31.647, 722.600, 242.589,   0.000, 289.292, 174.954,  96.900,   0.000,
62.258, 198.939, 159.588,   0.000,  12.049,  18.000,  17.441,   0.000,  17.797,
174.954,  56.892,   0.000,  11.918, 174.954,  98.579,   0.000,  99.325,  79.079,
12.568,   0.000,  12.589,
  540,  69.903,   8.222,   0.000,   8.517,  70.325,  10.882,   0.000,  11.063,
69.242,  10.156,   0.000,  10.248, 122.598,  13.253,   0.000,  13.410, 123.559,
25.776,   0.000,  23.725, 123.559,  43.264,   0.000,  33.389, 185.338, 100.122,
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0.000,  32.680, 765.491, 249.728,   0.000, 301.154, 185.338,  99.751,   0.000,
64.128, 210.747, 164.284,   0.000,  12.538,  19.068,  17.954,   0.000,  18.664,
185.338,  58.566,   0.000,  12.284, 185.338, 101.479,   0.000, 102.723,  83.773,
12.924,   0.000,  12.976,
  600,  72.680,   8.417,   0.000,   8.724,  73.118,  11.149,   0.000,  11.340,
71.992,  10.388,   0.000,  10.485, 127.468,  13.562,   0.000,  13.727, 128.467,
26.436,   0.000,  24.337, 128.467,  44.488,   0.000,  34.342, 192.700, 103.063,
0.000,  33.678, 795.897, 257.063,   0.000, 311.226, 192.700, 102.681,   0.000,
66.026, 219.118, 169.109,   0.000,  12.956,  19.826,  18.482,   0.000,  19.337,
192.700,  60.286,   0.000,  12.650, 192.700, 104.460,   0.000, 105.915,  87.100,
13.252,   0.000,  13.321,
  660,  74.316,   8.582,   0.000,   8.897,  74.765,  11.385,   0.000,  11.580,
73.613,  10.579,   0.000,  10.678, 130.338,  13.822,   0.000,  13.991, 131.359,
27.043,   0.000,  24.896, 131.359,  45.711,   0.000,  35.282, 197.039, 106.083,
0.000,  34.639, 813.818, 264.594,   0.000, 319.509, 197.039, 105.690,   0.000,
67.951, 224.052, 174.064,   0.000,  13.302,  20.272,  19.023,   0.000,  19.818,
197.039,  62.053,   0.000,  13.017, 197.039, 107.521,   0.000, 108.899,  89.061,
13.552,   0.000,  13.622,
  720,  74.813,   8.719,   0.000,   9.035,  75.264,  11.589,   0.000,  11.784,
74.105,  10.728,   0.000,  10.828, 131.209,  14.032,   0.000,  14.202, 132.237,
27.597,   0.000,  25.400, 132.237,  46.933,   0.000,  36.211, 198.356, 109.181,
0.000,  35.564, 819.255, 272.322,   0.000, 326.002, 198.356, 108.777,   0.000,
69.903, 225.549, 179.148,   0.000,  13.576,  20.408,  19.579,   0.000,  20.106,
198.356,  63.865,   0.000,  13.385, 198.356, 110.661,   0.000, 111.677,  89.656,
13.823,   0.000,  13.880,
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Pollutant Name: Oxides of Nitrogen,,,,Temperature: 57F,,Relative Humidity: ALL

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Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    5,   1.199,   0.209,   0.000,   0.213,   1.176,   0.242,   0.000,   0.244,
1.163,   0.402,   0.000,   0.402,   1.805,   0.550,   0.000,   0.550,   0.609,
1.322,   0.000,   1.199,   0.609,   1.389,   0.000,   1.053,   0.913,   1.725,
0.000,   0.518,   3.781,   5.320,   0.000,   4.476,   0.913,   2.061,   0.000,
1.304,   1.138,   2.901,   0.000,   0.163,   0.292,   0.089,   0.000,   0.218,
0.913,   1.229,   0.000,   0.249,   0.913,   1.370,   0.000,   1.242,   0.786,
0.348,   0.000,   0.331,
   10,   1.303,   0.242,   0.000,   0.247,   1.279,   0.281,   0.000,   0.283,
1.264,   0.451,   0.000,   0.452,   1.962,   0.617,   0.000,   0.617,   0.661,
1.607,   0.000,   1.457,   0.661,   1.921,   0.000,   1.455,   0.992,   2.599,
0.000,   0.774,   4.110,   8.016,   0.000,   6.499,   0.992,   3.105,   0.000,
1.962,   1.237,   4.371,   0.000,   0.235,   0.317,   0.134,   0.000,   0.251,
0.992,   1.852,   0.000,   0.375,   0.992,   2.064,   0.000,   1.837,   0.854,
0.427,   0.000,   0.405,
   20,   1.493,   0.301,   0.000,   0.306,   1.465,   0.352,   0.000,   0.353,
1.448,   0.539,   0.000,   0.540,   2.248,   0.736,   0.000,   0.736,   0.758,
2.109,   0.000,   1.913,   0.758,   2.856,   0.000,   2.162,   1.137,   4.134,
0.000,   1.222,   4.709,  12.751,   0.000,  10.054,   1.137,   4.940,   0.000,
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3.117, 1.417, 6.953, 0.000, 0.361, 0.364, 0.213, 0.000, 0.309,
1.137, 2.947, 0.000, 0.595, 1.137, 3.284, 0.000, 2.882, 0.978,
0.566, 0.000, 0.535,
30, 1.657, 0.349, 0.000, 0.355, 1.626, 0.410, 0.000, 0.411,
1.607, 0.613, 0.000, 0.613, 2.495, 0.835, 0.000, 0.835, 0.841,
2.523, 0.000, 2.288, 0.841, 3.619, 0.000, 2.740, 1.262, 5.385,
0.000, 1.587, 5.227, 16.609, 0.000, 12.956, 1.262, 6.434, 0.000,
4.059, 1.573, 9.057, 0.000, 0.463, 0.404, 0.278, 0.000, 0.358,
1.262, 3.838, 0.000, 0.774, 1.262, 4.277, 0.000, 3.734, 1.086,
0.681, 0.000, 0.642,
40, 1.796, 0.388, 0.000, 0.394, 1.762, 0.456, 0.000, 0.456,
1.742, 0.671, 0.000, 0.672, 2.704, 0.914, 0.000, 0.914, 0.912,
2.847, 0.000, 2.582, 0.912, 4.212, 0.000, 3.187, 1.368, 6.351,
0.000, 1.870, 5.665, 19.591, 0.000, 15.204, 1.368, 7.589, 0.000,
4.787, 1.704, 10.683, 0.000, 0.543, 0.437, 0.327, 0.000, 0.397,
1.368, 4.527, 0.000, 0.913, 1.368, 5.045, 0.000, 4.393, 1.177,
0.770, 0.000, 0.726,
50, 1.909, 0.416, 0.000, 0.423, 1.874, 0.489, 0.000, 0.490,
1.852, 0.715, 0.000, 0.716, 2.875, 0.973, 0.000, 0.973, 0.969,
3.082, 0.000, 2.795, 0.969, 4.633, 0.000, 3.506, 1.454, 7.033,
0.000, 2.069, 6.024, 21.695, 0.000, 16.799, 1.454, 8.404, 0.000,
5.301, 1.812, 11.831, 0.000, 0.600, 0.465, 0.363, 0.000, 0.428,
1.454, 5.013, 0.000, 1.010, 1.454, 5.587, 0.000, 4.860, 1.251,
0.835, 0.000, 0.787,
60, 1.998, 0.434, 0.000, 0.441, 1.960, 0.511, 0.000, 0.512,
1.938, 0.744, 0.000, 0.745, 3.008, 1.013, 0.000, 1.012, 1.014,
3.228, 0.000, 2.928, 1.014, 4.882, 0.000, 3.695, 1.521, 7.432,
0.000, 2.186, 6.303, 22.924, 0.000, 17.740, 1.521, 8.880, 0.000,
5.601, 1.896, 12.500, 0.000, 0.633, 0.487, 0.383, 0.000, 0.449,
1.521, 5.297, 0.000, 1.068, 1.521, 5.903, 0.000, 5.134, 1.309,
0.875, 0.000, 0.825,
120, 2.053, 0.457, 0.000, 0.464, 2.015, 0.540, 0.000, 0.540,
1.992, 0.792, 0.000, 0.792, 3.092, 1.079, 0.000, 1.079, 1.042,
3.372, 0.000, 3.058, 1.042, 5.006, 0.000, 3.788, 1.564, 7.561,
0.000, 2.225, 6.478, 23.323, 0.000, 18.060, 1.564, 9.034, 0.000,
5.698, 1.949, 12.725, 0.000, 0.645, 0.500, 0.385, 0.000, 0.458,
1.564, 5.389, 0.000, 1.086, 1.564, 6.013, 0.000, 5.231, 1.346,
0.912, 0.000, 0.859,
180, 2.004, 0.478, 0.000, 0.485, 1.967, 0.562, 0.000, 0.561,
1.944, 0.827, 0.000, 0.828, 3.018, 1.127, 0.000, 1.126, 1.018,
3.375, 0.000, 3.060, 1.018, 4.994, 0.000, 3.779, 1.526, 7.533,
0.000, 2.216, 6.323, 23.238, 0.000, 17.973, 1.526, 9.001, 0.000,
5.677, 1.902, 12.678, 0.000, 0.642, 0.488, 0.388, 0.000, 0.452,
1.526, 5.369, 0.000, 1.082, 1.526, 5.991, 0.000, 5.209, 1.314,
0.934, 0.000, 0.879,
240, 1.939, 0.475, 0.000, 0.481, 1.903, 0.558, 0.000, 0.557,
1.881, 0.822, 0.000, 0.822, 2.920, 1.119, 0.000, 1.118, 0.985,
3.353, 0.000, 3.041, 0.985, 4.965, 0.000, 3.757, 1.477, 7.491,
0.000, 2.203, 6.118, 23.107, 0.000, 17.845, 1.477, 8.950, 0.000,
5.644, 1.841, 12.606, 0.000, 0.637, 0.472, 0.386, 0.000, 0.441,
1.477, 5.339, 0.000, 1.076, 1.477, 5.957, 0.000, 5.176, 1.271,
0.928, 0.000, 0.873,
300, 1.859, 0.470, 0.000, 0.476, 1.824, 0.552, 0.000, 0.551,
1.803, 0.813, 0.000, 0.813, 2.799, 1.107, 0.000, 1.105, 0.944,
3.321, 0.000, 3.011, 0.944, 4.924, 0.000, 3.726, 1.415, 7.434,
0.000, 2.185, 5.863, 22.931, 0.000, 17.677, 1.415, 8.882, 0.000,
5.601, 1.764, 12.510, 0.000, 0.631, 0.453, 0.383, 0.000, 0.427,

1.415, 5.298, 0.000, 1.067, 1.415, 5.912, 0.000, 5.131, 1.218,
0.919, 0.000, 0.864,
360, 1.762, 0.463, 0.000, 0.469, 1.729, 0.544, 0.000, 0.543,
1.709, 0.800, 0.000, 0.800, 2.653, 1.090, 0.000, 1.088, 0.894,
3.279, 0.000, 2.973, 0.894, 4.872, 0.000, 3.686, 1.342, 7.362,
0.000, 2.163, 5.558, 22.709, 0.000, 17.468, 1.342, 8.796, 0.000,
5.547, 1.672, 12.390, 0.000, 0.623, 0.429, 0.380, 0.000, 0.411,
1.342, 5.247, 0.000, 1.057, 1.342, 5.855, 0.000, 5.076, 1.155,
0.908, 0.000, 0.853,
420, 1.649, 0.455, 0.000, 0.460, 1.618, 0.535, 0.000, 0.533,
1.600, 0.785, 0.000, 0.785, 2.484, 1.069, 0.000, 1.067, 0.837,
3.226, 0.000, 2.925, 0.837, 4.808, 0.000, 3.638, 1.256, 7.276,
0.000, 2.136, 5.203, 22.443, 0.000, 17.218, 1.256, 8.693, 0.000,
5.481, 1.565, 12.244, 0.000, 0.614, 0.402, 0.375, 0.000, 0.392,
1.256, 5.185, 0.000, 1.044, 1.256, 5.786, 0.000, 5.011, 1.081,
0.893, 0.000, 0.839,
480, 1.521, 0.445, 0.000, 0.449, 1.492, 0.523, 0.000, 0.521,
1.475, 0.766, 0.000, 0.766, 2.290, 1.043, 0.000, 1.042, 0.772,
3.163, 0.000, 2.867, 0.772, 4.733, 0.000, 3.581, 1.158, 7.174,
0.000, 2.104, 4.798, 22.131, 0.000, 16.927, 1.158, 8.572, 0.000,
5.404, 1.443, 12.074, 0.000, 0.603, 0.370, 0.370, 0.000, 0.370,
1.158, 5.113, 0.000, 1.030, 1.158, 5.706, 0.000, 4.934, 0.997,
0.876, 0.000, 0.822,
540, 1.376, 0.433, 0.000, 0.437, 1.351, 0.510, 0.000, 0.507,
1.335, 0.745, 0.000, 0.744, 2.073, 1.014, 0.000, 1.011, 0.699,
3.089, 0.000, 2.800, 0.699, 4.647, 0.000, 3.515, 1.048, 7.059,
0.000, 2.069, 4.342, 21.773, 0.000, 16.595, 1.048, 8.434, 0.000,
5.316, 1.306, 11.879, 0.000, 0.591, 0.335, 0.364, 0.000, 0.346,
1.048, 5.031, 0.000, 1.013, 1.048, 5.614, 0.000, 4.846, 0.902,
0.856, 0.000, 0.802,
600, 1.216, 0.420, 0.000, 0.423, 1.193, 0.494, 0.000, 0.491,
1.180, 0.720, 0.000, 0.719, 1.831, 0.979, 0.000, 0.977, 0.617,
3.005, 0.000, 2.724, 0.617, 4.549, 0.000, 3.441, 0.926, 6.928,
0.000, 2.028, 3.837, 21.371, 0.000, 16.223, 0.926, 8.278, 0.000,
5.217, 1.154, 11.659, 0.000, 0.577, 0.296, 0.357, 0.000, 0.318,
0.926, 4.938, 0.000, 0.994, 0.926, 5.510, 0.000, 4.747, 0.797,
0.833, 0.000, 0.780,
660, 1.040, 0.405, 0.000, 0.407, 1.021, 0.477, 0.000, 0.473,
1.009, 0.691, 0.000, 0.690, 1.566, 0.941, 0.000, 0.938, 0.528,
2.910, 0.000, 2.638, 0.528, 4.439, 0.000, 3.357, 0.792, 6.783,
0.000, 1.984, 3.281, 20.923, 0.000, 15.809, 0.792, 8.104, 0.000,
5.107, 0.987, 11.415, 0.000, 0.562, 0.253, 0.350, 0.000, 0.288,
0.792, 4.834, 0.000, 0.973, 0.792, 5.394, 0.000, 4.637, 0.682,
0.807, 0.000, 0.754,
720, 0.848, 0.388, 0.000, 0.390, 0.832, 0.457, 0.000, 0.453,
0.823, 0.660, 0.000, 0.659, 1.277, 0.898, 0.000, 0.895, 0.431,
2.805, 0.000, 2.542, 0.431, 4.319, 0.000, 3.265, 0.646, 6.623,
0.000, 1.935, 2.676, 20.430, 0.000, 15.355, 0.646, 7.914, 0.000,
4.986, 0.805, 11.146, 0.000, 0.545, 0.207, 0.342, 0.000, 0.256,
0.646, 4.720, 0.000, 0.949, 0.646, 5.267, 0.000, 4.516, 0.556,
0.779, 0.000, 0.726,

Pollutant Name: Carbon Dioxide,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O

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BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
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min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    5, 111.902,  10.587,   0.000,  11.078, 112.175,  12.825,   0.000,  13.204,
112.294,  13.630,   0.000,  13.793, 135.465,  18.006,   0.000,  18.159, 170.667,
17.842,   0.000,  16.680, 170.667,  13.465,   0.000,  11.141, 170.667,   9.546,
0.000,   6.110, 170.667,   9.546,   0.000,  33.407, 170.667,   9.546,   0.000,
7.242, 170.667,   9.546,   0.000,   4.321,  34.321,   1.787,   0.000,  22.499,
170.667,   9.546,   0.000,   2.403, 170.667,   9.546,   0.000,  23.594,  82.212,
11.753,   0.000,  11.875,
   10, 121.432,  12.775,   0.000,  13.298, 121.728,  15.661,   0.000,  16.037,
121.857,  16.180,   0.000,  16.350, 147.001,  21.734,   0.000,  21.888, 185.200,
24.182,   0.000,  22.467, 185.200,  21.469,   0.000,  17.270, 185.200,  19.039,
0.000,   9.150, 185.200,  19.039,   0.000,  42.599, 185.200,  19.039,   0.000,
13.322, 185.200,  19.039,   0.000,   5.099,  37.244,   3.563,   0.000,  25.006,
185.200,  19.039,   0.000,   4.350, 185.200,  19.039,   0.000,  32.949,  89.214,
14.505,   0.000,  14.504,
   20, 139.927,  17.525,   0.000,  18.106, 140.269,  21.775,   0.000,  22.133,
140.418,  21.780,   0.000,  21.963, 169.391,  29.829,   0.000,  29.977, 213.408,
37.319,   0.000,  34.453, 213.408,  37.608,   0.000,  29.624, 213.408,  37.866,
0.000,  15.165, 213.408,  37.866,   0.000,  60.735, 213.408,  37.866,   0.000,
25.377, 213.408,  37.866,   0.000,   6.628,  42.916,   7.087,   0.000,  29.898,
213.408,  37.866,   0.000,   8.209, 213.408,  37.866,   0.000,  51.445, 102.802,
20.404,   0.000,  20.122,
   30, 157.671,  22.775,   0.000,  23.407, 158.056,  28.478,   0.000,  28.803,
158.224,  28.047,   0.000,  28.237, 190.871,  38.773,   0.000,  38.908, 240.470,
51.064,   0.000,  46.987, 240.470,  53.923,   0.000,  42.105, 240.470,  56.482,
0.000,  21.096, 240.470,  56.482,   0.000,  78.540, 240.470,  56.482,   0.000,
37.291, 240.470,  56.482,   0.000,   8.121,  48.358,  10.571,   0.000,  34.628,
240.470,  56.482,   0.000,  12.023, 240.470,  56.482,   0.000,  69.659, 115.838,
26.830,   0.000,  26.219,
   40, 174.663,  28.525,   0.000,  29.199, 175.089,  35.771,   0.000,  36.045,
175.275,  34.981,   0.000,  35.175, 211.441,  48.567,   0.000,  48.683, 266.386,
65.419,   0.000,  60.068, 266.386,  70.414,   0.000,  54.712, 266.386,  74.887,
0.000,  26.944, 266.386,  74.887,   0.000,  96.012, 266.386,  74.887,   0.000,
49.063, 266.386,  74.887,   0.000,   9.578,  53.570,  14.016,   0.000,  39.198,
266.386,  74.887,   0.000,  15.791, 266.386,  74.887,   0.000,  87.589, 128.322,
33.782,   0.000,  32.795,
   50, 190.904,  34.775,   0.000,  35.485, 191.370,  43.652,   0.000,  43.861,
191.573,  42.582,   0.000,  42.775, 231.101,  59.211,   0.000,  59.300, 291.155,
80.383,   0.000,  73.698, 291.155,  87.082,   0.000,  67.447, 291.155,  93.081,
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Pollutant Name: Sulfur Dioxide,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
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0.008,   0.005,   0.000,   0.001,   0.008,   0.006,   0.000,   0.006,   0.004,
0.002,   0.000,   0.002,
  720,   0.004,   0.002,   0.000,   0.002,   0.004,   0.003,   0.000,   0.003,
0.004,   0.003,   0.000,   0.003,   0.006,   0.004,   0.000,   0.004,   0.007,
0.005,   0.000,   0.004,   0.007,   0.005,   0.000,   0.004,   0.008,   0.006,
0.000,   0.002,   0.018,   0.009,   0.000,   0.009,   0.008,   0.006,   0.000,
0.004,   0.008,   0.007,   0.000,   0.001,   0.001,   0.001,   0.196,   0.001,
0.008,   0.005,   0.000,   0.001,   0.008,   0.006,   0.000,   0.006,   0.004,
0.003,   0.000,   0.002,
```

Pollutant Name: PM10,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

5, 0.011, 0.001, 0.000, 0.001, 0.011, 0.001, 0.000, 0.001,
0.011, 0.001, 0.000, 0.001, 0.012, 0.001, 0.000, 0.001, 0.011,
0.001, 0.000, 0.001, 0.011, 0.001, 0.000, 0.001, 0.011, 0.001,
0.000, 0.001, 0.011, 0.002, 0.000, 0.003, 0.011, 0.002, 0.000,
0.001, 0.011, 0.002, 0.000, 0.000, 0.020, 0.000, 0.000, 0.013,
0.011, 0.001, 0.000, 0.000, 0.011, 0.000, 0.000, 0.001, 0.016,
0.001, 0.000, 0.001,
10, 0.010, 0.001, 0.000, 0.001, 0.010, 0.001, 0.000, 0.001,
0.010, 0.002, 0.000, 0.002, 0.010, 0.003, 0.000, 0.003, 0.010,
0.002, 0.000, 0.001, 0.010, 0.002, 0.000, 0.002, 0.010, 0.003,
0.000, 0.001, 0.010, 0.004, 0.000, 0.004, 0.010, 0.003, 0.000,
0.002, 0.010, 0.003, 0.000, 0.000, 0.017, 0.000, 0.000, 0.011,
0.010, 0.002, 0.000, 0.000, 0.010, 0.001, 0.000, 0.002, 0.014,
0.001, 0.000, 0.002,
20, 0.008, 0.002, 0.000, 0.002, 0.008, 0.003, 0.000, 0.003,
0.008, 0.004, 0.000, 0.004, 0.008, 0.006, 0.000, 0.006, 0.008,
0.003, 0.000, 0.003, 0.008, 0.005, 0.000, 0.004, 0.008, 0.005,
0.000, 0.002, 0.008, 0.007, 0.000, 0.006, 0.008, 0.006, 0.000,
0.004, 0.008, 0.007, 0.000, 0.000, 0.013, 0.001, 0.000, 0.009,
0.008, 0.003, 0.000, 0.001, 0.008, 0.001, 0.000, 0.002, 0.011,
0.003, 0.000, 0.003,
30, 0.006, 0.003, 0.000, 0.003, 0.006, 0.004, 0.000, 0.004,
0.006, 0.007, 0.000, 0.006, 0.006, 0.008, 0.000, 0.008, 0.006,
0.004, 0.000, 0.004, 0.006, 0.007, 0.000, 0.005, 0.006, 0.007,
0.000, 0.002, 0.006, 0.010, 0.000, 0.008, 0.006, 0.008, 0.000,
0.005, 0.006, 0.009, 0.000, 0.001, 0.010, 0.001, 0.000, 0.007,
0.006, 0.004, 0.000, 0.001, 0.006, 0.002, 0.000, 0.002, 0.008,
0.004, 0.000, 0.004,
40, 0.004, 0.004, 0.000, 0.004, 0.004, 0.005, 0.000, 0.005,
0.004, 0.008, 0.000, 0.008, 0.004, 0.010, 0.000, 0.010, 0.004,
0.006, 0.000, 0.005, 0.004, 0.009, 0.000, 0.007, 0.004, 0.009,
0.000, 0.003, 0.004, 0.012, 0.000, 0.010, 0.004, 0.010, 0.000,
0.007, 0.004, 0.012, 0.000, 0.001, 0.008, 0.001, 0.000, 0.005,
0.004, 0.005, 0.000, 0.001, 0.004, 0.003, 0.000, 0.003, 0.006,
0.005, 0.000, 0.005,
50, 0.003, 0.005, 0.000, 0.005, 0.003, 0.006, 0.000, 0.006,
0.003, 0.010, 0.000, 0.010, 0.003, 0.013, 0.000, 0.013, 0.003,
0.007, 0.000, 0.006, 0.003, 0.010, 0.000, 0.008, 0.003, 0.011,
0.000, 0.003, 0.003, 0.015, 0.000, 0.011, 0.003, 0.012, 0.000,
0.008, 0.003, 0.014, 0.000, 0.001, 0.006, 0.002, 0.000, 0.004,
0.003, 0.006, 0.000, 0.001, 0.003, 0.003, 0.000, 0.003, 0.005,
0.006, 0.000, 0.006,
60, 0.003, 0.005, 0.000, 0.005, 0.003, 0.007, 0.000, 0.007,
0.003, 0.012, 0.000, 0.012, 0.003, 0.015, 0.000, 0.015, 0.003,
0.008, 0.000, 0.007, 0.003, 0.012, 0.000, 0.009, 0.003, 0.012,
0.000, 0.004, 0.003, 0.017, 0.000, 0.013, 0.003, 0.014, 0.000,
0.009, 0.003, 0.016, 0.000, 0.001, 0.005, 0.002, 0.000, 0.004,
0.003, 0.007, 0.000, 0.001, 0.003, 0.004, 0.000, 0.003, 0.004,
0.007, 0.000, 0.007,
120, 0.007, 0.008, 0.000, 0.008, 0.007, 0.010, 0.000, 0.010,
0.007, 0.018, 0.000, 0.018, 0.007, 0.022, 0.000, 0.022, 0.007,

```
0.011,   0.000,   0.010,   0.007,   0.016,   0.000,   0.012,   0.007,   0.017,
0.000,   0.005,   0.007,   0.023,   0.000,   0.018,   0.007,   0.019,   0.000,
0.012,   0.007,   0.022,   0.000,   0.001,   0.013,   0.002,   0.000,   0.009,
0.007,   0.010,   0.000,   0.002,   0.007,   0.005,   0.000,   0.005,   0.010,
0.011,   0.000,   0.010,
  180,   0.011,   0.009,   0.000,   0.009,   0.011,   0.011,   0.000,   0.010,
0.012,   0.019,   0.000,   0.019,   0.012,   0.024,   0.000,   0.024,   0.011,
0.011,   0.000,   0.010,   0.011,   0.017,   0.000,   0.013,   0.011,   0.017,
0.000,   0.005,   0.011,   0.024,   0.000,   0.019,   0.011,   0.020,   0.000,
0.013,   0.011,   0.023,   0.000,   0.001,   0.020,   0.002,   0.000,   0.014,
0.011,   0.010,   0.000,   0.002,   0.011,   0.005,   0.000,   0.005,   0.016,
0.012,   0.000,   0.011,
  240,   0.015,   0.009,   0.000,   0.009,   0.015,   0.011,   0.000,   0.011,
0.015,   0.020,   0.000,   0.020,   0.015,   0.025,   0.000,   0.025,   0.015,
0.012,   0.000,   0.011,   0.015,   0.018,   0.000,   0.013,   0.015,   0.018,
0.000,   0.005,   0.015,   0.025,   0.000,   0.020,   0.015,   0.021,   0.000,
0.013,   0.015,   0.024,   0.000,   0.001,   0.026,   0.002,   0.000,   0.018,
0.015,   0.011,   0.000,   0.002,   0.015,   0.005,   0.000,   0.006,   0.021,
0.012,   0.000,   0.012,
  300,   0.018,   0.010,   0.000,   0.010,   0.018,   0.012,   0.000,   0.012,
0.019,   0.022,   0.000,   0.021,   0.019,   0.027,   0.000,   0.026,   0.018,
0.012,   0.000,   0.011,   0.018,   0.018,   0.000,   0.014,   0.018,   0.018,
0.000,   0.006,   0.018,   0.025,   0.000,   0.021,   0.018,   0.021,   0.000,
0.013,   0.018,   0.024,   0.000,   0.002,   0.032,   0.003,   0.000,   0.021,
0.018,   0.011,   0.000,   0.002,   0.018,   0.005,   0.000,   0.006,   0.025,
0.013,   0.000,   0.012,
  360,   0.021,   0.010,   0.000,   0.010,   0.021,   0.012,   0.000,   0.012,
0.021,   0.023,   0.000,   0.022,   0.022,   0.028,   0.000,   0.028,   0.021,
0.013,   0.000,   0.012,   0.021,   0.019,   0.000,   0.014,   0.021,   0.019,
0.000,   0.006,   0.021,   0.026,   0.000,   0.022,   0.021,   0.022,   0.000,
0.014,   0.021,   0.025,   0.000,   0.002,   0.037,   0.003,   0.000,   0.025,
0.021,   0.011,   0.000,   0.002,   0.021,   0.006,   0.000,   0.007,   0.029,
0.014,   0.000,   0.013,
  420,   0.023,   0.011,   0.000,   0.011,   0.023,   0.013,   0.000,   0.013,
0.024,   0.023,   0.000,   0.023,   0.024,   0.029,   0.000,   0.029,   0.023,
0.013,   0.000,   0.012,   0.023,   0.019,   0.000,   0.015,   0.023,   0.019,
0.000,   0.006,   0.023,   0.027,   0.000,   0.023,   0.023,   0.022,   0.000,
0.014,   0.023,   0.026,   0.000,   0.002,   0.041,   0.003,   0.000,   0.027,
0.023,   0.012,   0.000,   0.002,   0.023,   0.006,   0.000,   0.007,   0.033,
0.014,   0.000,   0.014,
  480,   0.025,   0.011,   0.000,   0.011,   0.025,   0.013,   0.000,   0.013,
0.026,   0.024,   0.000,   0.024,   0.026,   0.030,   0.000,   0.030,   0.025,
0.013,   0.000,   0.012,   0.025,   0.020,   0.000,   0.015,   0.025,   0.020,
0.000,   0.006,   0.025,   0.028,   0.000,   0.024,   0.025,   0.023,   0.000,
0.015,   0.025,   0.026,   0.000,   0.002,   0.045,   0.003,   0.000,   0.029,
0.025,   0.012,   0.000,   0.002,   0.025,   0.006,   0.000,   0.007,   0.035,
0.015,   0.000,   0.014,
  540,   0.027,   0.011,   0.000,   0.011,   0.026,   0.014,   0.000,   0.014,
0.027,   0.025,   0.000,   0.025,   0.028,   0.031,   0.000,   0.031,   0.027,
0.014,   0.000,   0.013,   0.027,   0.020,   0.000,   0.016,   0.027,   0.021,
0.000,   0.007,   0.027,   0.028,   0.000,   0.025,   0.027,   0.024,   0.000,
0.015,   0.027,   0.027,   0.000,   0.002,   0.047,   0.003,   0.000,   0.031,
0.027,   0.012,   0.000,   0.003,   0.027,   0.006,   0.000,   0.008,   0.037,
0.015,   0.000,   0.014,
  600,   0.028,   0.012,   0.000,   0.012,   0.027,   0.014,   0.000,   0.014,
0.029,   0.025,   0.000,   0.025,   0.029,   0.031,   0.000,   0.031,   0.028,
0.014,   0.000,   0.013,   0.028,   0.021,   0.000,   0.016,   0.028,   0.021,
```

```
0.000,   0.007,   0.028,   0.029,   0.000,   0.026,   0.028,   0.025,   0.000,
0.016,   0.028,   0.028,   0.000,   0.002,   0.049,   0.003,   0.000,   0.032,
0.028,   0.013,   0.000,   0.003,   0.028,   0.006,   0.000,   0.008,   0.039,
0.015,   0.000,   0.015,
  660,   0.029,   0.012,   0.000,   0.012,   0.028,   0.014,   0.000,   0.014,
0.029,   0.026,   0.000,   0.026,   0.029,   0.032,   0.000,   0.032,   0.029,
0.015,   0.000,   0.013,   0.029,   0.022,   0.000,   0.016,   0.029,   0.022,
0.000,   0.007,   0.029,   0.030,   0.000,   0.026,   0.029,   0.025,   0.000,
0.016,   0.029,   0.029,   0.000,   0.002,   0.050,   0.003,   0.000,   0.033,
0.029,   0.013,   0.000,   0.003,   0.029,   0.006,   0.000,   0.008,   0.040,
0.016,   0.000,   0.015,
  720,   0.029,   0.012,   0.000,   0.012,   0.028,   0.014,   0.000,   0.014,
0.029,   0.026,   0.000,   0.026,   0.030,   0.032,   0.000,   0.032,   0.029,
0.015,   0.000,   0.014,   0.029,   0.022,   0.000,   0.017,   0.029,   0.022,
0.000,   0.007,   0.029,   0.031,   0.000,   0.027,   0.029,   0.026,   0.000,
0.017,   0.029,   0.030,   0.000,   0.002,   0.051,   0.003,   0.000,   0.033,
0.029,   0.013,   0.000,   0.003,   0.029,   0.007,   0.000,   0.008,   0.040,
0.016,   0.000,   0.015,
```

```
Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area     : San Francisco
********************************************************************************
*********
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,,  San Francisco,,,,,,County Average

,,,,Table  4:  Hot Soak Emissions (grams/trip)

Pollutant Name: Total Organic Gases,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    5,   0.821,   0.053,   0.000,   0.057,   0.834,   0.063,   0.000,   0.067,
0.827,   0.046,   0.000,   0.048,   0.403,   0.041,   0.000,   0.042,   0.356,
0.020,   0.000,   0.020,   0.356,   0.044,   0.000,   0.035,   0.205,   0.017,
0.000,   0.009,   0.205,   0.019,   0.000,   0.046,   0.205,   0.012,   0.000,
0.009,   0.857,   0.343,   0.000,   0.036,   0.110,   0.155,   0.000,   0.126,
```

```
0.202,   0.009,   0.000,   0.002,   0.204,   0.082,   0.000,   0.088,   0.353,
0.051,   0.000,   0.052,
   10,   1.513,   0.098,   0.000,   0.105,   1.536,   0.117,   0.000,   0.123,
1.523,   0.086,   0.000,   0.088,   0.743,   0.076,   0.000,   0.077,   0.657,
0.038,   0.000,   0.036,   0.656,   0.081,   0.000,   0.065,   0.378,   0.032,
0.000,   0.017,   0.378,   0.035,   0.000,   0.084,   0.378,   0.023,   0.000,
0.017,   1.578,   0.633,   0.000,   0.066,   0.202,   0.288,   0.000,   0.233,
0.373,   0.017,   0.000,   0.004,   0.376,   0.151,   0.000,   0.162,   0.650,
0.095,   0.000,   0.096,
   20,   2.568,   0.168,   0.000,   0.179,   2.607,   0.200,   0.000,   0.210,
2.585,   0.146,   0.000,   0.151,   1.261,   0.130,   0.000,   0.131,   1.114,
0.065,   0.000,   0.062,   1.114,   0.139,   0.000,   0.112,   0.641,   0.056,
0.000,   0.029,   0.642,   0.062,   0.000,   0.144,   0.642,   0.039,   0.000,
0.029,   2.678,   1.079,   0.000,   0.112,   0.344,   0.497,   0.000,   0.400,
0.632,   0.029,   0.000,   0.008,   0.638,   0.257,   0.000,   0.275,   1.103,
0.162,   0.000,   0.163,
   30,   3.280,   0.215,   0.000,   0.230,   3.328,   0.256,   0.000,   0.270,
3.301,   0.188,   0.000,   0.194,   1.610,   0.167,   0.000,   0.169,   1.422,
0.084,   0.000,   0.081,   1.422,   0.180,   0.000,   0.144,   0.818,   0.074,
0.000,   0.038,   0.820,   0.081,   0.000,   0.186,   0.819,   0.050,   0.000,
0.038,   3.419,   1.385,   0.000,   0.143,   0.440,   0.647,   0.000,   0.516,
0.807,   0.037,   0.000,   0.010,   0.814,   0.329,   0.000,   0.353,   1.409,
0.208,   0.000,   0.210,
   40,   3.539,   0.233,   0.000,   0.249,   3.590,   0.278,   0.000,   0.292,
3.560,   0.204,   0.000,   0.210,   1.737,   0.181,   0.000,   0.183,   1.534,
0.092,   0.000,   0.088,   1.534,   0.196,   0.000,   0.157,   0.883,   0.082,
0.000,   0.041,   0.884,   0.089,   0.000,   0.202,   0.884,   0.055,   0.000,
0.041,   3.688,   1.498,   0.000,   0.154,   0.476,   0.706,   0.000,   0.559,
0.871,   0.040,   0.000,   0.011,   0.878,   0.356,   0.000,   0.381,   1.520,
0.225,   0.000,   0.227,
```

Hot soak results are scaled to reflect zero emissions for trip lengths of less than 5 minutes (about 25% of in-use trips).

```
Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area     : San Francisco
*******************************************************************************
*********
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,,  San Francisco,,,,,,County Average

,,,,Table 5a:  Partial Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity: ALL
```

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CA
T,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NC
AT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
LL,

   57,   0.255,   0.037,   0.000,   0.039,   0.253,   0.045,   0.000,   0.046,
0.256,   0.033,   0.000,   0.034,   0.131,   0.030,   0.000,   0.030,   0.014,
0.002,   0.000,   0.001,   0.014,   0.004,   0.000,   0.002,   0.013,   0.004,
0.000,   0.001,   0.012,   0.003,   0.000,   0.002,   0.013,   0.002,   0.000,
0.001,   0.011,   0.006,   0.000,   0.001,   0.038,   0.143,   0.000,   0.076,
0.017,   0.001,   0.000,   0.000,   0.014,   0.009,   0.000,   0.009,   0.087,
0.038,   0.000,   0.039,

Title   : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area   : San Francisco
****
****
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 5b: Multi-Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity: ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CA
T,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NC
AT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
LL,

   57,   0.015,   0.003,   0.000,   0.003,   0.015,   0.004,   0.000,   0.004,
0.015,   0.003,   0.000,   0.003,   0.008,   0.002,   0.000,   0.002,   0.000,
0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,   0.001,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,
0.000,   0.003,   0.002,   0.000,   0.000,   0.002,   0.014,   0.000,   0.006,
0.001,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,   0.005,
0.003,   0.000,   0.003,

```
Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area     : San Francisco
*********************************************************************************
*********
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,,  San Francisco,,,,,,County Average

,,,,Table 6a:  Partial Day Resting Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity: ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CA
T,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NC
AT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
LL,

   57,   0.159,   0.020,   0.000,   0.021,   0.159,   0.024,   0.000,   0.025,
0.162,   0.018,   0.000,   0.019,   0.084,   0.017,   0.000,   0.017,   0.009,
0.001,   0.000,   0.001,   0.010,   0.002,   0.000,   0.001,   0.009,   0.002,
0.000,   0.001,   0.008,   0.002,   0.000,   0.001,   0.009,   0.001,   0.000,
0.001,   0.007,   0.004,   0.000,   0.000,   0.022,   0.059,   0.000,   0.036,
0.012,   0.001,   0.000,   0.000,   0.010,   0.006,   0.000,   0.006,   0.054,
0.020,   0.000,   0.021,
```


```
Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area     : San Francisco
*********************************************************************************
*********
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,,  San Francisco,,,,,,County Average
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,,,,Table 6b:  Multi-Day Resting Loss Emissions (grams/hour)
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Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity: ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

57, 0.010, 0.002, 0.000, 0.002, 0.010, 0.002, 0.000, 0.002,
0.010, 0.001, 0.000, 0.001, 0.005, 0.001, 0.000, 0.001, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.002, 0.001, 0.000, 0.000, 0.001, 0.006, 0.000, 0.003,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.003,
0.002, 0.000, 0.002,

Title : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season : Annual
Area : San Francisco
****
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 7: Estimated Travel Fractions

Pollutant Name: ,,,,Temperature: ALL,,Relative Humidity: ALL

,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,
,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

%VMT, 0.002, 0.606, 0.001, 0.610, 0.001, 0.109, 0.001, 0.111,
0.000, 0.161, 0.000, 0.162, 0.000, 0.053, 0.000, 0.053, 0.000,
0.004, 0.001, 0.006, 0.000, 0.003, 0.002, 0.005, 0.000, 0.004,
0.023, 0.028, 0.000, 0.001, 0.002, 0.003, 0.000, 0.001, 0.001,
0.002, 0.000, 0.000, 0.010, 0.010, 0.005, 0.004, 0.000, 0.009,
0.000, 0.000, 0.001, 0.001, 0.000, 0.001, 0.000, 0.001, 0.009,
0.947, 0.044, 1.000,

```
%TRIP,   0.003,   0.575,   0.001,   0.580,   0.001,   0.101,   0.001,   0.103,
0.000,   0.146,   0.000,   0.147,   0.000,   0.042,   0.000,   0.042,   0.000,
0.017,   0.002,   0.019,   0.000,   0.012,   0.004,   0.016,   0.001,   0.021,
0.051,   0.073,   0.000,   0.002,   0.000,   0.003,   0.000,   0.004,   0.002,
0.006,   0.000,   0.000,   0.001,   0.002,   0.006,   0.004,   0.000,   0.010,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.012,
0.924,   0.064,   1.000,
%VEH,   0.005,   0.616,   0.002,   0.623,   0.001,   0.108,   0.002,   0.111,
0.000,   0.156,   0.000,   0.157,   0.000,   0.045,   0.000,   0.045,   0.000,
0.003,   0.001,   0.004,   0.000,   0.002,   0.002,   0.005,   0.000,   0.003,
0.012,   0.015,   0.000,   0.000,   0.000,   0.001,   0.000,   0.001,   0.001,
0.001,   0.000,   0.000,   0.002,   0.003,   0.021,   0.012,   0.000,   0.034,
0.000,   0.000,   0.001,   0.001,   0.000,   0.001,   0.000,   0.002,   0.029,
0.948,   0.023,   1.000,
```

```
Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2011 -- All model years in the range 1967 to 2011 selected
Season   : Annual
Area     : San Francisco
********************************************************************************
*********
Year:,2011,, -- Model Years,,1967, to ,2011, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,,  San Francisco,,,,,,County Average

,,,,Table  8:  Evaporative Running Loss Emissions (grams/minute)

Pollutant Name: Total Organic Gases,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    1,   1.501,   0.014,   0.000,   0.020,   1.596,   0.581,   0.000,   0.579,
1.544,   0.398,   0.000,   0.399,   0.812,   0.302,   0.000,   0.301,   1.710,
0.387,   0.000,   0.305,   1.621,   1.096,   0.000,   0.598,   1.646,   0.374,
0.000,   0.060,   2.595,   0.566,   0.000,   0.147,   1.897,   0.302,   0.000,
0.139,   3.705,   5.276,   0.000,   0.333,   0.152,   0.003,   0.000,   0.086,
1.952,   0.204,   0.000,   0.047,   1.315,   3.763,   0.000,   3.321,   0.794,
0.172,   0.000,   0.170,
    2,   1.393,   0.018,   0.000,   0.023,   1.155,   0.298,   0.000,   0.298,
1.102,   0.204,   0.000,   0.206,   0.524,   0.155,   0.000,   0.156,   1.137,
0.205,   0.000,   0.162,   1.090,   0.576,   0.000,   0.315,   1.111,   0.213,
```

```
0.000,   0.035,   1.726,   0.309,   0.000,   0.083,   1.179,   0.159,   0.000,
0.074,   2.117,   2.772,   0.000,   0.179,   0.154,   0.085,   0.000,   0.123,
1.178,   0.108,   0.000,   0.025,   0.952,   1.994,   0.000,   1.779,   0.667,
0.096,   0.000,   0.097,
    3,   1.358,   0.022,   0.000,   0.027,   1.008,   0.206,   0.000,   0.208,
0.955,   0.142,   0.000,   0.143,   0.429,   0.109,   0.000,   0.109,   0.946,
0.146,   0.000,   0.115,   0.913,   0.405,   0.000,   0.222,   0.932,   0.161,
0.000,   0.026,   1.437,   0.225,   0.000,   0.062,   0.940,   0.115,   0.000,
0.053,   1.588,   1.939,   0.000,   0.128,   0.155,   0.128,   0.000,   0.143,
0.921,   0.078,   0.000,   0.018,   0.833,   1.407,   0.000,   1.268,   0.625,
0.073,   0.000,   0.075,
    4,   1.341,   0.026,   0.000,   0.031,   0.935,   0.162,   0.000,   0.164,
0.882,   0.112,   0.000,   0.113,   0.381,   0.087,   0.000,   0.088,   0.851,
0.117,   0.000,   0.093,   0.825,   0.321,   0.000,   0.176,   0.843,   0.136,
0.000,   0.022,   1.293,   0.185,   0.000,   0.052,   0.821,   0.094,   0.000,
0.043,   1.324,   1.523,   0.000,   0.102,   0.157,   0.152,   0.000,   0.155,
0.792,   0.065,   0.000,   0.015,   0.778,   1.116,   0.000,   1.015,   0.605,
0.063,   0.000,   0.065,
    5,   1.331,   0.028,   0.000,   0.033,   0.891,   0.136,   0.000,   0.138,
0.839,   0.095,   0.000,   0.096,   0.352,   0.075,   0.000,   0.075,   0.794,
0.101,   0.000,   0.080,   0.772,   0.271,   0.000,   0.149,   0.790,   0.121,
0.000,   0.020,   1.207,   0.161,   0.000,   0.046,   0.749,   0.082,   0.000,
0.038,   1.165,   1.274,   0.000,   0.087,   0.160,   0.167,   0.000,   0.163,
0.715,   0.057,   0.000,   0.013,   0.746,   0.943,   0.000,   0.864,   0.594,
0.058,   0.000,   0.060,
   10,   1.313,   0.034,   0.000,   0.039,   0.805,   0.088,   0.000,   0.090,
0.752,   0.063,   0.000,   0.064,   0.295,   0.052,   0.000,   0.052,   0.681,
0.070,   0.000,   0.055,   0.667,   0.176,   0.000,   0.097,   0.685,   0.093,
0.000,   0.016,   1.036,   0.113,   0.000,   0.034,   0.607,   0.060,   0.000,
0.028,   0.849,   0.778,   0.000,   0.056,   0.171,   0.200,   0.000,   0.184,
0.561,   0.043,   0.000,   0.010,   0.683,   0.599,   0.000,   0.565,   0.576,
0.048,   0.000,   0.051,
   15,   1.309,   0.036,   0.000,   0.041,   0.778,   0.075,   0.000,   0.078,
0.725,   0.055,   0.000,   0.056,   0.277,   0.047,   0.000,   0.047,   0.644,
0.062,   0.000,   0.049,   0.634,   0.149,   0.000,   0.082,   0.651,   0.086,
0.000,   0.014,   0.980,   0.099,   0.000,   0.030,   0.561,   0.055,   0.000,
0.025,   0.745,   0.614,   0.000,   0.046,   0.181,   0.211,   0.000,   0.194,
0.511,   0.040,   0.000,   0.009,   0.664,   0.488,   0.000,   0.469,   0.574,
0.046,   0.000,   0.049,
   20,   1.309,   0.038,   0.000,   0.043,   0.765,   0.071,   0.000,   0.074,
0.712,   0.053,   0.000,   0.054,   0.268,   0.046,   0.000,   0.046,   0.626,
0.060,   0.000,   0.048,   0.617,   0.139,   0.000,   0.077,   0.634,   0.084,
0.000,   0.014,   0.954,   0.093,   0.000,   0.028,   0.538,   0.054,   0.000,
0.025,   0.694,   0.533,   0.000,   0.041,   0.191,   0.217,   0.000,   0.202,
0.486,   0.040,   0.000,   0.009,   0.655,   0.435,   0.000,   0.422,   0.577,
0.047,   0.000,   0.049,
   25,   1.310,   0.039,   0.000,   0.044,   0.758,   0.071,   0.000,   0.074,
0.705,   0.054,   0.000,   0.055,   0.263,   0.047,   0.000,   0.047,   0.617,
0.060,   0.000,   0.048,   0.608,   0.136,   0.000,   0.075,   0.625,   0.084,
0.000,   0.014,   0.939,   0.090,   0.000,   0.028,   0.525,   0.055,   0.000,
0.026,   0.664,   0.486,   0.000,   0.038,   0.201,   0.220,   0.000,   0.210,
0.472,   0.041,   0.000,   0.010,   0.650,   0.405,   0.000,   0.396,   0.581,
0.048,   0.000,   0.050,
   30,   1.313,   0.039,   0.000,   0.044,   0.760,   0.072,   0.000,   0.074,
0.707,   0.054,   0.000,   0.055,   0.264,   0.047,   0.000,   0.047,   0.618,
0.060,   0.000,   0.048,   0.610,   0.136,   0.000,   0.075,   0.627,   0.084,
0.000,   0.014,   0.941,   0.090,   0.000,   0.028,   0.527,   0.055,   0.000,
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0.026,   0.666,   0.487,   0.000,   0.038,   0.201,   0.221,   0.000,   0.210,
0.473,   0.041,   0.000,   0.010,   0.652,   0.406,   0.000,   0.398,   0.582,
0.048,   0.000,   0.050,
   35,   1.316,   0.039,   0.000,   0.044,   0.762,   0.072,   0.000,   0.074,
0.709,   0.054,   0.000,   0.055,   0.264,   0.047,   0.000,   0.047,   0.620,
0.060,   0.000,   0.048,   0.611,   0.137,   0.000,   0.076,   0.628,   0.084,
0.000,   0.014,   0.944,   0.090,   0.000,   0.028,   0.528,   0.055,   0.000,
0.026,   0.667,   0.489,   0.000,   0.038,   0.202,   0.221,   0.000,   0.210,
0.474,   0.041,   0.000,   0.010,   0.654,   0.407,   0.000,   0.399,   0.584,
0.048,   0.000,   0.050,
   40,   1.319,   0.039,   0.000,   0.044,   0.764,   0.072,   0.000,   0.074,
0.710,   0.054,   0.000,   0.055,   0.265,   0.047,   0.000,   0.047,   0.621,
0.060,   0.000,   0.048,   0.613,   0.137,   0.000,   0.076,   0.630,   0.084,
0.000,   0.014,   0.946,   0.091,   0.000,   0.028,   0.530,   0.055,   0.000,
0.026,   0.669,   0.490,   0.000,   0.038,   0.202,   0.222,   0.000,   0.211,
0.475,   0.041,   0.000,   0.010,   0.655,   0.408,   0.000,   0.400,   0.585,
0.048,   0.000,   0.050,
   45,   1.322,   0.039,   0.000,   0.044,   0.766,   0.072,   0.000,   0.075,
0.712,   0.054,   0.000,   0.055,   0.266,   0.047,   0.000,   0.047,   0.623,
0.060,   0.000,   0.048,   0.614,   0.137,   0.000,   0.076,   0.631,   0.084,
0.000,   0.014,   0.948,   0.091,   0.000,   0.028,   0.531,   0.055,   0.000,
0.026,   0.671,   0.491,   0.000,   0.038,   0.203,   0.222,   0.000,   0.211,
0.476,   0.041,   0.000,   0.010,   0.657,   0.410,   0.000,   0.401,   0.586,
0.048,   0.000,   0.050,
   50,   1.296,   0.039,   0.000,   0.044,   0.760,   0.072,   0.000,   0.075,
0.707,   0.054,   0.000,   0.055,   0.265,   0.047,   0.000,   0.048,   0.620,
0.060,   0.000,   0.048,   0.611,   0.137,   0.000,   0.076,   0.627,   0.085,
0.000,   0.014,   0.940,   0.091,   0.000,   0.028,   0.532,   0.056,   0.000,
0.026,   0.671,   0.493,   0.000,   0.038,   0.199,   0.222,   0.000,   0.209,
0.478,   0.041,   0.000,   0.010,   0.655,   0.411,   0.000,   0.402,   0.576,
0.048,   0.000,   0.050,
   55,   1.259,   0.039,   0.000,   0.043,   0.751,   0.072,   0.000,   0.075,
0.699,   0.054,   0.000,   0.055,   0.263,   0.047,   0.000,   0.048,   0.615,
0.060,   0.000,   0.048,   0.606,   0.138,   0.000,   0.076,   0.620,   0.085,
0.000,   0.014,   0.928,   0.091,   0.000,   0.028,   0.533,   0.056,   0.000,
0.026,   0.671,   0.494,   0.000,   0.039,   0.193,   0.223,   0.000,   0.206,
0.479,   0.041,   0.000,   0.010,   0.652,   0.411,   0.000,   0.402,   0.562,
0.048,   0.000,   0.050,
   60,   1.228,   0.038,   0.000,   0.043,   0.744,   0.072,   0.000,   0.075,
0.693,   0.054,   0.000,   0.056,   0.262,   0.047,   0.000,   0.048,   0.611,
0.060,   0.000,   0.048,   0.601,   0.138,   0.000,   0.076,   0.615,   0.085,
0.000,   0.014,   0.918,   0.091,   0.000,   0.028,   0.534,   0.056,   0.000,
0.026,   0.671,   0.495,   0.000,   0.039,   0.188,   0.223,   0.000,   0.203,
0.480,   0.041,   0.000,   0.010,   0.649,   0.412,   0.000,   0.403,   0.550,
0.047,   0.000,   0.050,
```

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Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season   : Annual
Area     : San Francisco
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Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 1: Running Exhaust Emissions (grams/mile; grams/idle-hour)

Pollutant Name: Total Organic Gases,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000, 21.754,
22.793,   3.612, 18.867, 21.754, 23.152,   3.612, 14.598, 21.754, 22.896,
3.612,   6.890,   0.000,   0.000,   9.682,   9.074,   0.000, 22.419,   3.612,
8.549,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000, 22.126,   3.612,   6.854,   0.000,   0.000,   0.000,   0.000,   0.043,
0.302,   3.093,   0.417,
5, 10.081,   0.133,   0.363,   0.133,   8.243,   0.194,   0.256,   0.195,
8.818,   0.222,   0.238,   0.223, 33.582,   0.321,   0.227,   0.330, 20.589,
0.384,   0.415,   0.392, 20.589,   0.471,   0.477,   0.475, 30.878,   0.814,
0.419,   0.493, 89.683, 21.693,   4.184,   5.291,   0.000,   1.953,   0.349,
0.770,   0.000, 49.630,   2.634,   6.067,   6.762,   4.437,   0.000,   5.273,
0.000,   2.020,   1.101,   1.262, 30.878,   1.274,   0.280,   1.246,   6.973,
0.242,   1.191,   0.304,
10,   7.182,   0.088,   0.285,   0.088,   5.873,   0.130,   0.201,   0.131,
6.283,   0.147,   0.187,   0.147, 23.918,   0.212,   0.178,   0.218, 13.495,
0.252,   0.326,   0.268, 13.495,   0.309,   0.375,   0.339, 20.236,   0.534,
0.329,   0.368, 58.768, 14.218,   2.289,   3.043,   0.000,   1.281,   0.274,
0.538,   0.000, 32.522,   1.910,   4.147,   5.343,   3.260,   0.000,   4.009,
0.000,   1.325,   0.864,   0.945, 20.236,   0.836,   0.220,   0.821,   5.477,
0.162,   0.832,   0.208,
15,   5.355,   0.061,   0.229,   0.061,   4.379,   0.092,   0.162,   0.093,
4.685,   0.102,   0.150,   0.103, 17.826,   0.148,   0.143,   0.152,   9.221,
0.172,   0.261,   0.191,   9.221,   0.211,   0.301,   0.251, 13.825,   0.365,
0.264,   0.284, 40.143,   9.714,   1.091,   1.636,   0.000,   0.876,   0.220,
0.392,   0.000, 22.215,   1.435,   2.953,   4.418,   2.526,   0.000,   3.206,
0.000,   0.906,   0.693,   0.731, 13.825,   0.572,   0.176,   0.564,   4.505,
0.114,   0.595,   0.149,
20,   4.178,   0.045,   0.188,   0.045,   3.418,   0.068,   0.132,   0.069,
3.656,   0.075,   0.123,   0.075, 13.904,   0.108,   0.117,   0.112,   6.568,
0.123,   0.214,   0.142,   6.568,   0.151,   0.247,   0.193,   9.846,   0.260,
0.217,   0.226, 28.583,   6.919,   0.622,   1.020,   0.000,   0.625,   0.180,
0.297,   0.000, 15.818,   1.117,   2.191,   3.822,   2.065,   0.000,   2.696,
0.000,   0.646,   0.569,   0.582,   9.846,   0.408,   0.145,   0.404,   3.879,
0.084,   0.456,   0.113,

25,	3.411,	0.034,	0.157,	0.035,	2.791,	0.053,	0.111,	0.053,
2.985,	0.058,	0.103,	0.058,	11.348,	0.083,	0.098,	0.086,	4.877,
0.091,	0.180,	0.110,	4.877,	0.112,	0.207,	0.154,	7.310,	0.193,
0.182,	0.185,	21.215,	5.138,	0.530,	0.821,	0.000,	0.464,	0.151,
0.233,	0.000,	11.740,	0.900,	1.692,	3.460,	1.779,	0.000,	2.384,
0.000,	0.481,	0.477,	0.478,	7.310,	0.303,	0.121,	0.301,	3.497,
0.066,	0.374,	0.090,						
30,	2.915,	0.028,	0.135,	0.028,	2.385,	0.043,	0.095,	0.044,
2.551,	0.047,	0.088,	0.047,	9.692,	0.067,	0.084,	0.070,	3.775,
0.071,	0.154,	0.088,	3.775,	0.087,	0.177,	0.127,	5.657,	0.150,
0.156,	0.156,	16.413,	3.977,	0.452,	0.675,	0.000,	0.360,	0.130,
0.190,	0.000,	9.083,	0.751,	1.360,	3.278,	1.616,	0.000,	2.214,
0.000,	0.373,	0.409,	0.403,	5.657,	0.235,	0.104,	0.234,	3.301,
0.054,	0.316,	0.076,						
35,	2.606,	0.024,	0.118,	0.024,	2.132,	0.037,	0.083,	0.037,
2.280,	0.040,	0.078,	0.040,	8.662,	0.057,	0.074,	0.059,	3.046,
0.057,	0.135,	0.073,	3.046,	0.070,	0.155,	0.108,	4.564,	0.121,
0.136,	0.135,	13.237,	3.208,	0.389,	0.567,	0.000,	0.291,	0.114,
0.160,	0.000,	7.325,	0.649,	1.137,	3.248,	1.548,	0.000,	2.159,
0.000,	0.301,	0.358,	0.348,	4.564,	0.190,	0.091,	0.190,	3.261,
0.046,	0.274,	0.067,						
40,	2.437,	0.021,	0.106,	0.021,	1.994,	0.033,	0.075,	0.033,
2.133,	0.035,	0.069,	0.036,	8.100,	0.051,	0.066,	0.053,	2.562,
0.048,	0.121,	0.063,	2.562,	0.059,	0.139,	0.094,	3.838,	0.102,
0.122,	0.120,	11.128,	2.698,	0.340,	0.489,	0.000,	0.245,	0.102,
0.139,	0.000,	6.158,	0.581,	0.988,	3.368,	1.562,	0.000,	2.211,
0.000,	0.253,	0.321,	0.309,	3.838,	0.160,	0.082,	0.160,	3.371,
0.042,	0.245,	0.062,						
45,	2.385,	0.020,	0.097,	0.020,	1.952,	0.031,	0.068,	0.031,
2.087,	0.033,	0.064,	0.033,	7.927,	0.048,	0.061,	0.050,	2.246,
0.042,	0.111,	0.056,	2.246,	0.052,	0.128,	0.085,	3.363,	0.089,
0.112,	0.109,	9.751,	2.365,	0.305,	0.435,	0.000,	0.215,	0.093,
0.125,	0.000,	5.396,	0.538,	0.893,	3.655,	1.661,	0.000,	2.378,
0.000,	0.222,	0.294,	0.281,	3.363,	0.140,	0.075,	0.141,	3.649,
0.040,	0.225,	0.060,						
50,	2.442,	0.019,	0.091,	0.020,	1.998,	0.030,	0.064,	0.031,
2.137,	0.033,	0.060,	0.033,	8.117,	0.047,	0.057,	0.049,	2.052,
0.038,	0.104,	0.052,	2.052,	0.047,	0.119,	0.079,	3.073,	0.082,
0.105,	0.102,	8.906,	2.161,	0.284,	0.403,	0.000,	0.196,	0.087,
0.116,	0.000,	4.928,	0.517,	0.839,	4.149,	1.862,	0.000,	2.684,
0.000,	0.203,	0.275,	0.263,	3.073,	0.128,	0.070,	0.129,	4.133,
0.041,	0.214,	0.062,						
55,	2.616,	0.020,	0.087,	0.020,	2.140,	0.031,	0.061,	0.031,
2.289,	0.034,	0.057,	0.034,	8.696,	0.049,	0.054,	0.051,	1.954,
0.037,	0.099,	0.050,	1.954,	0.045,	0.114,	0.075,	2.925,	0.078,
0.100,	0.097,	8.478,	2.057,	0.278,	0.391,	0.000,	0.187,	0.084,
0.111,	0.000,	4.692,	0.513,	0.819,	4.929,	2.200,	0.000,	3.181,
0.000,	0.194,	0.263,	0.251,	2.925,	0.122,	0.067,	0.123,	4.899,
0.043,	0.210,	0.067,						
60,	2.932,	0.022,	0.085,	0.022,	2.399,	0.033,	0.060,	0.034,
2.566,	0.037,	0.056,	0.037,	9.750,	0.053,	0.053,	0.056,	1.939,
0.036,	0.097,	0.049,	1.939,	0.045,	0.112,	0.074,	2.903,	0.077,
0.098,	0.095,	8.413,	2.042,	0.287,	0.398,	0.000,	0.186,	0.082,
0.109,	0.000,	4.655,	0.529,	0.830,	6.127,	2.739,	0.000,	3.957,
0.000,	0.192,	0.258,	0.246,	2.903,	0.121,	0.065,	0.122,	6.080,
0.049,	0.212,	0.076,						

65, 3.439, 0.025, 0.085, 0.025, 2.813, 0.038, 0.060, 0.038,
3.009, 0.042, 0.056, 0.042, 11.439, 0.061, 0.053, 0.064, 2.005,
0.038, 0.097, 0.050, 2.005, 0.046, 0.112, 0.075, 3.002, 0.080,
0.098, 0.096, 8.701, 2.111, 0.309, 0.423, 0.000, 0.192, 0.082,
0.111, 0.000, 4.815, 0.563, 0.874, 7.970, 3.595, 0.000, 5.168,
0.000, 0.199, 0.258, 0.247, 3.002, 0.125, 0.065, 0.126, 7.896,
0.058, 0.222, 0.091,

Pollutant Name: Carbon Monoxide,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LH
D1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,
OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,AL
L,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

0, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 127.976,
132.067, 26.300, 110.419, 127.976, 133.482, 26.300, 86.557, 127.976, 132.472,
26.300, 44.349, 0.000, 0.000, 44.861, 42.043, 0.000, 130.596, 26.300,
53.676, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 129.441, 26.300, 44.361, 0.000, 0.000, 0.000, 0.000, 0.251,
1.747, 20.792, 2.534,
5, 75.615, 1.548, 2.512, 1.552, 114.596, 2.585, 2.262, 2.597,
116.271, 2.650, 2.200, 2.657, 382.816, 3.306, 2.171, 3.402, 366.674,
3.448, 3.004, 3.387, 366.674, 4.816, 2.843, 3.969, 550.011, 9.033,
5.431, 6.161,2217.604, 197.359, 6.811, 18.997, 0.000, 22.708, 4.679,
9.411, 0.000, 141.681, 14.121, 23.440, 47.170, 13.426, 0.000, 25.556,
0.000, 23.469, 10.981, 13.168, 550.011, 21.830, 3.488, 21.283, 50.588,
2.250, 7.301, 2.624,
10, 55.113, 1.388, 1.732, 1.391, 83.525, 2.276, 1.560, 2.283,
84.746, 2.374, 1.517, 2.379, 279.022, 2.968, 1.497, 3.037, 243.952,
2.294, 2.072, 2.269, 243.952, 3.204, 1.960, 2.671, 365.928, 6.010,
3.744, 4.208,1475.397, 131.305, 4.297, 12.420, 0.000, 15.108, 3.226,
6.345, 0.000, 94.262, 8.888, 15.125, 38.686, 12.070, 0.000, 21.637,
0.000, 15.614, 7.572, 8.980, 365.928, 14.524, 2.405, 14.168, 40.989,
1.955, 4.812, 2.205,
15, 42.304, 1.254, 1.250, 1.256, 64.112, 2.028, 1.126, 2.032,
65.049, 2.142, 1.094, 2.146, 214.171, 2.683, 1.080, 2.735, 171.481,
1.612, 1.495, 1.603, 171.481, 2.252, 1.414, 1.894, 257.222, 4.224,
2.702, 3.016,1037.099, 92.298, 2.636, 8.370, 0.000, 10.620, 2.328,
4.505, 0.000, 66.259, 5.940, 10.347, 33.413, 10.987, 0.000, 19.048,
0.000, 10.976, 5.464, 6.429, 257.222, 10.209, 1.735, 9.963, 35.035,
1.729, 3.332, 1.908,
20, 34.196, 1.140, 0.944, 1.141, 51.825, 1.825, 0.850, 1.827,
52.582, 1.946, 0.827, 1.948, 173.124, 2.439, 0.816, 2.481, 127.354,
1.198, 1.129, 1.194, 127.354, 1.673, 1.068, 1.414, 191.031, 3.137,
2.041, 2.268, 770.225, 68.547, 1.872, 6.136, 0.000, 7.887, 1.758,
3.367, 0.000, 49.209, 4.215, 7.502, 30.392, 10.112, 0.000, 17.402,
0.000, 8.151, 4.126, 4.831, 191.031, 7.582, 1.311, 7.401, 31.582,
1.550, 2.446, 1.689,

```
   25,  29.111,   1.042,   0.746,   1.043,  44.117,   1.657,   0.672,   1.657,
44.762,   1.777,   0.653,   1.779, 147.377,   2.230,   0.645,   2.265,  99.930,
0.940,   0.892,   0.938,  99.930,   1.313,   0.844,   1.112, 149.895,   2.462,
1.613,   1.789, 604.368,  53.787,   1.709,   5.039,   0.000,   6.189,   1.390,
2.649,   0.000,  38.612,   3.176,   5.765,  29.112,   9.408,   0.000,  16.491,
0.000,   6.396,   3.261,   3.810, 149.895,   5.949,   1.036,   5.808,  30.019,
1.405,   1.913,   1.522,
   30,  26.097,   0.957,   0.617,   0.958,  39.551,   1.516,   0.556,   1.516,
40.129,   1.632,   0.540,   1.634, 132.123,   2.050,   0.533,   2.081,  82.845,
0.779,   0.738,   0.777,  82.845,   1.088,   0.698,   0.921, 124.268,   2.041,
1.334,   1.481, 501.039,  44.591,   1.584,   4.334,   0.000,   5.131,   1.149,
2.194,   0.000,  32.011,   2.541,   4.694,  29.367,   8.855,   0.000,  16.228,
0.000,   5.302,   2.698,   3.154, 124.268,   4.932,   0.857,   4.815,  30.081,
1.285,   1.574,   1.394,
   35,  24.639,   0.884,   0.534,   0.885,  37.340,   1.399,   0.481,   1.399,
37.886,   1.507,   0.468,   1.508, 124.738,   1.893,   0.462,   1.923,  72.564,
0.682,   0.639,   0.679,  72.564,   0.953,   0.605,   0.804, 108.846,   1.788,
1.155,   1.286, 438.861,  39.057,   1.496,   3.898,   0.000,   4.494,   0.995,
1.913,   0.000,  28.038,   2.159,   4.050,  31.198,   8.446,   0.000,  16.625,
0.000,   4.644,   2.335,   2.740, 108.846,   4.320,   0.742,   4.217,  31.772,
1.185,   1.362,   1.296,
   40,  24.497,   0.820,   0.484,   0.821,  37.126,   1.301,   0.436,   1.301,
37.668,   1.398,   0.424,   1.400, 124.021,   1.757,   0.418,   1.787,  67.153,
0.631,   0.579,   0.626,  67.153,   0.882,   0.548,   0.739, 100.729,   1.654,
1.046,   1.171, 406.134,  36.144,   1.445,   3.665,   0.000,   4.159,   0.901,
1.756,   0.000,  25.948,   1.948,   3.701,  34.903,   8.192,   0.000,  17.794,
0.000,   4.298,   2.116,   2.498, 100.729,   3.998,   0.672,   3.901,  35.367,
1.102,   1.238,   1.224,
   45,  25.650,   0.765,   0.459,   0.766,  38.873,   1.220,   0.413,   1.221,
39.441,   1.305,   0.402,   1.307, 129.857,   1.639,   0.397,   1.671,  65.659,
0.617,   0.549,   0.609,  65.659,   0.862,   0.519,   0.715,  98.488,   1.618,
0.992,   1.120, 397.098,  35.340,   1.433,   3.601,   0.000,   4.066,   0.855,
1.698,   0.000,  25.370,   1.866,   3.583,  41.123,   8.121,   0.000,  19.984,
0.000,   4.202,   2.006,   2.391,  98.488,   3.909,   0.637,   3.812,  41.488,
1.034,   1.182,   1.177,
   50,  28.283,   0.718,   0.455,   0.719,  42.864,   1.154,   0.410,   1.156,
43.490,   1.225,   0.399,   1.227, 143.190,   1.538,   0.394,   1.573,  67.828,
0.638,   0.545,   0.624,  67.828,   0.891,   0.515,   0.730, 101.742,   1.671,
0.984,   1.123, 410.216,  36.508,   1.457,   3.699,   0.000,   4.201,   0.848,
1.728,   0.000,  26.208,   1.898,   3.674,  51.023,   8.292,   0.000,  23.652,
0.000,   4.341,   1.991,   2.402, 101.742,   4.038,   0.632,   3.936,  51.281,
0.980,   1.186,   1.159,
   55,  32.844,   0.679,   0.473,   0.680,  49.775,   1.104,   0.426,   1.107,
50.503,   1.157,   0.414,   1.160, 166.277,   1.452,   0.409,   1.493,  74.030,
0.696,   0.566,   0.676,  74.030,   0.972,   0.535,   0.784, 111.045,   1.824,
1.022,   1.182, 447.727,  39.846,   1.519,   3.971,   0.000,   4.585,   0.881,
1.853,   0.000,  28.605,   2.050,   3.990,  66.670,   8.811,   0.000,  29.608,
0.000,   4.738,   2.067,   2.535, 111.045,   4.407,   0.657,   4.293,  66.786,
0.941,   1.250,   1.176,
   60,  40.165,   0.646,   0.514,   0.648,  60.870,   1.070,   0.463,   1.075,
61.760,   1.102,   0.450,   1.105, 203.342,   1.382,   0.444,   1.433,  85.368,
0.803,   0.615,   0.771,  85.368,   1.121,   0.582,   0.889, 128.052,   2.103,
1.111,   1.307, 516.298,  45.949,   1.619,   4.454,   0.000,   5.287,   0.957,
2.094,   0.000,  32.986,   2.351,   4.589,  91.742,   9.875,   0.000,  39.302,
0.000,   5.464,   2.247,   2.810, 128.052,   5.082,   0.714,   4.946,  91.635,
0.917,   1.385,   1.243,
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65, 51.727, 0.621, 0.585, 0.623, 78.393, 1.055, 0.526, 1.062,
79.539, 1.059, 0.512, 1.064, 261.877, 1.327, 0.505, 1.394, 104.009,
0.978, 0.699, 0.930, 104.009, 1.366, 0.662, 1.063, 156.013, 2.562,
1.264, 1.518, 629.033, 55.982, 1.756, 5.224, 0.000, 6.441, 1.089,
2.494, 0.000, 40.188, 2.862, 5.589, 132.948, 11.845, 0.000, 55.376,
0.000, 6.657, 2.555, 3.274, 156.013, 6.192, 0.812, 6.021, 132.457,
0.914, 1.613, 1.387,

Pollutant Name: Oxides of Nitrogen,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LH
D1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,
OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,AL
L,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

0, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 1.288,
1.363, 75.051, 16.445, 1.288, 1.389, 75.051, 33.638, 1.288, 1.371,
75.051, 62.525, 0.000, 0.000, 120.599, 113.024, 0.000, 1.336, 75.051,
55.702, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 1.315, 75.051, 62.139, 0.000, 0.000, 0.000, 0.000, 0.003,
0.018, 58.834, 2.464,
5, 2.116, 0.139, 2.084, 0.140, 1.893, 0.241, 2.097, 0.250,
2.119, 0.323, 2.108, 0.324, 6.569, 0.445, 2.110, 0.449, 1.596,
0.241, 3.954, 1.002, 1.596, 0.320, 4.166, 2.004, 2.394, 0.528,
4.544, 3.861, 14.857, 9.845, 11.694, 11.579, 0.000, 1.628, 3.462,
2.980, 0.000, 7.867, 35.842, 33.799, 1.091, 1.317, 0.000, 1.236,
0.000, 1.722, 16.589, 13.985, 2.394, 0.756, 8.277, 1.432, 1.132,
0.218, 12.307, 0.723,
10, 2.225, 0.120, 1.729, 0.121, 1.990, 0.205, 1.740, 0.213,
2.228, 0.278, 1.749, 0.279, 6.908, 0.382, 1.750, 0.386, 1.677,
0.254, 3.281, 0.873, 1.677, 0.337, 3.456, 1.702, 2.515, 0.555,
3.770, 3.224, 15.610, 10.344, 8.530, 8.644, 0.000, 1.711, 2.872,
2.567, 0.000, 8.266, 27.416, 26.017, 1.144, 1.212, 0.000, 1.187,
0.000, 1.809, 13.763, 11.670, 2.515, 0.794, 6.867, 1.341, 1.187,
0.191, 9.598, 0.585,
15, 2.337, 0.106, 1.486, 0.107, 2.090, 0.179, 1.496, 0.186,
2.340, 0.244, 1.503, 0.245, 7.254, 0.335, 1.505, 0.339, 1.757,
0.266, 2.820, 0.789, 1.757, 0.353, 2.971, 1.499, 2.636, 0.582,
3.241, 2.789, 16.363, 10.843, 6.387, 6.667, 0.000, 1.793, 2.469,
2.292, 0.000, 8.665, 22.046, 21.068, 1.197, 1.133, 0.000, 1.156,
0.000, 1.897, 11.831, 10.091, 2.636, 0.833, 5.903, 1.290, 1.243,
0.171, 7.837, 0.493,
20, 2.450, 0.096, 1.324, 0.096, 2.191, 0.160, 1.332, 0.166,
2.454, 0.219, 1.339, 0.220, 7.606, 0.300, 1.340, 0.304, 1.838,
0.278, 2.512, 0.736, 1.838, 0.369, 2.646, 1.366, 2.757, 0.609,
2.886, 2.500, 17.116, 11.342, 5.280, 5.662, 0.000, 1.876, 2.199,
2.114, 0.000, 9.064, 18.637, 17.937, 1.252, 1.075, 0.000, 1.139,
0.000, 1.984, 10.538, 9.040, 2.757, 0.871, 5.258, 1.267, 1.300,
0.156, 6.723, 0.433,

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   25,   2.566,   0.088,   1.222,   0.088,   2.295,   0.146,   1.229,   0.152,
2.570,   0.201,   1.236,   0.201,   7.966,   0.275,   1.237,   0.278,   1.919,
0.290,   2.318,   0.706,   1.919,   0.385,   2.442,   1.286,   2.879,   0.635,
2.664,   2.319,  17.869,  11.841,   4.837,   5.278,   0.000,   1.959,   2.029,
2.011,   0.000,   9.462,  16.562,  16.044,   1.307,   1.036,   0.000,   1.133,
0.000,   2.071,   9.725,   8.385,   2.879,   0.909,   4.852,   1.266,   1.357,
0.145,   6.056,   0.395,
   30,   2.684,   0.082,   1.168,   0.083,   2.400,   0.137,   1.176,   0.142,
2.687,   0.187,   1.182,   0.188,   8.331,   0.256,   1.183,   0.259,   2.000,
0.303,   2.217,   0.695,   2.000,   0.402,   2.335,   1.248,   3.000,   0.662,
2.547,   2.227,  18.623,  12.340,   4.468,   4.963,   0.000,   2.041,   1.941,
1.967,   0.000,   9.861,  15.474,  15.064,   1.362,   1.013,   0.000,   1.139,
0.000,   2.159,   9.300,   8.049,   3.000,   0.948,   4.640,   1.282,   1.415,
0.138,   5.696,   0.373,
   35,   2.803,   0.078,   1.157,   0.079,   2.507,   0.130,   1.165,   0.135,
2.807,   0.178,   1.171,   0.179,   8.701,   0.243,   1.172,   0.247,   2.081,
0.315,   2.196,   0.700,   2.081,   0.418,   2.314,   1.248,   3.121,   0.689,
2.524,   2.212,  19.376,  12.839,   4.172,   4.717,   0.000,   2.124,   1.923,
1.975,   0.000,  10.260,  15.197,  14.837,   1.419,   1.005,   0.000,   1.154,
0.000,   2.246,   9.214,   7.994,   3.121,   0.986,   4.597,   1.313,   1.474,
0.133,   5.596,   0.365,
   40,   2.924,   0.075,   1.188,   0.076,   2.614,   0.127,   1.196,   0.132,
2.927,   0.172,   1.202,   0.173,   9.075,   0.236,   1.203,   0.240,   2.162,
0.327,   2.255,   0.722,   2.162,   0.434,   2.375,   1.284,   3.243,   0.716,
2.591,   2.273,  20.129,  13.338,   3.951,   4.541,   0.000,   2.206,   1.974,
2.035,   0.000,  10.659,  15.692,  15.324,   1.475,   1.010,   0.000,   1.177,
0.000,   2.333,   9.459,   8.211,   3.243,   1.024,   4.719,   1.359,   1.533,
0.130,   5.743,   0.368,
   45,   3.045,   0.074,   1.264,   0.075,   2.723,   0.126,   1.272,   0.132,
3.049,   0.170,   1.279,   0.171,   9.453,   0.233,   1.280,   0.237,   2.243,
0.339,   2.399,   0.761,   2.243,   0.450,   2.527,   1.359,   3.364,   0.742,
2.756,   2.414,  20.882,  13.837,   3.804,   4.435,   0.000,   2.289,   2.100,
2.149,   0.000,  11.058,  17.033,  16.596,   1.532,   1.030,   0.000,   1.210,
0.000,   2.420,  10.062,   8.724,   3.364,   1.062,   5.020,   1.421,   1.592,
0.130,   6.161,   0.386,
   50,   3.168,   0.075,   1.393,   0.076,   2.833,   0.128,   1.402,   0.134,
3.172,   0.171,   1.409,   0.172,   9.832,   0.235,   1.410,   0.240,   2.324,
0.352,   2.643,   0.821,   2.324,   0.467,   2.785,   1.481,   3.485,   0.769,
3.037,   2.652,  21.635,  14.336,   3.730,   4.397,   0.000,   2.371,   2.314,
2.329,   0.000,  11.456,  19.436,  18.853,   1.588,   1.064,   0.000,   1.253,
0.000,   2.508,  11.089,   9.587,   3.485,   1.101,   5.533,   1.502,   1.651,
0.131,   6.911,   0.419,
   55,   3.290,   0.077,   1.591,   0.078,   2.942,   0.132,   1.601,   0.140,
3.295,   0.176,   1.609,   0.177,  10.214,   0.242,   1.610,   0.247,   2.405,
0.364,   3.019,   0.907,   2.405,   0.483,   3.180,   1.664,   3.607,   0.796,
3.469,   3.015,  22.388,  14.835,   3.731,   4.429,   0.000,   2.454,   2.643,
2.593,   0.000,  11.855,  23.316,  22.478,   1.645,   1.114,   0.000,   1.305,
0.000,   2.595,  12.663,  10.900,   3.607,   1.139,   6.318,   1.607,   1.710,
0.135,   8.115,   0.473,
   60,   3.413,   0.080,   1.882,   0.081,   3.053,   0.140,   1.894,   0.149,
3.418,   0.184,   1.904,   0.186,  10.596,   0.255,   1.906,   0.260,   2.485,
0.376,   3.572,   1.030,   2.485,   0.499,   3.763,   1.928,   3.728,   0.823,
4.104,   3.547,  23.141,  15.334,   3.806,   4.531,   0.000,   2.536,   3.127,
2.972,   0.000,  12.254,  29.404,  28.151,   1.701,   1.183,   0.000,   1.369,
0.000,   2.682,  14.984,  12.830,   3.728,   1.177,   7.476,   1.746,   1.769,
0.142,   9.978,   0.556,
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   65,   3.536,   0.085,   2.307,   0.086,   3.162,   0.152,   2.322,   0.163,
3.541,   0.197,   2.334,   0.199,  10.977,   0.274,   2.336,   0.280,   2.566,
0.388,   4.379,   1.205,   2.566,   0.515,   4.613,   2.309,   3.849,   0.850,
5.032,   4.321,  23.894,  15.834,   3.954,   4.701,   0.000,   2.619,   3.833,
3.515,   0.000,  12.653,  38.983,  37.060,   1.757,   1.273,   0.000,   1.447,
0.000,   2.770,  18.370,  15.638,   3.849,   1.216,   9.165,   1.932,   1.827,
0.151,  12.860,   0.685,
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Pollutant Name: Carbon Dioxide,,,,Temperature: 57F,,Relative Humidity: 65%

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Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LH
D1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,
OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,AL
L,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
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    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,4776.900,4776.900,4098.000,4637.946,4776.900,4776.899,4098.000,4479.678,47
76.900,4776.899,4098.000,4213.419,   0.000,   0.000,6541.716,6130.815,
0.000,4776.900,4098.000,4276.199,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,4776.900,4098.000,4216.880,   0.000,   0.000,
0.000,   0.000,   9.378,  62.997,3209.578, 193.676,
    5,1313.986, 933.363, 352.762, 933.072,1351.231,1173.737,
347.239,1169.760,1350.989,1189.492, 346.392,1188.881,1843.696,1620.818,
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524.552,1642.745,2513.510,2513.510,1505.000,1676.456,2513.510,2513.510,3845.361,
3761.704,   0.000,2513.510,1505.000,1769.716,
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261.077,1060.345,1815.626,1089.056,
   10, 992.919, 705.300, 352.762, 705.126,1021.064, 886.939, 347.239,
884.345,1020.881, 898.845, 346.392, 898.446,1393.197,1224.778,
346.070,1223.459,1672.267,1672.267, 520.110,1436.449,1672.267,1672.267,
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3071.656,   0.000,1672.267,1505.000,1548.905,
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798.020,1769.844, 836.481,
   15, 778.741, 553.162, 352.762, 553.066, 800.815, 695.621, 347.239, 693.949,
800.671, 704.959, 346.392, 704.701,1092.676, 960.587, 346.070,
959.668,1175.484,1175.484, 520.110,1041.346,1175.484,1175.484, 524.552,
890.506,1175.484,1175.484,1505.000,1448.979,1175.484,1175.485,2595.958,2506.734,
0.000,1175.485,1505.000,1418.508,   0.000,1175.484,2657.996,2549.685, 172.212,
198.920,   0.000, 189.320,
0.000,1175.484,1505.000,1447.300,1175.484,1175.484,1505.000,1204.958, 188.092,
623.973,1731.497, 668.560,
   20, 633.910, 450.285, 352.762, 450.242, 651.879, 566.249, 347.239, 565.201,
651.762, 573.851, 346.392, 573.688, 889.460, 781.936, 346.070, 781.288, 873.000,
873.000, 520.110, 800.772, 873.000, 873.000, 524.552, 720.450, 873.000,
873.000,1505.000,1397.554, 873.000, 873.000,2183.160,2100.866,   0.000,
873.000,1505.000,1339.111,   0.000, 873.000,2657.996,2527.586, 151.958, 176.199,
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0.000, 167.485,   0.000, 873.000,1505.000,1394.333, 873.000, 873.000,1505.000,
929.530, 164.417, 506.775,1703.701, 555.396,
   25, 535.572, 380.433, 352.762, 380.426, 550.754, 478.408, 347.239, 477.782,
550.655, 484.830, 346.392, 484.732, 751.479, 660.635, 346.070, 660.171, 685.012,
685.012, 520.110, 651.260, 685.012, 685.012, 524.552, 614.762, 685.012,
685.012,1505.000,1365.594, 685.012, 685.012,2042.684,1957.406,   0.000,
685.012,1505.000,1289.767,   0.000, 685.012,2657.996,2513.852, 136.173, 161.707,
0.000, 152.529,   0.000, 685.011,1505.000,1361.415, 685.012, 685.012,1505.000,
758.356, 146.398, 427.462,1694.242, 479.195,
   30, 469.639, 333.599, 352.762, 333.615, 482.952, 419.512, 347.239, 419.170,
482.865, 425.144, 346.392, 425.089, 658.966, 579.306, 346.070, 578.965, 567.895,
567.895, 520.110, 558.114, 567.895, 567.895, 524.552, 548.919, 567.895,
567.895,1505.000,1345.683, 567.895, 567.895,1924.234,1839.039,   0.000,
567.895,1505.000,1259.026,   0.000, 567.895,2657.996,2505.295, 123.928, 153.784,
0.000, 143.053,   0.000, 567.895,1505.000,1340.907, 567.895, 567.895,1505.000,
651.715, 132.713, 374.427,1686.266, 428.168,
   35, 427.432, 303.617, 352.762, 303.649, 439.547, 381.809, 347.239, 381.649,
439.469, 386.935, 346.392, 386.908, 599.743, 527.242, 346.070, 526.980, 497.421,
497.421, 520.110, 502.065, 497.421, 497.421, 524.552, 509.299, 497.421,
497.421,1505.000,1333.702, 497.421, 497.421,1827.808,1744.243,   0.000,
497.421,1505.000,1240.528,   0.000, 497.421,2657.996,2500.147, 114.541, 151.581,
0.000, 138.267,   0.000, 497.421,1505.000,1328.566, 497.421, 497.421,1505.000,
587.544, 122.449, 340.561,1679.774, 395.519,
   40, 403.761, 286.803, 352.762, 286.844, 415.206, 360.665, 347.239, 360.607,
415.132, 365.507, 346.392, 365.496, 566.530, 498.044, 346.070, 497.826, 460.326,
460.326, 520.110, 472.563, 460.326, 460.326, 524.552, 488.444, 460.326,
460.326,1505.000,1327.396, 460.326, 460.327,1753.407,1672.185,   0.000,
460.327,1505.000,1230.791,   0.000, 460.326,2657.996,2497.437, 107.512, 154.899,
0.000, 137.866,   0.000, 460.326,1505.000,1322.071, 460.326, 460.326,1505.000,
553.768, 114.975, 321.632,1674.764, 377.208,
   45, 395.857, 281.189, 352.762, 281.232, 407.078, 353.605, 347.239, 353.581,
407.005, 358.351, 346.392, 358.346, 555.439, 488.294, 346.070, 488.091, 450.085,
450.085, 520.110, 464.417, 450.085, 450.085, 524.552, 482.686, 450.085,
450.085,1505.000,1325.655, 450.085, 450.085,1701.031,1622.456,   0.000,
450.085,1505.000,1228.103,   0.000, 450.085,2657.996,2496.688, 102.486, 164.161,
0.000, 141.992,   0.000, 450.085,1505.000,1320.277, 450.085, 450.085,1505.000,
544.443, 109.865, 315.393,1671.237, 371.086,
   50, 402.817, 286.132, 352.762, 286.173, 414.235, 359.822, 347.239, 359.768,
414.160, 364.652, 346.392, 364.641, 565.205, 496.879, 346.070, 496.663, 464.953,
464.953, 520.110, 476.242, 464.953, 464.953, 524.552, 491.045, 464.953,
464.953,1505.000,1328.182, 464.953, 464.953,1670.679,1594.944,   0.000,
464.953,1505.000,1232.006,   0.000, 464.953,2657.996,2497.775,  99.216, 180.493,
0.000, 151.278,   0.000, 464.953,1505.000,1322.881, 464.953, 464.953,1505.000,
557.981, 106.855, 321.124,1669.193, 376.464,
   55, 425.434, 302.198, 352.762, 302.231, 437.493, 380.025, 347.239, 379.874,
437.415, 385.127, 346.392, 385.101, 596.940, 524.778, 346.070, 524.520, 507.469,
507.469, 520.110, 510.057, 507.469, 507.469, 524.552, 514.948, 507.469,
507.469,1505.000,1335.411, 507.469, 507.469,1662.352,1589.811,   0.000,
507.469,1505.000,1243.165,   0.000, 507.469,2657.996,2500.881,  97.546, 205.954,
0.000, 166.987,   0.000, 507.469,1505.000,1330.326, 507.469, 507.469,1505.000,
596.694, 105.815, 339.492,1668.633, 393.979,
   60, 466.351, 331.263, 352.762, 331.281, 479.570, 416.575, 347.239, 416.248,
479.484, 422.167, 346.392, 422.115, 654.353, 575.250, 346.070, 574.915, 585.190,
585.190, 520.110, 571.870, 585.190, 585.190, 524.552, 558.643, 585.190,
585.190,1505.000,1348.624, 585.190, 585.190,1676.049,1607.530,   0.000,
585.190,1505.000,1263.566,   0.000, 585.190,2657.996,2506.559,  97.398, 243.965,
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0.000, 191.281,   0.000, 585.190,1505.000,1343.935, 585.190, 585.190,1505.000,
667.463, 106.744, 372.682,1669.555, 425.719,
   65, 530.579, 376.886, 352.762, 376.880, 545.618, 473.947, 347.239, 473.343,
545.521, 480.309, 346.392, 480.215, 744.472, 654.476, 346.070, 654.020, 712.968,
712.968, 520.110, 673.495, 712.968, 712.968, 524.552, 630.479, 712.968,
712.968,1505.000,1370.347, 712.968, 712.968,1711.772,1649.035,   0.000,
712.968,1505.000,1297.105,   0.000, 712.968,2657.996,2515.894, 98.764, 300.085,
0.000, 227.720,   0.000, 712.968,1505.000,1366.310, 712.968, 712.968,1505.000,
783.812, 109.781, 424.846,1671.960, 475.646,

Pollutant Name: Sulfur Dioxide,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.048,
0.048,   0.039,   0.047,   0.048,   0.049,   0.039,   0.044,   0.048,   0.049,
0.039,   0.041,   0.000,   0.000,   0.062,   0.059,   0.000,   0.048,   0.039,
0.042,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.048,   0.039,   0.041,   0.000,   0.000,   0.000,   0.000,   0.000,
0.001,   0.031,   0.002,
    5,   0.014,   0.009,   0.003,   0.009,   0.015,   0.011,   0.003,   0.011,
0.015,   0.011,   0.003,   0.011,   0.024,   0.016,   0.003,   0.016,   0.030,
0.024,   0.005,   0.020,   0.030,   0.024,   0.005,   0.016,   0.033,   0.024,
0.014,   0.016,   0.060,   0.028,   0.037,   0.036,   0.000,   0.025,   0.014,
0.017,   0.000,   0.028,   0.025,   0.026,   0.003,   0.003,   0.000,   0.003,
0.000,   0.025,   0.014,   0.016,   0.033,   0.024,   0.014,   0.024,   0.003,
0.010,   0.017,   0.010,
   10,   0.011,   0.007,   0.003,   0.007,   0.011,   0.009,   0.003,   0.009,
0.011,   0.009,   0.003,   0.009,   0.018,   0.012,   0.003,   0.012,   0.020,
0.016,   0.005,   0.014,   0.020,   0.016,   0.005,   0.011,   0.022,   0.016,
0.014,   0.015,   0.040,   0.018,   0.030,   0.029,   0.000,   0.016,   0.014,
0.015,   0.000,   0.018,   0.025,   0.025,   0.003,   0.003,   0.000,   0.003,
0.000,   0.016,   0.014,   0.015,   0.022,   0.016,   0.014,   0.016,   0.003,
0.008,   0.017,   0.008,
   15,   0.008,   0.005,   0.003,   0.005,   0.009,   0.007,   0.003,   0.007,
0.009,   0.007,   0.003,   0.007,   0.014,   0.009,   0.003,   0.009,   0.014,
0.011,   0.005,   0.010,   0.014,   0.011,   0.005,   0.009,   0.016,   0.011,
0.014,   0.014,   0.028,   0.013,   0.025,   0.024,   0.000,   0.011,   0.014,
0.014,   0.000,   0.013,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,
0.000,   0.011,   0.014,   0.014,   0.016,   0.011,   0.014,   0.012,   0.002,
0.006,   0.017,   0.006,
   20,   0.007,   0.004,   0.003,   0.004,   0.007,   0.005,   0.003,   0.005,
0.007,   0.006,   0.003,   0.006,   0.012,   0.008,   0.003,   0.008,   0.010,
0.008,   0.005,   0.008,   0.010,   0.008,   0.005,   0.007,   0.012,   0.008,
0.014,   0.013,   0.021,   0.010,   0.021,   0.020,   0.000,   0.009,   0.014,
0.013,   0.000,   0.010,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,

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0.000,   0.009,   0.014,   0.013,   0.012,   0.009,   0.014,   0.009,   0.002,
0.005,   0.016,   0.005,
   25,   0.006,   0.004,   0.003,   0.004,   0.006,   0.005,   0.003,   0.005,
0.006,   0.005,   0.003,   0.005,   0.010,   0.006,   0.003,   0.006,   0.008,
0.007,   0.005,   0.006,   0.008,   0.007,   0.005,   0.006,   0.009,   0.007,
0.014,   0.013,   0.016,   0.008,   0.020,   0.019,   0.000,   0.007,   0.014,
0.012,   0.000,   0.007,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,
0.000,   0.007,   0.014,   0.013,   0.009,   0.007,   0.014,   0.007,   0.002,
0.004,   0.016,   0.005,
   30,   0.005,   0.003,   0.003,   0.003,   0.005,   0.004,   0.003,   0.004,
0.005,   0.004,   0.003,   0.004,   0.009,   0.006,   0.003,   0.006,   0.007,
0.005,   0.005,   0.005,   0.007,   0.005,   0.005,   0.005,   0.007,   0.005,
0.014,   0.013,   0.013,   0.006,   0.018,   0.018,   0.000,   0.006,   0.014,
0.012,   0.000,   0.006,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,
0.000,   0.006,   0.014,   0.013,   0.007,   0.006,   0.014,   0.006,   0.002,
0.004,   0.016,   0.004,
   35,   0.005,   0.003,   0.003,   0.003,   0.005,   0.004,   0.003,   0.004,
0.005,   0.004,   0.003,   0.004,   0.008,   0.005,   0.003,   0.005,   0.006,
0.005,   0.005,   0.005,   0.006,   0.005,   0.005,   0.005,   0.007,   0.005,
0.014,   0.013,   0.012,   0.005,   0.017,   0.017,   0.000,   0.005,   0.014,
0.012,   0.000,   0.005,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,
0.000,   0.005,   0.014,   0.013,   0.007,   0.005,   0.014,   0.006,   0.002,
0.003,   0.016,   0.004,
   40,   0.004,   0.003,   0.003,   0.003,   0.005,   0.003,   0.003,   0.003,
0.005,   0.004,   0.003,   0.004,   0.008,   0.005,   0.003,   0.005,   0.006,
0.004,   0.005,   0.005,   0.006,   0.004,   0.005,   0.005,   0.006,   0.004,
0.014,   0.013,   0.011,   0.005,   0.017,   0.016,   0.000,   0.004,   0.014,
0.012,   0.000,   0.005,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,
0.000,   0.004,   0.014,   0.013,   0.006,   0.004,   0.014,   0.005,   0.002,
0.003,   0.016,   0.004,
   45,   0.004,   0.003,   0.003,   0.003,   0.005,   0.003,   0.003,   0.003,
0.005,   0.003,   0.003,   0.003,   0.008,   0.005,   0.003,   0.005,   0.005,
0.004,   0.005,   0.004,   0.005,   0.004,   0.005,   0.005,   0.006,   0.004,
0.014,   0.013,   0.011,   0.005,   0.016,   0.016,   0.000,   0.004,   0.014,
0.012,   0.000,   0.005,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,
0.000,   0.004,   0.014,   0.013,   0.006,   0.004,   0.014,   0.005,   0.002,
0.003,   0.016,   0.004,
   50,   0.004,   0.003,   0.003,   0.003,   0.005,   0.003,   0.003,   0.003,
0.005,   0.004,   0.003,   0.004,   0.008,   0.005,   0.003,   0.005,   0.006,
0.004,   0.005,   0.005,   0.006,   0.004,   0.005,   0.005,   0.006,   0.004,
0.014,   0.013,   0.011,   0.005,   0.016,   0.015,   0.000,   0.005,   0.014,
0.012,   0.000,   0.005,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,
0.000,   0.005,   0.014,   0.013,   0.006,   0.005,   0.014,   0.005,   0.002,
0.003,   0.016,   0.004,
   55,   0.005,   0.003,   0.003,   0.003,   0.005,   0.004,   0.003,   0.004,
0.005,   0.004,   0.003,   0.004,   0.008,   0.005,   0.003,   0.005,   0.006,
0.005,   0.005,   0.005,   0.006,   0.005,   0.005,   0.005,   0.007,   0.005,
0.014,   0.013,   0.012,   0.006,   0.016,   0.015,   0.000,   0.005,   0.014,
0.012,   0.000,   0.005,   0.025,   0.024,   0.002,   0.002,   0.000,   0.002,
0.000,   0.005,   0.014,   0.013,   0.007,   0.005,   0.014,   0.006,   0.002,
0.003,   0.016,   0.004,
   60,   0.005,   0.003,   0.003,   0.003,   0.006,   0.004,   0.003,   0.004,
0.006,   0.004,   0.003,   0.004,   0.010,   0.006,   0.003,   0.006,   0.007,
0.006,   0.005,   0.005,   0.007,   0.006,   0.005,   0.005,   0.008,   0.006,
0.014,   0.013,   0.014,   0.006,   0.016,   0.015,   0.000,   0.006,   0.014,
0.012,   0.000,   0.006,   0.025,   0.024,   0.002,   0.003,   0.000,   0.003,
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0.000,   0.006,   0.014,   0.013,   0.008,   0.006,   0.014,   0.006,   0.003,
0.004,   0.016,   0.004,
   65,   0.006,   0.004,   0.003,   0.004,   0.006,   0.005,   0.003,   0.005,
0.007,   0.005,   0.003,   0.005,   0.011,   0.006,   0.003,   0.006,   0.008,
0.007,   0.005,   0.006,   0.008,   0.007,   0.005,   0.006,   0.009,   0.007,
0.014,   0.013,   0.017,   0.008,   0.016,   0.016,   0.000,   0.007,   0.014,
0.012,   0.000,   0.008,   0.025,   0.024,   0.003,   0.003,   0.000,   0.003,
0.000,   0.007,   0.014,   0.013,   0.009,   0.007,   0.014,   0.008,   0.003,
0.004,   0.016,   0.005,

Pollutant Name: PM10,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.784,   0.160,   0.000,   0.000,   0.863,   0.378,   0.000,   0.000,
0.828,   0.687,   0.000,   0.000,   0.470,   0.440,   0.000,   0.000,   0.864,
0.637,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.785,   0.647,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.592,   0.025,
    5,   0.104,   0.048,   0.231,   0.048,   0.077,   0.056,   0.148,   0.056,
0.119,   0.122,   0.134,   0.123,   0.109,   0.143,   0.127,   0.143,   0.101,
0.046,   0.086,   0.054,   0.101,   0.042,   0.087,   0.062,   0.101,   0.049,
0.426,   0.362,   0.101,   0.106,   0.337,   0.322,   0.000,   0.066,   0.358,
0.281,   0.000,   0.100,   0.792,   0.741,   0.080,   0.006,   0.000,   0.032,
0.000,   0.072,   1.058,   0.885,   0.101,   0.018,   0.409,   0.054,   0.081,
0.066,   0.478,   0.083,
   10,   0.074,   0.031,   0.182,   0.031,   0.055,   0.036,   0.116,   0.037,
0.084,   0.080,   0.105,   0.080,   0.078,   0.093,   0.100,   0.093,   0.066,
0.030,   0.067,   0.038,   0.066,   0.028,   0.068,   0.045,   0.066,   0.032,
0.335,   0.283,   0.066,   0.069,   0.251,   0.240,   0.000,   0.043,   0.281,
0.218,   0.000,   0.066,   0.574,   0.537,   0.063,   0.004,   0.000,   0.025,
0.000,   0.047,   0.830,   0.693,   0.066,   0.012,   0.321,   0.040,   0.064,
0.043,   0.364,   0.056,
   15,   0.055,   0.021,   0.146,   0.021,   0.041,   0.025,   0.093,   0.025,
0.063,   0.054,   0.084,   0.054,   0.058,   0.064,   0.080,   0.064,   0.045,
0.021,   0.054,   0.027,   0.045,   0.019,   0.055,   0.035,   0.045,   0.022,
0.269,   0.227,   0.045,   0.047,   0.187,   0.178,   0.000,   0.029,   0.225,
0.174,   0.000,   0.045,   0.431,   0.403,   0.052,   0.003,   0.000,   0.021,
0.000,   0.032,   0.666,   0.555,   0.045,   0.008,   0.258,   0.031,   0.052,
0.029,   0.284,   0.040,
   20,   0.043,   0.015,   0.120,   0.015,   0.032,   0.018,   0.076,   0.018,
0.049,   0.039,   0.069,   0.039,   0.045,   0.046,   0.066,   0.046,   0.032,
0.015,   0.044,   0.021,   0.032,   0.014,   0.045,   0.027,   0.032,   0.016,
0.220,   0.186,   0.032,   0.034,   0.147,   0.140,   0.000,   0.021,   0.185,
0.142,   0.000,   0.032,   0.336,   0.313,   0.045,   0.003,   0.000,   0.018,

```
0.000,   0.023,   0.547,   0.455,   0.032,   0.006,   0.211,   0.024,   0.045,
0.021,   0.228,   0.030,
   25,   0.035,   0.012,   0.100,   0.012,   0.026,   0.014,   0.064,   0.014,
0.040,   0.030,   0.058,   0.030,   0.037,   0.035,   0.055,   0.035,   0.024,
0.011,   0.037,   0.016,   0.024,   0.010,   0.037,   0.022,   0.024,   0.012,
0.185,   0.155,   0.024,   0.025,   0.134,   0.127,   0.000,   0.016,   0.155,
0.118,   0.000,   0.024,   0.270,   0.252,   0.041,   0.002,   0.000,   0.016,
0.000,   0.017,   0.458,   0.381,   0.024,   0.004,   0.177,   0.020,   0.041,
0.016,   0.190,   0.023,
   30,   0.030,   0.009,   0.086,   0.009,   0.022,   0.011,   0.055,   0.011,
0.034,   0.024,   0.050,   0.024,   0.031,   0.028,   0.047,   0.028,   0.019,
0.008,   0.032,   0.013,   0.019,   0.008,   0.032,   0.018,   0.019,   0.009,
0.158,   0.133,   0.019,   0.019,   0.126,   0.119,   0.000,   0.012,   0.133,
0.101,   0.000,   0.018,   0.226,   0.211,   0.039,   0.002,   0.000,   0.015,
0.000,   0.013,   0.393,   0.326,   0.019,   0.003,   0.152,   0.017,   0.039,
0.013,   0.162,   0.019,
   35,   0.027,   0.008,   0.075,   0.008,   0.020,   0.009,   0.048,   0.010,
0.031,   0.020,   0.044,   0.020,   0.028,   0.024,   0.041,   0.024,   0.015,
0.007,   0.028,   0.011,   0.015,   0.006,   0.028,   0.016,   0.015,   0.007,
0.139,   0.116,   0.015,   0.016,   0.125,   0.118,   0.000,   0.010,   0.116,
0.088,   0.000,   0.015,   0.195,   0.182,   0.038,   0.002,   0.000,   0.015,
0.000,   0.011,   0.344,   0.286,   0.015,   0.003,   0.133,   0.014,   0.038,
0.011,   0.142,   0.016,
   40,   0.025,   0.007,   0.067,   0.007,   0.019,   0.008,   0.043,   0.009,
0.029,   0.018,   0.039,   0.018,   0.026,   0.021,   0.037,   0.021,   0.013,
0.006,   0.025,   0.010,   0.013,   0.005,   0.025,   0.014,   0.013,   0.006,
0.124,   0.104,   0.013,   0.013,   0.130,   0.123,   0.000,   0.008,   0.104,
0.079,   0.000,   0.012,   0.175,   0.163,   0.040,   0.002,   0.000,   0.016,
0.000,   0.009,   0.309,   0.256,   0.013,   0.002,   0.119,   0.013,   0.040,
0.010,   0.129,   0.015,
   45,   0.024,   0.007,   0.062,   0.007,   0.018,   0.008,   0.040,   0.008,
0.028,   0.017,   0.036,   0.017,   0.026,   0.020,   0.034,   0.020,   0.011,
0.005,   0.023,   0.009,   0.011,   0.005,   0.023,   0.013,   0.011,   0.005,
0.114,   0.095,   0.011,   0.011,   0.142,   0.134,   0.000,   0.007,   0.096,
0.072,   0.000,   0.011,   0.162,   0.151,   0.043,   0.002,   0.000,   0.017,
0.000,   0.008,   0.283,   0.234,   0.011,   0.002,   0.109,   0.012,   0.043,
0.009,   0.120,   0.014,
   50,   0.025,   0.007,   0.058,   0.007,   0.019,   0.008,   0.037,   0.008,
0.029,   0.017,   0.033,   0.017,   0.026,   0.020,   0.032,   0.020,   0.010,
0.005,   0.022,   0.008,   0.010,   0.004,   0.022,   0.012,   0.010,   0.005,
0.107,   0.089,   0.010,   0.010,   0.160,   0.150,   0.000,   0.007,   0.089,
0.068,   0.000,   0.010,   0.155,   0.145,   0.049,   0.002,   0.000,   0.019,
0.000,   0.007,   0.264,   0.219,   0.010,   0.002,   0.102,   0.011,   0.049,
0.009,   0.115,   0.014,
   55,   0.027,   0.007,   0.055,   0.007,   0.020,   0.008,   0.035,   0.008,
0.031,   0.018,   0.032,   0.018,   0.028,   0.020,   0.030,   0.020,   0.010,
0.004,   0.021,   0.008,   0.010,   0.004,   0.021,   0.011,   0.010,   0.005,
0.102,   0.085,   0.010,   0.010,   0.184,   0.173,   0.000,   0.006,   0.086,
0.065,   0.000,   0.009,   0.154,   0.144,   0.058,   0.003,   0.000,   0.023,
0.000,   0.007,   0.253,   0.210,   0.010,   0.002,   0.098,   0.010,   0.058,
0.009,   0.113,   0.014,
   60,   0.030,   0.008,   0.054,   0.008,   0.022,   0.009,   0.035,   0.009,
0.034,   0.019,   0.031,   0.019,   0.032,   0.022,   0.030,   0.022,   0.009,
0.004,   0.020,   0.008,   0.009,   0.004,   0.020,   0.011,   0.009,   0.005,
0.100,   0.084,   0.009,   0.010,   0.214,   0.202,   0.000,   0.006,   0.084,
0.063,   0.000,   0.009,   0.159,   0.148,   0.073,   0.003,   0.000,   0.028,
```

```
0.000,   0.007,   0.248,   0.205,   0.009,   0.002,   0.096,   0.010,   0.072,
0.010,   0.115,   0.015,
   65,   0.035,   0.009,   0.054,   0.009,   0.026,   0.010,   0.035,   0.010,
0.040,   0.022,   0.031,   0.022,   0.037,   0.026,   0.030,   0.026,   0.010,
0.004,   0.020,   0.008,   0.010,   0.004,   0.020,   0.011,   0.010,   0.005,
0.100,   0.084,   0.010,   0.010,   0.251,   0.236,   0.000,   0.006,   0.084,
0.063,   0.000,   0.010,   0.169,   0.158,   0.095,   0.005,   0.000,   0.037,
0.000,   0.007,   0.248,   0.205,   0.010,   0.002,   0.096,   0.010,   0.093,
0.012,   0.120,   0.017,
```

Pollutant Name: PM10 - Tire Wear,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

```
    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,
    5,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   10,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   15,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   20,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
```

```
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   25,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   30,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   35,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   40,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   45,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   50,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   55,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
   60,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
```

0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,
65,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,
0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.008,   0.012,
0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,
0.012,   0.012,   0.012,   0.012,   0.036,   0.034,   0.000,   0.012,   0.012,
0.012,   0.000,   0.012,   0.008,   0.008,   0.004,   0.004,   0.000,   0.004,
0.000,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.012,   0.004,
0.008,   0.013,   0.008,

Pollutant Name: PM10 - Brake Wear,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,
5,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
10,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
15,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
20,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,

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0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
   25,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
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0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
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0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
   35,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
   40,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
   45,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
   50,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
   55,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
   60,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
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0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,
   65,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,
0.013,   0.013,   0.028,   0.028,   0.028,   0.028,   0.000,   0.013,   0.013,
0.013,   0.000,   0.013,   0.013,   0.013,   0.006,   0.006,   0.000,   0.006,
0.000,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.013,   0.006,
0.013,   0.014,   0.013,

Pollutant Name: Gasoline - mi/gal,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LH
D1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,
OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,AL
L,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,
    5,   6.057,   9.465,   0.000,   9.465,   5.695,   7.520,   0.000,   7.520,
5.680,   7.420,   0.000,   7.420,   3.481,   5.447,   0.000,   5.446,   2.812,
3.516,   0.000,   3.516,   2.812,   3.513,   0.000,   3.513,   2.553,   3.502,
0.000,   3.501,   1.414,   3.068,   0.000,   3.065,   0.000,   3.468,   0.000,
3.468,   0.000,   3.072,   0.000,   3.072,  27.180,  28.010,   0.000,  27.712,
0.000,   3.466,   0.000,   3.466,   2.553,   3.473,   0.000,   3.471,  26.689,
8.708,   0.000,   8.772,
   10,   8.048,  12.521,   0.000,  12.520,   7.575,   9.947,   0.000,   9.946,
7.555,   9.813,   0.000,   9.813,   4.656,   7.204,   0.000,   7.203,   4.228,
5.285,   0.000,   5.285,   4.228,   5.280,   0.000,   5.280,   3.840,   5.264,
0.000,   5.262,   2.127,   4.612,   0.000,   4.608,   0.000,   5.213,   0.000,
5.213,   0.000,   4.621,   0.000,   4.621,  32.227,  33.903,   0.000,  33.300,
0.000,   5.210,   0.000,   5.210,   3.840,   5.220,   0.000,   5.217,  31.661,
11.509,   0.000,  11.580,
   15,  10.289,  15.957,   0.000,  15.957,   9.688,  12.676,   0.000,  12.675,
9.665,  12.505,   0.000,  12.505,   5.977,   9.181,   0.000,   9.180,   6.018,
7.519,   0.000,   7.519,   6.018,   7.512,   0.000,   7.512,   5.466,   7.489,
0.000,   7.487,   3.029,   6.566,   0.000,   6.560,   0.000,   7.417,   0.000,
7.417,   0.000,   6.583,   0.000,   6.583,  37.245,  39.609,   0.000,  38.759,
0.000,   7.413,   0.000,   7.413,   5.466,   7.426,   0.000,   7.422,  36.612,
14.657,   0.000,  14.734,
   20,  12.657,  19.596,   0.000,  19.595,  11.918,  15.565,   0.000,  15.564,
11.889,  15.354,   0.000,  15.354,   7.365,  11.273,   0.000,  11.272,   8.109,
10.124,   0.000,  10.124,   8.109,  10.115,   0.000,  10.115,   7.368,  10.085,
0.000,  10.081,   4.086,   8.849,   0.000,   8.841,   0.000,   9.987,   0.000,
9.987,   0.000,   8.882,   0.000,   8.882,  41.970,  44.700,   0.000,  43.719,
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0.000,   9.982,   0.000,   9.982,   7.368, 10.000,   0.000,   9.994, 41.278,
17.987,   0.000, 18.069,
   25, 14.981, 23.187,   0.000, 23.187, 14.101, 18.416,   0.000, 18.416,
14.068, 18.166,   0.000, 18.166,   8.713, 13.338,   0.000, 13.337, 10.345,
12.903,   0.000, 12.903, 10.345, 12.891,   0.000, 12.891,   9.403, 12.853,
0.000, 12.848,   5.218, 11.290,   0.000, 11.279,   0.000, 12.730,   0.000,
12.730,   0.000, 11.349,   0.000, 11.349, 46.092, 48.745,   0.000, 47.791,
0.000, 12.723,   0.000, 12.723,   9.403, 12.745,   0.000, 12.738, 45.354,
21.270,   0.000, 21.355,
   30, 17.062, 26.437,   0.000, 26.437, 16.047, 20.997,   0.000, 20.997,
16.009, 20.712,   0.000, 20.711,   9.894, 15.207,   0.000, 15.205, 12.492,
15.565,   0.000, 15.564, 12.492, 15.550,   0.000, 15.550, 11.359, 15.504,
0.000, 15.499,   6.310, 13.636,   0.000, 13.623,   0.000, 15.357,   0.000,
15.357,   0.000, 13.730,   0.000, 13.730, 49.267, 51.367,   0.000, 50.613,
0.000, 15.349,   0.000, 15.349, 11.359, 15.375,   0.000, 15.366, 48.500,
24.238,   0.000, 24.324,
   35, 18.698, 29.047,   0.000, 29.046, 17.562, 23.070,   0.000, 23.069,
17.519, 22.755,   0.000, 22.755, 10.785, 16.707,   0.000, 16.706, 14.280,
17.770,   0.000, 17.770, 14.280, 17.754,   0.000, 17.753, 12.991, 17.702,
0.000, 17.696,   7.224, 15.591,   0.000, 15.576,   0.000, 17.535,   0.000,
17.535,   0.000, 15.728,   0.000, 15.728, 51.144, 52.292,   0.000, 51.879,
0.000, 17.526,   0.000, 17.526, 12.991, 17.555,   0.000, 17.545, 50.367,
26.615,   0.000, 26.698,
   40, 19.713, 30.752,   0.000, 30.752, 18.481, 24.425,   0.000, 24.424,
18.435, 24.092,   0.000, 24.092, 11.279, 17.689,   0.000, 17.687, 15.452,
19.203,   0.000, 19.202, 15.452, 19.185,   0.000, 19.185, 14.064, 19.130,
0.000, 19.123,   7.829, 16.873,   0.000, 16.858,   0.000, 18.951,   0.000,
18.951,   0.000, 17.057,   0.000, 17.057, 51.395, 51.394,   0.000, 51.394,
0.000, 18.941,   0.000, 18.941, 14.064, 18.972,   0.000, 18.961, 50.633,
28.159,   0.000, 28.238,
   45, 19.991, 31.373,   0.000, 31.373, 18.696, 24.919,   0.000, 24.918,
18.647, 24.581,   0.000, 24.580, 11.314, 18.047,   0.000, 18.045, 15.825,
19.640,   0.000, 19.640, 15.825, 19.622,   0.000, 19.622, 14.411, 19.566,
0.000, 19.560,   8.032, 17.285,   0.000, 17.269,   0.000, 19.386,   0.000,
19.386,   0.000, 17.509,   0.000, 17.509, 49.777, 48.724,   0.000, 49.102,
0.000, 19.376,   0.000, 19.376, 14.411, 19.406,   0.000, 19.394, 49.056,
28.706,   0.000, 28.778,
   50, 19.495, 30.842,   0.000, 30.841, 18.175, 24.498,   0.000, 24.497,
18.126, 24.167,   0.000, 24.167, 10.880, 17.743,   0.000, 17.741, 15.340,
19.013,   0.000, 19.013, 15.340, 18.996,   0.000, 18.995, 13.977, 18.942,
0.000, 18.935,   7.799, 16.759,   0.000, 16.743,   0.000, 18.769,   0.000,
18.769,   0.000, 17.012,   0.000, 17.012, 46.203, 44.514,   0.000, 45.121,
0.000, 18.759,   0.000, 18.759, 13.977, 18.787,   0.000, 18.776, 45.551,
28.195,   0.000, 28.256,
   55, 18.276, 29.214,   0.000, 29.214, 16.973, 23.206,   0.000, 23.206,
16.924, 22.895,   0.000, 22.895, 10.021, 16.808,   0.000, 16.806, 14.074,
17.421,   0.000, 17.420, 14.074, 17.405,   0.000, 17.405, 12.830, 17.356,
0.000, 17.350,   7.167, 15.378,   0.000, 15.364,   0.000, 17.199,   0.000,
17.199,   0.000, 15.644,   0.000, 15.644, 40.827, 39.148,   0.000, 39.751,
0.000, 17.190,   0.000, 17.190, 12.830, 17.215,   0.000, 17.205, 40.269,
26.681,   0.000, 26.729,
   60, 16.464, 26.663,   0.000, 26.663, 15.216, 21.181,   0.000, 21.181,
15.169, 20.899,   0.000, 20.899,   8.834, 15.342,   0.000, 15.341, 12.221,
15.107,   0.000, 15.107, 12.221, 15.094,   0.000, 15.094, 11.145, 15.052,
0.000, 15.047,   6.233, 13.356,   0.000, 13.344,   0.000, 14.917,   0.000,
14.917,   0.000, 13.613,   0.000, 13.613, 34.097, 33.107,   0.000, 33.463,

0.000, 14.910,   0.000, 14.910, 11.145, 14.930,   0.000, 14.921, 33.652,
24.324,   0.000, 24.357,
   65, 14.244, 23.447,   0.000, 23.446, 13.085, 18.627,   0.000, 18.627,
13.041, 18.381,   0.000, 18.381,   7.445, 13.493,   0.000, 13.491, 10.043,
12.400,   0.000, 12.400, 10.043, 12.389,   0.000, 12.389,   9.163, 12.355,
0.000, 12.351,   5.130, 10.977,   0.000, 10.967,   0.000, 12.245,   0.000,
12.245,   0.000, 11.209,   0.000, 11.209, 26.729, 26.899,   0.000, 26.838,
0.000, 12.239,   0.000, 12.239,   9.163, 12.255,   0.000, 12.248, 26.403,
21.364,   0.000, 21.382,

Pollutant Name: Diesel - mi/gal,,,,Temperature: 57F,,Relative Humidity: 65%

Speed,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

MPH,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

    0,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,
    5,   0.000,   0.000, 28.574, 28.574,   0.000,   0.000, 29.028, 29.028,
0.000,   0.000, 29.099, 29.099,   0.000,   0.000, 29.126, 29.126,   0.000,
0.000, 19.380, 19.380,   0.000,   0.000, 19.216, 19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   2.621,   2.621,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.380,   7.380,
   10,   0.000,   0.000, 28.574, 28.574,   0.000,   0.000, 29.028, 29.028,
0.000,   0.000, 29.099, 29.099,   0.000,   0.000, 29.126, 29.126,   0.000,
0.000, 19.380, 19.380,   0.000,   0.000, 19.216, 19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   3.184,   3.184,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.418,   7.418,
   15,   0.000,   0.000, 28.574, 28.574,   0.000,   0.000, 29.028, 29.028,
0.000,   0.000, 29.099, 29.099,   0.000,   0.000, 29.126, 29.126,   0.000,
0.000, 19.380, 19.380,   0.000,   0.000, 19.216, 19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   3.883,   3.883,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.465,   7.465,
   20,   0.000,   0.000, 28.574, 28.574,   0.000,   0.000, 29.028, 29.028,
0.000,   0.000, 29.099, 29.099,   0.000,   0.000, 29.126, 29.126,   0.000,
0.000, 19.380, 19.380,   0.000,   0.000, 19.216, 19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   4.617,   4.617,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,

```
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.514,   7.514,
   25,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   4.935,   4.935,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.536,   7.536,
   30,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.238,   5.238,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.556,   7.556,
   35,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.515,   5.515,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.575,   7.575,
   40,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.749,   5.749,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.590,   7.590,
   45,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.926,   5.926,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.602,   7.602,
   50,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   6.033,   6.033,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.610,   7.610,
   55,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   6.064,   6.064,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.612,   7.612,
   60,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   6.014,   6.014,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
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0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.608,   7.608,
   65,   0.000,   0.000,  28.574,  28.574,   0.000,   0.000,  29.028,  29.028,
0.000,   0.000,  29.099,  29.099,   0.000,   0.000,  29.126,  29.126,   0.000,
0.000,  19.380,  19.380,   0.000,   0.000,  19.216,  19.216,   0.000,   0.000,
6.698,   6.698,   0.000,   0.000,   5.889,   5.889,   0.000,   0.000,   6.698,
6.698,   0.000,   0.000,   3.792,   3.792,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   6.698,   6.698,   0.000,   0.000,   6.698,   6.698,   0.000,
0.000,   7.600,   7.600,
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Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season   : Annual
Area     : San Francisco
*******************************************************************************
*********
Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,,  San Francisco,,,,,,County Average

,,,,Table  2:  Starting Emissions (grams/trip)

Pollutant Name: Total Organic Gases,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    5,   2.067,   0.024,   0.000,   0.024,   1.610,   0.034,   0.000,   0.034,
1.723,   0.035,   0.000,   0.035,   6.898,   0.056,   0.000,   0.058,   7.729,
0.154,   0.000,   0.141,   7.729,   0.190,   0.000,   0.147,  11.594,   0.405,
0.000,   0.143,  19.757,   2.197,   0.000,   1.699,   0.000,   0.549,   0.000,
0.266,   0.000,   1.620,   0.000,   0.118,   2.346,   0.359,   0.000,   1.144,
0.000,   0.449,   0.000,   0.079,  11.594,   0.351,   0.000,   0.350,   2.726,
0.048,   0.000,   0.056,
   10,   2.049,   0.047,   0.000,   0.047,   1.596,   0.067,   0.000,   0.067,
1.709,   0.069,   0.000,   0.069,   6.839,   0.110,   0.000,   0.111,   7.663,
0.302,   0.000,   0.276,   7.663,   0.372,   0.000,   0.286,  11.495,   0.790,
0.000,   0.255,  19.587,   4.283,   0.000,   3.237,   0.000,   1.070,   0.000,
0.519,   0.000,   3.158,   0.000,   0.231,   2.326,   0.699,   0.000,   1.342,
0.000,   0.876,   0.000,   0.153,  11.495,   0.684,   0.000,   0.652,   2.703,
0.094,   0.000,   0.099,
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   20,   2.069,   0.090,   0.000,   0.090,   1.611,   0.129,   0.000,   0.128,
1.725,   0.133,   0.000,   0.133,   6.904,   0.211,   0.000,   0.213,   7.736,
0.579,   0.000,   0.528,   7.736,   0.711,   0.000,   0.546,  11.604,   1.498,
0.000,   0.462,  19.775,   8.119,   0.000,   6.067,   0.000,   2.028,   0.000,
0.983,   0.000,   5.988,   0.000,   0.437,   2.349,   1.326,   0.000,   1.730,
0.000,   1.660,   0.000,   0.291,  11.604,   1.297,   0.000,   1.209,   2.728,
0.180,   0.000,   0.179,
   30,   2.162,   0.130,   0.000,   0.130,   1.684,   0.184,   0.000,   0.183,
1.802,   0.192,   0.000,   0.192,   7.215,   0.305,   0.000,   0.307,   8.084,
0.832,   0.000,   0.759,   8.084,   1.018,   0.000,   0.781,  12.126,   2.124,
0.000,   0.646,  20.663,  11.509,   0.000,   8.572,   0.000,   2.875,   0.000,
1.394,   0.000,   8.488,   0.000,   0.620,   2.454,   1.879,   0.000,   2.106,
0.000,   2.353,   0.000,   0.412,  12.126,   1.839,   0.000,   1.702,   2.851,
0.257,   0.000,   0.252,
   40,   2.328,   0.165,   0.000,   0.165,   1.813,   0.234,   0.000,   0.233,
1.941,   0.246,   0.000,   0.246,   7.770,   0.391,   0.000,   0.393,   8.706,
1.062,   0.000,   0.968,   8.706,   1.291,   0.000,   0.990,  13.059,   2.667,
0.000,   0.807,  22.253,  14.454,   0.000,  10.749,   0.000,   3.610,   0.000,
1.750,   0.000,  10.659,   0.000,   0.779,   2.643,   2.360,   0.000,   2.472,
0.000,   2.955,   0.000,   0.518,  13.059,   2.309,   0.000,   2.131,   3.070,
0.326,   0.000,   0.317,
   50,   2.568,   0.197,   0.000,   0.197,   2.000,   0.279,   0.000,   0.277,
2.141,   0.295,   0.000,   0.295,   8.570,   0.469,   0.000,   0.471,   9.603,
1.267,   0.000,   1.154,   9.603,   1.531,   0.000,   1.175,  14.404,   3.128,
0.000,   0.945,  24.545,  16.951,   0.000,  12.601,   0.000,   4.234,   0.000,
2.053,   0.000,  12.501,   0.000,   0.913,   2.915,   2.768,   0.000,   2.826,
0.000,   3.466,   0.000,   0.607,  14.404,   2.708,   0.000,   2.497,   3.387,
0.387,   0.000,   0.375,
   60,   2.669,   0.225,   0.000,   0.225,   2.079,   0.317,   0.000,   0.316,
2.226,   0.339,   0.000,   0.339,   8.910,   0.539,   0.000,   0.541,   9.983,
1.448,   0.000,   1.319,   9.983,   1.738,   0.000,   1.333,  14.975,   3.506,
0.000,   1.057,  25.518,  19.003,   0.000,  14.118,   0.000,   4.746,   0.000,
2.301,   0.000,  14.014,   0.000,   1.024,   3.031,   3.103,   0.000,   3.074,
0.000,   3.886,   0.000,   0.680,  14.975,   3.036,   0.000,   2.796,   3.521,
0.440,   0.000,   0.425,
  120,   2.015,   0.302,   0.000,   0.302,   1.570,   0.403,   0.000,   0.401,
1.680,   0.474,   0.000,   0.473,   6.726,   0.766,   0.000,   0.766,   7.536,
1.744,   0.000,   1.589,   7.536,   1.920,   0.000,   1.473,  11.305,   3.063,
0.000,   0.919,  19.264,  16.100,   0.000,  11.952,   0.000,   4.246,   0.000,
2.059,   0.000,   9.304,   0.000,   0.680,   2.288,   3.381,   0.000,   2.949,
0.000,   3.527,   0.000,   0.618,  11.305,   2.256,   0.000,   2.078,   2.658,
0.523,   0.000,   0.498,
  180,   2.194,   0.221,   0.000,   0.221,   1.709,   0.306,   0.000,   0.304,
1.829,   0.348,   0.000,   0.348,   7.322,   0.560,   0.000,   0.561,   8.204,
1.612,   0.000,   1.469,   8.204,   1.850,   0.000,   1.419,  12.306,   3.250,
0.000,   0.976,  20.970,  17.084,   0.000,  12.684,   0.000,   4.505,   0.000,
2.184,   0.000,   9.872,   0.000,   0.721,   2.491,   2.741,   0.000,   2.642,
0.000,   3.742,   0.000,   0.655,  12.306,   2.394,   0.000,   2.206,   2.893,
0.431,   0.000,   0.414,
  240,   2.372,   0.234,   0.000,   0.234,   1.848,   0.324,   0.000,   0.322,
1.978,   0.369,   0.000,   0.369,   7.917,   0.594,   0.000,   0.595,   8.871,
1.709,   0.000,   1.557,   8.871,   1.958,   0.000,   1.502,  13.307,   3.431,
0.000,   1.031,  22.676,  18.036,   0.000,  13.393,   0.000,   4.756,   0.000,
2.306,   0.000,  10.422,   0.000,   0.761,   2.693,   2.894,   0.000,   2.815,
0.000,   3.950,   0.000,   0.692,  13.307,   2.527,   0.000,   2.330,   3.129,
0.457,   0.000,   0.439,
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  300,   2.551,   0.247,   0.000,   0.247,   1.987,   0.341,   0.000,   0.340,
2.127,   0.390,   0.000,   0.390,   8.513,   0.628,   0.000,   0.629,   9.539,
1.804,   0.000,   1.643,   9.539,   2.065,   0.000,   1.584,  14.308,   3.606,
0.000,   1.084,  24.382,  18.956,   0.000,  14.079,   0.000,   4.999,   0.000,
2.424,   0.000,  10.954,   0.000,   0.800,   2.896,   3.042,   0.000,   2.984,
0.000,   4.152,   0.000,   0.727,  14.308,   2.656,   0.000,   2.450,   3.364,
0.481,   0.000,   0.463,
  360,   2.729,   0.259,   0.000,   0.259,   2.126,   0.359,   0.000,   0.357,
2.276,   0.410,   0.000,   0.410,   9.109,   0.661,   0.000,   0.662,  10.206,
1.897,   0.000,   1.728,  10.206,   2.168,   0.000,   1.663,  15.309,   3.776,
0.000,   1.136,  26.088,  19.846,   0.000,  14.742,   0.000,   5.233,   0.000,
2.538,   0.000,  11.468,   0.000,   0.838,   3.098,   3.185,   0.000,   3.151,
0.000,   4.347,   0.000,   0.761,  15.309,   2.781,   0.000,   2.566,   3.599,
0.506,   0.000,   0.486,
  420,   2.908,   0.272,   0.000,   0.272,   2.265,   0.376,   0.000,   0.374,
2.424,   0.430,   0.000,   0.430,   9.704,   0.694,   0.000,   0.695,  10.874,
1.989,   0.000,   1.812,  10.874,   2.270,   0.000,   1.741,  16.310,   3.939,
0.000,   1.186,  27.794,  20.704,   0.000,  15.382,   0.000,   5.460,   0.000,
2.647,   0.000,  11.964,   0.000,   0.874,   3.301,   3.322,   0.000,   3.314,
0.000,   4.535,   0.000,   0.794,  16.310,   2.901,   0.000,   2.677,   3.835,
0.529,   0.000,   0.509,
  480,   3.086,   0.284,   0.000,   0.284,   2.404,   0.393,   0.000,   0.391,
2.573,   0.450,   0.000,   0.450,  10.300,   0.726,   0.000,   0.727,  11.541,
2.079,   0.000,   1.894,  11.541,   2.369,   0.000,   1.817,  17.312,   4.096,
0.000,   1.234,  29.500,  21.532,   0.000,  15.999,   0.000,   5.678,   0.000,
2.753,   0.000,  12.443,   0.000,   0.909,   3.504,   3.455,   0.000,   3.474,
0.000,   4.716,   0.000,   0.826,  17.312,   3.017,   0.000,   2.785,   4.070,
0.552,   0.000,   0.532,
  540,   3.265,   0.296,   0.000,   0.296,   2.543,   0.409,   0.000,   0.407,
2.722,   0.470,   0.000,   0.470,  10.896,   0.758,   0.000,   0.759,  12.209,
2.168,   0.000,   1.975,  12.209,   2.465,   0.000,   1.891,  18.313,   4.248,
0.000,   1.280,  31.206,  22.328,   0.000,  16.593,   0.000,   5.888,   0.000,
2.855,   0.000,  12.902,   0.000,   0.943,   3.706,   3.583,   0.000,   3.632,
0.000,   4.891,   0.000,   0.856,  18.313,   3.129,   0.000,   2.889,   4.306,
0.575,   0.000,   0.554,
  600,   3.443,   0.308,   0.000,   0.308,   2.682,   0.425,   0.000,   0.423,
2.871,   0.489,   0.000,   0.489,  11.491,   0.789,   0.000,   0.791,  12.876,
2.255,   0.000,   2.054,  12.876,   2.560,   0.000,   1.964,  19.314,   4.393,
0.000,   1.325,  32.912,  23.092,   0.000,  17.164,   0.000,   6.089,   0.000,
2.953,   0.000,  13.344,   0.000,   0.975,   3.909,   3.706,   0.000,   3.786,
0.000,   5.058,   0.000,   0.886,  19.314,   3.236,   0.000,   2.989,   4.541,
0.597,   0.000,   0.575,
  660,   3.621,   0.319,   0.000,   0.319,   2.821,   0.441,   0.000,   0.438,
3.020,   0.508,   0.000,   0.508,  12.087,   0.820,   0.000,   0.822,  13.543,
2.340,   0.000,   2.132,  13.543,   2.652,   0.000,   2.034,  20.315,   4.533,
0.000,   1.368,  34.618,  23.826,   0.000,  17.712,   0.000,   6.283,   0.000,
3.046,   0.000,  13.768,   0.000,   1.006,   4.112,   3.823,   0.000,   3.937,
0.000,   5.219,   0.000,   0.914,  20.315,   3.339,   0.000,   3.085,   4.776,
0.618,   0.000,   0.596,
  720,   3.800,   0.331,   0.000,   0.331,   2.960,   0.456,   0.000,   0.454,
3.168,   0.527,   0.000,   0.527,  12.683,   0.850,   0.000,   0.852,  14.211,
2.423,   0.000,   2.208,  14.211,   2.741,   0.000,   2.103,  21.316,   4.667,
0.000,   1.409,  36.324,  24.528,   0.000,  18.236,   0.000,   6.468,   0.000,
3.136,   0.000,  14.174,   0.000,   1.036,   4.314,   3.936,   0.000,   4.085,
0.000,   5.373,   0.000,   0.941,  21.316,   3.437,   0.000,   3.177,   5.012,
0.639,   0.000,   0.617,
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Pollutant Name: Carbon Monoxide,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

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    5,  10.945,   0.293,   0.000,   0.293,  16.544,   0.457,   0.000,   0.457,
16.786,   0.465,   0.000,   0.465,  56.743,   0.664,   0.000,   0.679,  39.388,
1.691,   0.000,   1.546,  39.388,   2.237,   0.000,   1.720,  59.082,   6.599,
0.000,   2.054, 247.227,  30.596,   0.000,  23.555,   0.000,   9.799,   0.000,
4.751,   0.000,  23.807,   0.000,   1.739,   6.277,   2.146,   0.000,   3.779,
0.000,   7.147,   0.000,   1.251,  59.082,   6.546,   0.000,   6.102,   8.836,
0.629,   0.000,   0.623,
   10,   9.692,   0.577,   0.000,   0.577,  14.650,   0.899,   0.000,   0.896,
14.865,   0.916,   0.000,   0.916,  50.247,   1.309,   0.000,   1.320,  34.879,
3.328,   0.000,   3.035,  34.879,   4.397,   0.000,   3.375,  52.318,  12.931,
0.000,   3.890, 218.925,  59.948,   0.000,  45.091,   0.000,  19.199,   0.000,
9.309,   0.000,  46.646,   0.000,   3.408,   5.558,   4.206,   0.000,   4.740,
0.000,  14.003,   0.000,   2.452,  52.318,  12.827,   0.000,  11.784,   7.824,
1.236,   0.000,   1.184,
   20,   7.482,   1.118,   0.000,   1.117,  11.309,   1.739,   0.000,   1.730,
11.475,   1.778,   0.000,   1.777,  38.788,   2.538,   0.000,   2.544,  26.924,
6.441,   0.000,   5.866,  26.924,   8.486,   0.000,   6.508,  40.387,  24.789,
0.000,   7.332, 168.998, 114.924,   0.000,  85.439,   0.000,  36.806,   0.000,
17.847,   0.000,  89.423,   0.000,   6.533,   4.291,   8.063,   0.000,   6.572,
0.000,  26.845,   0.000,   4.701,  40.387,  24.590,   0.000,  22.427,   6.040,
2.385,   0.000,   2.248,
   30,   5.665,   1.623,   0.000,   1.622,   8.564,   2.520,   0.000,   2.506,
8.689,   2.586,   0.000,   2.584,  29.371,   3.688,   0.000,   3.688,  20.388,
9.341,   0.000,   8.504,  20.388,  12.266,   0.000,   9.405,  30.582,  35.574,
0.000,  10.464, 127.971, 164.926,   0.000, 122.155,   0.000,  52.820,   0.000,
25.612,   0.000, 128.331,   0.000,   9.376,   3.249,  11.571,   0.000,   8.282,
0.000,  38.526,   0.000,   6.746,  30.582,  35.289,   0.000,  32.110,   4.574,
3.447,   0.000,   3.231,
   40,   4.243,   2.092,   0.000,   2.091,   6.414,   3.241,   0.000,   3.222,
6.508,   3.340,   0.000,   3.337,  21.998,   4.759,   0.000,   4.755,  15.270,
12.026,   0.000,  10.946,  15.270,  15.738,   0.000,  12.065,  22.905,  45.287,
0.000,  13.288,  95.846, 209.957,   0.000, 155.240,   0.000,  67.242,   0.000,
32.604,   0.000, 163.370,   0.000,  11.936,   2.433,  14.730,   0.000,   9.870,
0.000,  49.045,   0.000,   8.588,  22.905,  44.924,   0.000,  40.833,   3.425,
4.423,   0.000,   4.136,
   50,   3.215,   2.526,   0.000,   2.525,   4.860,   3.902,   0.000,   3.879,
4.931,   4.041,   0.000,   4.037,  16.668,   5.751,   0.000,   5.743,  11.570,
14.496,   0.000,  13.194,  11.570,  18.901,   0.000,  14.489,  17.355,  53.927,
0.000,  15.802,  72.623, 250.014,   0.000, 184.692,   0.000,  80.071,   0.000,
38.825,   0.000, 194.539,   0.000,  14.213,   1.844,  17.540,   0.000,  11.336,
0.000,  58.402,   0.000,  10.227,  17.355,  53.495,   0.000,  48.596,   2.595,
5.313,   0.000,   4.961,
   60,   2.581,   2.925,   0.000,   2.923,   3.901,   4.504,   0.000,   4.477,
3.959,   4.688,   0.000,   4.684,  13.381,   6.664,   0.000,   6.653,   9.288,
```

16.753,   0.000, 15.247,   9.288, 21.756,   0.000, 16.678, 13.933, 61.495,
0.000, 18.007, 58.301, 285.100,   0.000, 210.512,   0.000, 91.307,   0.000,
44.274,   0.000, 221.839,   0.000, 16.207,   1.480, 20.001,   0.000, 12.681,
0.000, 66.597,   0.000, 11.662, 13.933, 61.002,   0.000, 55.400,   2.084,
6.115,   0.000,   5.707,
120,   8.539,   4.176,   0.000,   4.173, 12.907,   6.004,   0.000,   5.969,
13.096,   6.790,   0.000,   6.785, 44.268,   9.614,   0.000,   9.605, 30.728,
19.200,   0.000, 17.477, 30.728, 22.615,   0.000, 17.339, 46.093, 45.611,
0.000, 13.431, 192.874, 200.173,   0.000, 148.412,   0.000, 69.377,   0.000,
33.640,   0.000, 128.402,   0.000,   9.381,   4.897, 24.045,   0.000, 16.477,
0.000, 51.254,   0.000,   8.975, 46.093, 39.645,   0.000, 36.105,   6.893,
7.064,   0.000,   6.611,
180, 13.492,   2.799,   0.000,   2.798, 20.394,   4.187,   0.000,   4.164,
20.693,   4.574,   0.000,   4.571, 69.946,   6.432,   0.000,   6.438, 48.553,
14.777,   0.000, 13.455, 48.553, 18.730,   0.000, 14.363, 72.830, 46.944,
0.000, 13.877, 304.756, 206.025,   0.000, 153.175,   0.000, 71.405,   0.000,
34.623,   0.000, 132.156,   0.000,   9.655,   7.737, 14.715,   0.000, 11.957,
0.000, 52.752,   0.000,   9.237, 72.830, 40.804,   0.000, 37.230, 10.892,
5.368,   0.000,   5.048,
240, 17.920,   2.989,   0.000,   2.988, 27.088,   4.443,   0.000,   4.420,
27.484,   4.905,   0.000,   4.902, 92.904,   6.881,   0.000,   6.893, 64.489,
15.735,   0.000, 14.330, 64.489, 19.757,   0.000, 15.153, 96.734, 48.321,
0.000, 14.330, 404.781, 212.070,   0.000, 158.033,   0.000, 73.500,   0.000,
35.639,   0.000, 136.033,   0.000,   9.938, 10.277, 15.147,   0.000, 13.222,
0.000, 54.300,   0.000,   9.508, 96.734, 42.001,   0.000, 38.382, 14.466,
5.666,   0.000,   5.340,
300, 21.823,   3.160,   0.000,   3.159, 32.988,   4.678,   0.000,   4.654,
33.470,   5.201,   0.000,   5.199, 113.139,   7.284,   0.000,   7.301, 78.536,
16.603,   0.000, 15.123, 78.536, 20.709,   0.000, 15.884, 117.804, 49.742,
0.000, 14.790, 492.948, 218.307,   0.000, 162.986,   0.000, 75.662,   0.000,
36.687,   0.000, 140.034,   0.000, 10.231, 12.515, 15.593,   0.000, 14.376,
0.000, 55.897,   0.000,   9.788, 117.804, 43.236,   0.000, 39.560, 17.617,
5.941,   0.000,   5.610,
360, 25.201,   3.313,   0.000,   3.312, 38.095,   4.890,   0.000,   4.866,
38.652,   5.464,   0.000,   5.461, 130.654,   7.643,   0.000,   7.664, 90.693,
17.384,   0.000, 15.835, 90.693, 21.584,   0.000, 16.557, 136.040, 51.207,
0.000, 15.257, 569.257, 224.737,   0.000, 168.034,   0.000, 77.890,   0.000,
37.768,   0.000, 144.159,   0.000, 10.532, 14.452, 16.052,   0.000, 15.420,
0.000, 57.543,   0.000, 10.076, 136.040, 44.510,   0.000, 40.766, 20.345,
6.194,   0.000,   5.857,
420, 28.055,   3.448,   0.000,   3.447, 42.408,   5.080,   0.000,   5.055,
43.028,   5.692,   0.000,   5.689, 145.446,   7.957,   0.000,   7.982, 100.962,
18.075,   0.000, 16.466, 100.962, 22.384,   0.000, 17.171, 151.442, 52.717,
0.000, 15.730, 633.709, 231.360,   0.000, 173.176,   0.000, 80.186,   0.000,
38.881,   0.000, 148.407,   0.000, 10.842, 16.089, 16.525,   0.000, 16.352,
0.000, 59.239,   0.000, 10.373, 151.442, 45.822,   0.000, 41.998, 22.648,
6.424,   0.000,   6.081,
480, 30.383,   3.564,   0.000,   3.563, 45.927,   5.248,   0.000,   5.222,
46.599,   5.886,   0.000,   5.883, 157.517,   8.226,   0.000,   8.254, 109.341,
18.677,   0.000, 17.016, 109.341, 23.107,   0.000, 17.727, 164.011, 54.270,
0.000, 16.211, 686.303, 238.176,   0.000, 178.414,   0.000, 82.548,   0.000,
40.026,   0.000, 152.780,   0.000, 11.162, 17.424, 17.012,   0.000, 17.175,
0.000, 60.984,   0.000, 10.679, 164.011, 47.171,   0.000, 43.258, 24.528,
6.632,   0.000,   6.283,
540, 32.187,   3.661,   0.000,   3.661, 48.653,   5.393,   0.000,   5.367,
49.365,   6.045,   0.000,   6.043, 166.867,   8.450,   0.000,   8.480, 115.831,
19.191,   0.000, 17.485, 115.831, 23.754,   0.000, 18.224, 173.746, 55.867,

0.000, 16.698, 727.040, 245.185,   0.000, 183.746,   0.000, 84.977,   0.000,
41.204,   0.000, 157.275,   0.000, 11.490, 18.458, 17.512,   0.000, 17.886,
0.000, 62.779,   0.000, 10.993, 173.746, 48.560,   0.000, 44.544, 25.984,
6.818,   0.000,   6.462,
  600, 33.465,   3.740,   0.000,   3.740, 50.586,   5.516,   0.000,   5.489,
51.326,   6.171,   0.000,   6.168, 173.495,   8.630,   0.000,   8.661, 120.432,
19.616,   0.000, 17.872, 120.432, 24.325,   0.000, 18.662, 180.648, 57.508,
0.000, 17.193, 755.919, 252.387,   0.000, 189.173,   0.000, 87.473,   0.000,
42.414,   0.000, 161.895,   0.000, 11.828, 19.191, 18.027,   0.000, 18.487,
0.000, 64.623,   0.000, 11.316, 180.648, 49.986,   0.000, 45.857, 27.016,
6.981,   0.000,   6.619,
  660, 34.219,   3.801,   0.000,   3.800, 51.725,   5.616,   0.000,   5.590,
52.481,   6.262,   0.000,   6.260, 177.402,   8.765,   0.000,   8.797, 123.144,
19.952,   0.000, 18.179, 123.144, 24.821,   0.000, 19.042, 184.715, 59.193,
0.000, 17.694, 772.940, 259.782,   0.000, 194.695,   0.000, 90.036,   0.000,
43.657,   0.000, 166.638,   0.000, 12.174, 19.624, 18.555,   0.000, 18.977,
0.000, 66.516,   0.000, 11.647, 184.715, 51.450,   0.000, 47.198, 27.624,
7.122,   0.000,   6.752,
  720, 34.447,   3.843,   0.000,   3.842, 52.071,   5.695,   0.000,   5.668,
52.832,   6.319,   0.000,   6.317, 178.587,   8.854,   0.000,   8.887, 123.966,
20.200,   0.000, 18.404, 123.966, 25.240,   0.000, 19.363, 185.949, 60.921,
0.000, 18.202, 778.104, 267.369,   0.000, 200.312,   0.000, 92.666,   0.000,
44.932,   0.000, 171.506,   0.000, 12.530, 19.755, 19.097,   0.000, 19.357,
0.000, 68.459,   0.000, 11.988, 185.949, 52.953,   0.000, 48.565, 27.809,
7.240,   0.000,   6.863,

Pollutant Name: Oxides of Nitrogen,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    5,   0.752,   0.088,   0.000,   0.088,   0.672,   0.121,   0.000,   0.121,
0.752,   0.225,   0.000,   0.225,   2.334,   0.325,   0.000,   0.325,   0.546,
1.366,   0.000,   1.243,   0.546,   1.282,   0.000,   0.983,   0.818,   0.999,
0.000,   0.294,   3.426,   5.150,   0.000,   3.812,   0.000,   1.774,   0.000,
0.860,   0.000,   2.936,   0.000,   0.215,   0.301,   0.098,   0.000,   0.178,
0.000,   1.431,   0.000,   0.251,   0.818,   0.764,   0.000,   0.696,   0.336,
0.195,   0.000,   0.183,
   10,   0.817,   0.098,   0.000,   0.098,   0.730,   0.137,   0.000,   0.136,
0.818,   0.245,   0.000,   0.245,   2.537,   0.356,   0.000,   0.355,   0.593,
1.534,   0.000,   1.396,   0.593,   1.531,   0.000,   1.174,   0.890,   1.505,
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1.296,   0.000,   4.424,   0.000,   0.323,   0.327,   0.148,   0.000,   0.219,
0.000,   2.157,   0.000,   0.378,   0.890,   1.151,   0.000,   1.047,   0.365,
0.232,   0.000,   0.218,
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0.937,   0.282,   0.000,   0.282,   2.906,   0.410,   0.000,   0.410,   0.679,
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0.000,   1.193,   5.458,  21.000,   0.000,  15.511,   0.000,   7.233,   0.000,
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0.433,   0.000,   0.405,
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0.421,   0.000,   0.393,
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0.391,   0.000,   0.365,
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Pollutant Name: Carbon Dioxide,,,,Temperature: 57F,,Relative Humidity: ALL

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Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
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BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
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L,

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123.849,   0.000, 255.419,   0.000,  18.661,  88.997,  47.393,   0.000,  63.836,
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130.778,   0.000, 122.304,
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287.826, 156.889,   0.000, 156.757, 392.810, 214.358,   0.000, 213.997, 426.960,
269.714,   0.000, 245.513, 426.960, 271.407,   0.000, 208.093, 426.960, 285.644,
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138.504,   0.000, 285.644,   0.000,  20.869,  89.066,  53.001,   0.000,  67.255,
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144.857,   0.000, 135.422,
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295.732,   0.000, 269.189, 427.294, 297.657,   0.000, 228.214, 427.294, 313.847,
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152.180,   0.000, 313.847,   0.000,  22.929,  89.136,  58.234,   0.000,  70.448,
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158.780,   0.000, 148.396,
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186.160,   0.000, 173.909,
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288.729, 216.525,   0.000, 216.336, 394.042, 295.648,   0.000, 295.108, 428.299,
370.755,   0.000, 337.459, 428.299, 372.409,   0.000, 285.512, 428.299, 386.319,
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187.320,   0.000, 386.319,   0.000,  28.224,  89.346,  71.681,   0.000,  78.663,
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199.617,   0.000, 186.448,
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226.065,   0.000, 211.093,
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289.406, 260.293,   0.000, 260.062, 394.966, 354.835,   0.000, 354.165, 429.303,
441.233,   0.000, 401.592, 429.303, 441.164,   0.000, 338.213, 429.303, 440.585,
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213.633,   0.000, 440.586,   0.000, 32.189, 89.555, 81.750,   0.000, 84.835,
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239.057,   0.000, 223.198,

Pollutant Name: Sulfur Dioxide,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

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0.000,   0.000,   0.000,

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0.002,   0.934,   0.006,   0.000,   0.000,   0.001,   0.001,   0.206,   0.001,
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0.000,   0.001,   0.016,   0.008,   0.000,   0.006,   1.062,   0.005,   0.000,
0.003,   0.934,   0.006,   0.000,   0.000,   0.001,   0.001,   0.206,   0.001,
0.000,   0.005,   0.000,   0.001,   0.007,   0.005,   0.000,   0.004,   0.002,
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0.004,   0.000,   0.004,   0.006,   0.004,   0.000,   0.003,   0.007,   0.005,
0.000,   0.001,   0.016,   0.008,   0.000,   0.006,   1.062,   0.005,   0.000,
0.003,   0.934,   0.007,   0.000,   0.000,   0.001,   0.001,   0.206,   0.001,
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0.004,   0.002,   0.000,   0.002,   0.007,   0.003,   0.000,   0.003,   0.006,
0.004,   0.000,   0.004,   0.006,   0.004,   0.000,   0.003,   0.007,   0.005,
0.000,   0.002,   0.017,   0.009,   0.000,   0.006,   1.062,   0.006,   0.000,
0.003,   0.934,   0.007,   0.000,   0.001,   0.001,   0.001,   0.206,   0.001,
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0.000,   0.002,   0.017,   0.009,   0.000,   0.007,   1.062,   0.006,   0.000,
0.003,   0.934,   0.007,   0.000,   0.001,   0.001,   0.001,   0.206,   0.001,
0.000,   0.005,   0.000,   0.001,   0.008,   0.005,   0.000,   0.005,   0.002,
0.002,   0.000,   0.002,
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Pollutant Name: PM10,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,

```
min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    5,   0.011,   0.000,   0.000,   0.000,   0.008,   0.001,   0.000,   0.001,
0.013,   0.001,   0.000,   0.001,   0.012,   0.002,   0.000,   0.002,   0.011,
0.001,   0.000,   0.001,   0.011,   0.001,   0.000,   0.001,   0.011,   0.001,
0.000,   0.000,   0.011,   0.002,   0.000,   0.001,   0.000,   0.001,   0.000,
0.001,   0.000,   0.002,   0.000,   0.000,   0.020,   0.000,   0.000,   0.008,
0.000,   0.002,   0.000,   0.000,   0.011,   0.000,   0.000,   0.000,   0.019,
0.001,   0.000,   0.001,
   10,   0.010,   0.001,   0.000,   0.001,   0.007,   0.001,   0.000,   0.001,
0.011,   0.003,   0.000,   0.003,   0.010,   0.003,   0.000,   0.003,   0.010,
0.002,   0.000,   0.002,   0.010,   0.002,   0.000,   0.001,   0.010,   0.002,
0.000,   0.001,   0.010,   0.004,   0.000,   0.003,   0.000,   0.003,   0.000,
0.001,   0.000,   0.003,   0.000,   0.000,   0.017,   0.000,   0.000,   0.007,
0.000,   0.003,   0.000,   0.001,   0.010,   0.001,   0.000,   0.001,   0.017,
0.001,   0.000,   0.001,
   20,   0.008,   0.002,   0.000,   0.002,   0.006,   0.002,   0.000,   0.002,
0.009,   0.005,   0.000,   0.005,   0.008,   0.006,   0.000,   0.006,   0.008,
0.003,   0.000,   0.003,   0.008,   0.003,   0.000,   0.002,   0.008,   0.005,
0.000,   0.001,   0.008,   0.007,   0.000,   0.005,   0.000,   0.006,   0.000,
0.003,   0.000,   0.006,   0.000,   0.000,   0.013,   0.001,   0.000,   0.006,
0.000,   0.006,   0.000,   0.001,   0.008,   0.001,   0.000,   0.001,   0.013,
0.003,   0.000,   0.003,
   30,   0.006,   0.003,   0.000,   0.003,   0.004,   0.003,   0.000,   0.003,
0.007,   0.007,   0.000,   0.007,   0.006,   0.009,   0.000,   0.009,   0.006,
0.005,   0.000,   0.004,   0.006,   0.005,   0.000,   0.004,   0.006,   0.007,
0.000,   0.002,   0.006,   0.010,   0.000,   0.007,   0.000,   0.008,   0.000,
0.004,   0.000,   0.009,   0.000,   0.001,   0.010,   0.001,   0.000,   0.005,
0.000,   0.009,   0.000,   0.001,   0.006,   0.002,   0.000,   0.002,   0.010,
0.004,   0.000,   0.004,
   40,   0.004,   0.004,   0.000,   0.004,   0.003,   0.004,   0.000,   0.004,
0.005,   0.009,   0.000,   0.009,   0.005,   0.011,   0.000,   0.011,   0.004,
0.006,   0.000,   0.005,   0.004,   0.006,   0.000,   0.005,   0.004,   0.009,
0.000,   0.003,   0.004,   0.012,   0.000,   0.009,   0.000,   0.010,   0.000,
0.005,   0.000,   0.012,   0.000,   0.001,   0.008,   0.001,   0.000,   0.004,
0.000,   0.011,   0.000,   0.002,   0.004,   0.002,   0.000,   0.002,   0.007,
0.005,   0.000,   0.005,
   50,   0.003,   0.004,   0.000,   0.004,   0.002,   0.005,   0.000,   0.005,
0.004,   0.011,   0.000,   0.011,   0.003,   0.014,   0.000,   0.014,   0.003,
0.007,   0.000,   0.007,   0.003,   0.007,   0.000,   0.006,   0.003,   0.010,
0.000,   0.003,   0.003,   0.015,   0.000,   0.011,   0.000,   0.012,   0.000,
0.006,   0.000,   0.014,   0.000,   0.001,   0.006,   0.002,   0.000,   0.003,
0.000,   0.013,   0.000,   0.002,   0.003,   0.003,   0.000,   0.003,   0.006,
0.006,   0.000,   0.006,
   60,   0.003,   0.005,   0.000,   0.005,   0.002,   0.006,   0.000,   0.006,
0.003,   0.013,   0.000,   0.013,   0.003,   0.016,   0.000,   0.016,   0.003,
0.008,   0.000,   0.008,   0.003,   0.008,   0.000,   0.006,   0.003,   0.012,
0.000,   0.003,   0.003,   0.017,   0.000,   0.012,   0.000,   0.014,   0.000,
0.007,   0.000,   0.016,   0.000,   0.001,   0.005,   0.002,   0.000,   0.003,
0.000,   0.015,   0.000,   0.003,   0.003,   0.003,   0.000,   0.003,   0.005,
0.007,   0.000,   0.007,
  120,   0.007,   0.008,   0.000,   0.008,   0.005,   0.010,   0.000,   0.010,
0.008,   0.021,   0.000,   0.021,   0.008,   0.026,   0.000,   0.025,   0.007,
```

```
0.013,   0.000,   0.012,   0.007,   0.012,   0.000,   0.009,   0.007,   0.016,
0.000,   0.005,   0.007,   0.023,   0.000,   0.017,   0.000,   0.019,   0.000,
0.009,   0.000,   0.022,   0.000,   0.002,   0.013,   0.002,   0.000,   0.006,
0.000,   0.020,   0.000,   0.004,   0.007,   0.004,   0.000,   0.004,   0.012,
0.011,   0.000,   0.011,
  180,   0.011,   0.009,   0.000,   0.009,   0.008,   0.011,   0.000,   0.011,
0.013,   0.024,   0.000,   0.024,   0.012,   0.028,   0.000,   0.028,   0.011,
0.014,   0.000,   0.013,   0.011,   0.013,   0.000,   0.010,   0.011,   0.016,
0.000,   0.005,   0.011,   0.024,   0.000,   0.018,   0.000,   0.020,   0.000,
0.010,   0.000,   0.022,   0.000,   0.002,   0.020,   0.002,   0.000,   0.009,
0.000,   0.021,   0.000,   0.004,   0.011,   0.005,   0.000,   0.004,   0.019,
0.013,   0.000,   0.012,
  240,   0.015,   0.010,   0.000,   0.010,   0.011,   0.012,   0.000,   0.012,
0.017,   0.026,   0.000,   0.026,   0.016,   0.031,   0.000,   0.030,   0.015,
0.015,   0.000,   0.013,   0.015,   0.014,   0.000,   0.010,   0.015,   0.017,
0.000,   0.005,   0.015,   0.025,   0.000,   0.018,   0.000,   0.020,   0.000,
0.010,   0.000,   0.023,   0.000,   0.002,   0.026,   0.002,   0.000,   0.012,
0.000,   0.021,   0.000,   0.004,   0.015,   0.005,   0.000,   0.004,   0.026,
0.014,   0.000,   0.013,
  300,   0.018,   0.010,   0.000,   0.010,   0.014,   0.012,   0.000,   0.012,
0.021,   0.027,   0.000,   0.027,   0.019,   0.033,   0.000,   0.033,   0.018,
0.016,   0.000,   0.014,   0.018,   0.014,   0.000,   0.011,   0.018,   0.017,
0.000,   0.005,   0.018,   0.025,   0.000,   0.019,   0.000,   0.021,   0.000,
0.010,   0.000,   0.024,   0.000,   0.002,   0.032,   0.003,   0.000,   0.014,
0.000,   0.022,   0.000,   0.004,   0.018,   0.005,   0.000,   0.004,   0.031,
0.015,   0.000,   0.014,
  360,   0.021,   0.011,   0.000,   0.011,   0.016,   0.013,   0.000,   0.013,
0.024,   0.029,   0.000,   0.029,   0.022,   0.034,   0.000,   0.034,   0.021,
0.016,   0.000,   0.015,   0.021,   0.015,   0.000,   0.011,   0.021,   0.018,
0.000,   0.005,   0.021,   0.026,   0.000,   0.019,   0.000,   0.021,   0.000,
0.010,   0.000,   0.024,   0.000,   0.002,   0.037,   0.003,   0.000,   0.016,
0.000,   0.023,   0.000,   0.004,   0.021,   0.005,   0.000,   0.005,   0.036,
0.015,   0.000,   0.014,
  420,   0.023,   0.011,   0.000,   0.011,   0.017,   0.014,   0.000,   0.014,
0.027,   0.030,   0.000,   0.030,   0.025,   0.036,   0.000,   0.036,   0.023,
0.017,   0.000,   0.015,   0.023,   0.015,   0.000,   0.012,   0.023,   0.018,
0.000,   0.005,   0.023,   0.027,   0.000,   0.020,   0.000,   0.022,   0.000,
0.011,   0.000,   0.025,   0.000,   0.002,   0.041,   0.003,   0.000,   0.018,
0.000,   0.023,   0.000,   0.004,   0.023,   0.005,   0.000,   0.005,   0.040,
0.016,   0.000,   0.015,
  480,   0.025,   0.012,   0.000,   0.012,   0.019,   0.014,   0.000,   0.014,
0.029,   0.031,   0.000,   0.031,   0.027,   0.037,   0.000,   0.037,   0.025,
0.018,   0.000,   0.016,   0.025,   0.016,   0.000,   0.012,   0.025,   0.019,
0.000,   0.006,   0.025,   0.028,   0.000,   0.020,   0.000,   0.023,   0.000,
0.011,   0.000,   0.026,   0.000,   0.002,   0.045,   0.003,   0.000,   0.019,
0.000,   0.024,   0.000,   0.004,   0.025,   0.005,   0.000,   0.005,   0.044,
0.017,   0.000,   0.016,
  540,   0.027,   0.012,   0.000,   0.012,   0.020,   0.015,   0.000,   0.014,
0.031,   0.032,   0.000,   0.032,   0.028,   0.038,   0.000,   0.038,   0.027,
0.018,   0.000,   0.016,   0.027,   0.016,   0.000,   0.013,   0.027,   0.019,
0.000,   0.006,   0.027,   0.028,   0.000,   0.021,   0.000,   0.023,   0.000,
0.011,   0.000,   0.027,   0.000,   0.002,   0.047,   0.003,   0.000,   0.020,
0.000,   0.025,   0.000,   0.004,   0.027,   0.005,   0.000,   0.005,   0.046,
0.017,   0.000,   0.016,
  600,   0.028,   0.012,   0.000,   0.012,   0.021,   0.015,   0.000,   0.015,
0.032,   0.033,   0.000,   0.033,   0.029,   0.039,   0.000,   0.039,   0.028,
0.018,   0.000,   0.017,   0.028,   0.017,   0.000,   0.013,   0.028,   0.020,
```

0.000,   0.006,   0.028,   0.029,   0.000,   0.022,   0.000,   0.024,   0.000,
0.012,   0.000,   0.027,   0.000,   0.002,   0.049,   0.003,   0.000,   0.021,
0.000,   0.025,   0.000,   0.004,   0.028,   0.006,   0.000,   0.005,   0.048,
0.017,   0.000,   0.016,
660,   0.029,   0.012,   0.000,   0.012,   0.021,   0.015,   0.000,   0.015,
0.033,   0.033,   0.000,   0.033,   0.030,   0.039,   0.000,   0.039,   0.029,
0.019,   0.000,   0.017,   0.029,   0.017,   0.000,   0.013,   0.029,   0.021,
0.000,   0.006,   0.029,   0.030,   0.000,   0.022,   0.000,   0.025,   0.000,
0.012,   0.000,   0.028,   0.000,   0.002,   0.050,   0.003,   0.000,   0.022,
0.000,   0.026,   0.000,   0.005,   0.029,   0.006,   0.000,   0.005,   0.049,
0.018,   0.000,   0.017,
720,   0.029,   0.013,   0.000,   0.013,   0.021,   0.015,   0.000,   0.015,
0.033,   0.033,   0.000,   0.033,   0.030,   0.040,   0.000,   0.039,   0.029,
0.019,   0.000,   0.017,   0.029,   0.017,   0.000,   0.013,   0.029,   0.021,
0.000,   0.006,   0.029,   0.031,   0.000,   0.023,   0.000,   0.025,   0.000,
0.012,   0.000,   0.029,   0.000,   0.002,   0.051,   0.003,   0.000,   0.022,
0.000,   0.027,   0.000,   0.005,   0.029,   0.006,   0.000,   0.005,   0.049,
0.018,   0.000,   0.017,

Title   : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season   : Annual
Area   : San Francisco
****
****
Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 4: Hot Soak Emissions (grams/trip)

Pollutant Name: Total Organic Gases,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

5,   0.368,   0.042,   0.000,   0.042,   0.680,   0.058,   0.000,   0.057,
0.673,   0.053,   0.000,   0.053,   0.153,   0.052,   0.000,   0.052,   0.353,
0.023,   0.000,   0.021,   0.353,   0.032,   0.000,   0.025,   0.203,   0.013,
0.000,   0.004,   0.203,   0.027,   0.000,   0.021,   0.000,   0.018,   0.000,
0.009,   0.000,   0.328,   0.000,   0.024,   0.017,   0.120,   0.000,   0.079,

0.000,	0.019,	0.000,	0.003,	0.200,	0.046,	0.000,	0.042,	0.032,
0.045,	0.000,	0.042,						
10,	0.682,	0.078,	0.000,	0.078,	1.252,	0.106,	0.000,	0.106,
1.240,	0.098,	0.000,	0.098,	0.282,	0.096,	0.000,	0.096,	0.650,
0.043,	0.000,	0.039,	0.650,	0.059,	0.000,	0.045,	0.374,	0.023,
0.000,	0.008,	0.375,	0.050,	0.000,	0.038,	0.000,	0.034,	0.000,
0.016,	0.000,	0.605,	0.000,	0.044,	0.031,	0.222,	0.000,	0.147,
0.000,	0.036,	0.000,	0.006,	0.368,	0.085,	0.000,	0.078,	0.058,
0.084,	0.000,	0.078,						
20,	1.173,	0.132,	0.000,	0.132,	2.125,	0.181,	0.000,	0.180,
2.105,	0.167,	0.000,	0.167,	0.479,	0.164,	0.000,	0.164,	1.104,
0.073,	0.000,	0.067,	1.104,	0.100,	0.000,	0.077,	0.636,	0.040,
0.000,	0.013,	0.636,	0.086,	0.000,	0.066,	0.000,	0.058,	0.000,
0.028,	0.000,	1.031,	0.000,	0.075,	0.053,	0.382,	0.000,	0.252,
0.000,	0.061,	0.000,	0.011,	0.625,	0.144,	0.000,	0.132,	0.099,
0.142,	0.000,	0.133,						
30,	1.520,	0.169,	0.000,	0.169,	2.713,	0.232,	0.000,	0.231,
2.687,	0.214,	0.000,	0.214,	0.612,	0.211,	0.000,	0.210,	1.409,
0.094,	0.000,	0.086,	1.409,	0.129,	0.000,	0.099,	0.811,	0.052,
0.000,	0.017,	0.811,	0.112,	0.000,	0.086,	0.000,	0.074,	0.000,
0.036,	0.000,	1.322,	0.000,	0.097,	0.068,	0.495,	0.000,	0.326,
0.000,	0.078,	0.000,	0.014,	0.798,	0.184,	0.000,	0.169,	0.127,
0.182,	0.000,	0.170,						
40,	1.653,	0.183,	0.000,	0.183,	2.926,	0.250,	0.000,	0.249,
2.898,	0.232,	0.000,	0.232,	0.660,	0.228,	0.000,	0.227,	1.520,
0.102,	0.000,	0.093,	1.520,	0.140,	0.000,	0.107,	0.875,	0.057,
0.000,	0.019,	0.875,	0.123,	0.000,	0.094,	0.000,	0.081,	0.000,
0.039,	0.000,	1.429,	0.000,	0.104,	0.073,	0.538,	0.000,	0.354,
0.000,	0.084,	0.000,	0.015,	0.860,	0.199,	0.000,	0.183,	0.137,
0.197,	0.000,	0.184,						

Hot soak results are scaled to reflect zero emissions for trip lengths of less than 5 minutes (about 25% of in-use trips).

Title : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season : Annual
Area : San Francisco
****

Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 5a: Partial Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity: ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CA
T,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NC
AT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
LL,

57, 0.348, 0.027, 0.000, 0.027, 0.275, 0.039, 0.000, 0.039,
0.273, 0.036, 0.000, 0.036, 0.062, 0.036, 0.000, 0.036, 0.018,
0.002, 0.000, 0.002, 0.018, 0.003, 0.000, 0.001, 0.016, 0.002,
0.000, 0.001, 0.010, 0.004, 0.000, 0.001, 0.000, 0.002, 0.000,
0.001, 0.000, 0.006, 0.000, 0.000, 0.006, 0.110, 0.000, 0.069,
0.000, 0.002, 0.000, 0.000, 0.017, 0.005, 0.000, 0.005, 0.009,
0.032, 0.000, 0.031,

Title : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season : Annual
Area : San Francisco
****
****
Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 5b: Multi-Day Diurnal Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity: ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CA
T,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NC
AT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
LL,

57, 0.021, 0.002, 0.000, 0.002, 0.016, 0.003, 0.000, 0.003,
0.016, 0.003, 0.000, 0.003, 0.004, 0.003, 0.000, 0.003, 0.001,
0.000, 0.000, 0.000, 0.001, 0.000, 0.000, 0.000, 0.001, 0.000,
0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000, 0.000,
0.000, 0.000, 0.002, 0.000, 0.000, 0.000, 0.010, 0.000, 0.006,
0.000, 0.000, 0.000, 0.000, 0.001, 0.000, 0.000, 0.000, 0.001,
0.003, 0.000, 0.002,

Title   : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season   : Annual
Area   : San Francisco
****
****
Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 6a: Partial Day Resting Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity: ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CA
T,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NC
AT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,A
LL,

57,   0.217,   0.017,   0.000,   0.017,   0.185,   0.024,   0.000,   0.024,
0.183,   0.024,   0.000,   0.024,   0.042,   0.024,   0.000,   0.024,   0.013,
0.001,   0.000,   0.001,   0.013,   0.002,   0.000,   0.001,   0.012,   0.002,
0.000,   0.000,   0.008,   0.003,   0.000,   0.001,   0.000,   0.002,   0.000,
0.001,   0.000,   0.004,   0.000,   0.000,   0.004,   0.049,   0.000,   0.031,
0.000,   0.002,   0.000,   0.000,   0.012,   0.003,   0.000,   0.003,   0.005,
0.020,   0.000,   0.019,

Title   : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season   : Annual
Area   : San Francisco
****
****
Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 6b: Multi-Day Resting Loss Emissions (grams/hour)

Pollutant Name: Total Organic Gases,,,,Temperature: ALL,,Relative Humidity: ALL

Temp,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,
degF,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

```
   57,   0.014,   0.001,   0.000,   0.001,   0.012,   0.002,   0.000,   0.002,
0.012,   0.002,   0.000,   0.002,   0.003,   0.002,   0.000,   0.002,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,
0.000,   0.000,   0.001,   0.000,   0.000,   0.000,   0.005,   0.000,   0.003,
0.000,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.000,   0.000,
0.002,   0.000,   0.002,
```

Title   : SF 2011 and 2020_EMFAC
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season   : Annual
Area   : San Francisco
****
Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,, San Francisco,,,,,,County Average

,,,,Table 7: Estimated Travel Fractions

Pollutant Name: ,,,,Temperature: ALL,,Relative Humidity: ALL

,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,OBUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL,ALL,ALL,ALL,
,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,

```
%VMT,   0.000,   0.614,   0.000,   0.614,   0.000,   0.111,   0.001,   0.112,
0.000,   0.158,   0.000,   0.158,   0.000,   0.052,   0.000,   0.052,   0.000,
0.004,   0.001,   0.005,   0.000,   0.003,   0.002,   0.005,   0.000,   0.005,
0.023,   0.027,   0.000,   0.000,   0.003,   0.003,   0.000,   0.000,   0.001,
0.002,   0.000,   0.001,   0.010,   0.010,   0.003,   0.006,   0.000,   0.009,
0.000,   0.000,   0.001,   0.001,   0.000,   0.001,   0.000,   0.001,   0.003,
0.955,   0.042,   1.000,
```

```
%TRIP,   0.000,   0.582,   0.000,   0.583,   0.000,   0.101,   0.001,   0.102,
0.000,   0.145,   0.000,   0.146,   0.000,   0.042,   0.000,   0.042,   0.000,
0.017,   0.002,   0.019,   0.000,   0.012,   0.004,   0.016,   0.000,   0.022,
0.052,   0.074,   0.000,   0.001,   0.000,   0.001,   0.000,   0.003,   0.003,
0.006,   0.000,   0.000,   0.001,   0.002,   0.004,   0.006,   0.000,   0.010,
0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.000,   0.004,
0.932,   0.064,   1.000,
%VEH,   0.000,   0.623,   0.001,   0.623,   0.000,   0.110,   0.001,   0.111,
0.000,   0.157,   0.000,   0.157,   0.000,   0.045,   0.000,   0.045,   0.000,
0.003,   0.001,   0.004,   0.000,   0.002,   0.002,   0.004,   0.000,   0.003,
0.012,   0.016,   0.000,   0.000,   0.000,   0.001,   0.000,   0.000,   0.001,
0.001,   0.000,   0.000,   0.002,   0.003,   0.013,   0.020,   0.000,   0.033,
0.000,   0.000,   0.001,   0.001,   0.000,   0.002,   0.000,   0.002,   0.013,
0.966,   0.021,   1.000,




Title    : SF 2011 and 2020_EMFAC
Version  : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/06/09 16:05:58
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season   : Annual
Area     : San Francisco
********************************************************************************
*********
Year:,2020,, -- Model Years,,1976, to ,2020, Inclusive --,,,Annual
     Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average,,,,,  San Francisco,,,,,,County Average

,,,,Table  8:  Evaporative Running Loss Emissions (grams/minute)

Pollutant Name: Total Organic Gases,,,,Temperature: 57F,,Relative Humidity: ALL

Time,LDA,LDA,LDA,LDA,LDT1,LDT1,LDT1,LDT1,LDT2,LDT2,LDT2,LDT2,MDV,MDV,MDV,MDV,LHD
1,LHD1,LHD1,LHD1,LHD2,LHD2,LHD2,LHD2,MHD,MHD,MHD,MHD,HHD,HHD,HHD,HHD,OBUS,OBUS,O
BUS,OBUS,UBUS,UBUS,UBUS,UBUS,MCY,MCY,MCY,MCY,SBUS,SBUS,SBUS,SBUS,MH,MH,MH,MH,ALL
,ALL,ALL,ALL,

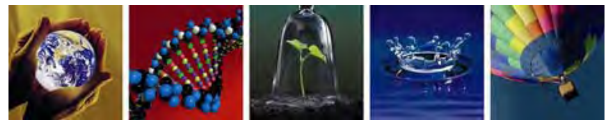
min,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT
,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCA
T,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,ALL,NCAT,CAT,DSL,AL
L,

    1,   1.042,   0.011,   0.000,   0.011,   1.206,   0.449,   0.000,   0.447,
1.197,   0.366,   0.000,   0.366,   0.334,   0.323,   0.000,   0.322,   1.916,
0.428,   0.000,   0.340,   1.791,   0.777,   0.000,   0.437,   1.682,   0.296,
0.000,   0.051,   5.163,   0.824,   0.000,   0.052,   0.000,   0.430,   0.000,
0.113,   0.000,   8.368,   0.000,   0.611,   0.022,   0.004,   0.000,   0.011,
0.000,   0.405,   0.000,   0.071,   2.008,   3.142,   0.000,   2.858,   0.045,
0.152,   0.000,   0.146,
    2,   0.827,   0.011,   0.000,   0.011,   0.695,   0.229,   0.000,   0.228,
0.690,   0.187,   0.000,   0.187,   0.188,   0.165,   0.000,   0.165,   1.073,
0.221,   0.000,   0.176,   1.010,   0.398,   0.000,   0.224,   0.955,   0.160,
```

```
0.000,   0.027,   2.699,   0.439,   0.000,   0.028,   0.000,   0.221,   0.000,
0.058,   0.000,   4.308,   0.000,   0.315,   0.023,   0.058,   0.000,   0.045,
0.000,   0.208,   0.000,   0.036,   1.252,   1.617,   0.000,   1.472,   0.038,
0.081,   0.000,   0.078,
    3,   0.756,   0.013,   0.000,   0.013,   0.525,   0.158,   0.000,   0.157,
0.521,   0.130,   0.000,   0.130,   0.139,   0.115,   0.000,   0.115,   0.792,
0.155,   0.000,   0.123,   0.749,   0.275,   0.000,   0.154,   0.713,   0.117,
0.000,   0.020,   1.877,   0.314,   0.000,   0.020,   0.000,   0.156,   0.000,
0.041,   0.000,   2.957,   0.000,   0.216,   0.023,   0.086,   0.000,   0.063,
0.000,   0.146,   0.000,   0.026,   1.006,   1.113,   0.000,   1.013,   0.035,
0.060,   0.000,   0.058,
    4,   0.721,   0.015,   0.000,   0.015,   0.440,   0.124,   0.000,   0.124,
0.436,   0.103,   0.000,   0.103,   0.115,   0.092,   0.000,   0.092,   0.652,
0.123,   0.000,   0.098,   0.619,   0.214,   0.000,   0.120,   0.592,   0.096,
0.000,   0.016,   1.467,   0.254,   0.000,   0.016,   0.000,   0.126,   0.000,
0.033,   0.000,   2.283,   0.000,   0.167,   0.023,   0.103,   0.000,   0.074,
0.000,   0.119,   0.000,   0.021,   0.884,   0.863,   0.000,   0.786,   0.034,
0.051,   0.000,   0.049,
    5,   0.700,   0.017,   0.000,   0.017,   0.389,   0.105,   0.000,   0.104,
0.386,   0.087,   0.000,   0.087,   0.100,   0.079,   0.000,   0.078,   0.568,
0.104,   0.000,   0.083,   0.541,   0.178,   0.000,   0.100,   0.519,   0.084,
0.000,   0.014,   1.220,   0.218,   0.000,   0.014,   0.000,   0.108,   0.000,
0.028,   0.000,   1.879,   0.000,   0.137,   0.024,   0.113,   0.000,   0.081,
0.000,   0.102,   0.000,   0.018,   0.811,   0.713,   0.000,   0.650,   0.034,
0.046,   0.000,   0.044,
   10,   0.659,   0.021,   0.000,   0.021,   0.287,   0.066,   0.000,   0.066,
0.284,   0.057,   0.000,   0.057,   0.071,   0.053,   0.000,   0.053,   0.400,
0.068,   0.000,   0.054,   0.385,   0.109,   0.000,   0.061,   0.374,   0.061,
0.000,   0.010,   0.728,   0.148,   0.000,   0.009,   0.000,   0.074,   0.000,
0.019,   0.000,   1.072,   0.000,   0.078,   0.026,   0.135,   0.000,   0.096,
0.000,   0.071,   0.000,   0.012,   0.665,   0.416,   0.000,   0.380,   0.034,
0.036,   0.000,   0.035,
   15,   0.647,   0.022,   0.000,   0.023,   0.253,   0.055,   0.000,   0.055,
0.251,   0.048,   0.000,   0.048,   0.061,   0.046,   0.000,   0.046,   0.344,
0.058,   0.000,   0.046,   0.334,   0.088,   0.000,   0.049,   0.326,   0.055,
0.000,   0.009,   0.564,   0.126,   0.000,   0.008,   0.000,   0.064,   0.000,
0.017,   0.000,   0.806,   0.000,   0.059,   0.028,   0.142,   0.000,   0.101,
0.000,   0.062,   0.000,   0.011,   0.618,   0.321,   0.000,   0.293,   0.036,
0.034,   0.000,   0.033,
   20,   0.643,   0.023,   0.000,   0.023,   0.236,   0.051,   0.000,   0.051,
0.234,   0.046,   0.000,   0.046,   0.057,   0.043,   0.000,   0.043,   0.316,
0.054,   0.000,   0.043,   0.308,   0.079,   0.000,   0.045,   0.302,   0.053,
0.000,   0.009,   0.482,   0.116,   0.000,   0.007,   0.000,   0.061,   0.000,
0.016,   0.000,   0.675,   0.000,   0.049,   0.029,   0.146,   0.000,   0.104,
0.000,   0.059,   0.000,   0.010,   0.595,   0.275,   0.000,   0.251,   0.037,
0.033,   0.000,   0.032,
   25,   0.641,   0.024,   0.000,   0.024,   0.227,   0.049,   0.000,   0.049,
0.225,   0.045,   0.000,   0.045,   0.054,   0.043,   0.000,   0.043,   0.300,
0.052,   0.000,   0.041,   0.293,   0.075,   0.000,   0.042,   0.288,   0.052,
0.000,   0.009,   0.433,   0.110,   0.000,   0.007,   0.000,   0.059,   0.000,
0.016,   0.000,   0.598,   0.000,   0.044,   0.031,   0.149,   0.000,   0.106,
0.000,   0.058,   0.000,   0.010,   0.581,   0.250,   0.000,   0.228,   0.039,
0.033,   0.000,   0.032,
   30,   0.641,   0.024,   0.000,   0.024,   0.227,   0.049,   0.000,   0.049,
0.225,   0.045,   0.000,   0.045,   0.054,   0.043,   0.000,   0.043,   0.300,
0.052,   0.000,   0.042,   0.293,   0.076,   0.000,   0.042,   0.289,   0.052,
0.000,   0.009,   0.434,   0.110,   0.000,   0.007,   0.000,   0.060,   0.000,
```

```
0.016,   0.000,   0.600,   0.000,   0.044,   0.031,   0.149,   0.000,   0.107,
0.000,   0.058,   0.000,   0.010,   0.583,   0.250,   0.000,   0.229,   0.039,
0.033,   0.000,   0.032,
   35,   0.642,   0.024,   0.000,   0.024,   0.228,   0.049,   0.000,   0.049,
0.226,   0.045,   0.000,   0.045,   0.054,   0.043,   0.000,   0.043,   0.301,
0.052,   0.000,   0.042,   0.294,   0.076,   0.000,   0.043,   0.289,   0.052,
0.000,   0.009,   0.435,   0.111,   0.000,   0.007,   0.000,   0.060,   0.000,
0.016,   0.000,   0.601,   0.000,   0.044,   0.031,   0.149,   0.000,   0.107,
0.000,   0.058,   0.000,   0.010,   0.585,   0.251,   0.000,   0.229,   0.039,
0.033,   0.000,   0.032,
   40,   0.642,   0.024,   0.000,   0.024,   0.228,   0.049,   0.000,   0.049,
0.226,   0.045,   0.000,   0.045,   0.054,   0.043,   0.000,   0.043,   0.301,
0.052,   0.000,   0.042,   0.295,   0.076,   0.000,   0.043,   0.290,   0.052,
0.000,   0.009,   0.436,   0.111,   0.000,   0.007,   0.000,   0.060,   0.000,
0.016,   0.000,   0.603,   0.000,   0.044,   0.031,   0.150,   0.000,   0.107,
0.000,   0.058,   0.000,   0.010,   0.586,   0.252,   0.000,   0.230,   0.039,
0.033,   0.000,   0.032,
   45,   0.642,   0.024,   0.000,   0.024,   0.228,   0.049,   0.000,   0.049,
0.226,   0.045,   0.000,   0.045,   0.054,   0.043,   0.000,   0.043,   0.302,
0.052,   0.000,   0.042,   0.295,   0.076,   0.000,   0.043,   0.291,   0.052,
0.000,   0.009,   0.437,   0.111,   0.000,   0.007,   0.000,   0.060,   0.000,
0.016,   0.000,   0.605,   0.000,   0.044,   0.031,   0.150,   0.000,   0.107,
0.000,   0.058,   0.000,   0.010,   0.588,   0.252,   0.000,   0.231,   0.039,
0.033,   0.000,   0.032,
   50,   0.611,   0.024,   0.000,   0.024,   0.229,   0.049,   0.000,   0.049,
0.227,   0.045,   0.000,   0.045,   0.054,   0.043,   0.000,   0.043,   0.303,
0.053,   0.000,   0.042,   0.296,   0.076,   0.000,   0.043,   0.291,   0.052,
0.000,   0.009,   0.438,   0.111,   0.000,   0.007,   0.000,   0.060,   0.000,
0.016,   0.000,   0.606,   0.000,   0.044,   0.031,   0.150,   0.000,   0.107,
0.000,   0.058,   0.000,   0.010,   0.589,   0.253,   0.000,   0.231,   0.038,
0.033,   0.000,   0.032,
   55,   0.568,   0.024,   0.000,   0.024,   0.229,   0.050,   0.000,   0.049,
0.227,   0.045,   0.000,   0.045,   0.054,   0.043,   0.000,   0.043,   0.303,
0.053,   0.000,   0.042,   0.296,   0.076,   0.000,   0.043,   0.292,   0.052,
0.000,   0.009,   0.439,   0.111,   0.000,   0.007,   0.000,   0.060,   0.000,
0.016,   0.000,   0.608,   0.000,   0.044,   0.030,   0.150,   0.000,   0.107,
0.000,   0.058,   0.000,   0.010,   0.590,   0.254,   0.000,   0.232,   0.037,
0.033,   0.000,   0.032,
   60,   0.532,   0.024,   0.000,   0.024,   0.229,   0.050,   0.000,   0.049,
0.227,   0.045,   0.000,   0.045,   0.055,   0.043,   0.000,   0.043,   0.304,
0.053,   0.000,   0.042,   0.297,   0.076,   0.000,   0.043,   0.292,   0.052,
0.000,   0.009,   0.440,   0.111,   0.000,   0.007,   0.000,   0.060,   0.000,
0.016,   0.000,   0.609,   0.000,   0.045,   0.029,   0.150,   0.000,   0.107,
0.000,   0.058,   0.000,   0.010,   0.591,   0.254,   0.000,   0.232,   0.036,
0.033,   0.000,   0.032,
```

Appendix C
Life Cycle Greenhouse Gas Emissions from Building Materials



Life Cycle Greenhouse Gas Emissions from Building Materials

Prepared for:
PBS&J
San Francisco, California

Prepared by:
ENVIRON International Corporation
San Francisco, California

Date:
October 15, 2009

Project Number:
03-22796A

ENVIRON

Contents

Acronyms

AP-42	Compilation of Air Pollutant Emission Factors
$CaCO_3$	limestone
CaO	calcium oxide
CCAR	California Climate Action Registry
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CP-HPS	Candlestick Park-Hunters Point Shipyard Redevelopment Plan Phase II
DOE	Department of Energy
EERE	Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
ENVIRON	ENVIRON International Corporation
ft^2	square feet
GHG	greenhouse gas
GRP	General Reporting Protocol
kWh/m^2	kilowatt hour per square meter
LCA	life cycle analyses
MMBTU	million British thermal units

EXECUTIVE SUMMARY

This report evaluates the life cycle greenhouse gas (GHG) emissions associated with the building materials used in the construction of the Candlestick Park-Hunters Point Shipyard Redevelopment Plan Phase II (CP-HPS Plan). The life cycle GHG emissions include the embodied energy from the materials manufacture and the energy used to transport those materials to the site. This report then compares the life cycle GHG emissions to the overall annual operational emissions of CP-HPS Plan. The materials analyzed in this report include materials for 1) residential and non-residential buildings and 2) site infrastructure. This report calculates the overall life cycle emissions from construction materials to be 3,068 – 16,285 tonnes per year, or 2 – 10% of the overall CP-HPS Plan project emissions.

ENVIRON estimated the life cycle GHG emissions for buildings by conducting an analysis of available literature on life cycle analyses (LCA) for buildings. According to these studies, approximately 75 - 97% of GHG emissions from buildings are associated with energy usage during the operational phase; the other 3 - 25% of the GHG emissions are due to material manufacture and transport. Using the GHG emissions from the operation of CP-HPS Plan buildings, 3% to 25% corresponds to 1,352 – 14,568 tonnes CO_2 per year or 0.9 – 9% of CP-HPS Plan project emissions.

ENVIRON calculated the life cycle GHG emissions for infrastructure (roads, storm drains, utilities, gas, electricity, cable) to be equal to a one time emission of 68,663 tonnes CO_2. This analysis considered the manufacture and transport of concrete. Based on this analysis, the manufacture of the materials leads to 56,139 tonnes of emissions, and the transport of the materials leads to 12,524 tonnes of CO_2 emissions. The majority of the emissions for infrastructure result from the manufacture of concrete because of the higher CO_2 emission factor associated with this process. Because the concrete is locally sourced, the transportation emissions are relatively small. If a 40 year lifespan of the infrastructure is assumed, the total annualized emissions are 1,717 tonnes per year or 1.1% of CP-HPS Plan project emissions.

The overall life cycle emissions from embodied energy in CP-HPS Plan building materials, annualized by 40 years, are 3,068 – 16,285 tonnes CO_2 per year. This represents 2 – 10% of the annualized GHG emissions from the CP-HPS Plan project. The bulk of these emissions are based on general life cycle analysis studies and do not reflect the design features of CP-HPS Plan. Aspects of the project will tend to drive the life cycle emissions towards the lower end of the range; one example is the emphasis on the use of local construction materials.

1 Introduction

This report evaluates the life cycle greenhouse gas (GHG) emissions associated with the building materials used in the construction of the Candlestick Park-Hunters Point Shipyard Redevelopment Plan Phase II (CP-HPS Plan) development. The life cycle GHG emissions include the embodied energy from the materials manufacture and the energy used to transport those materials to the site. This report then compares the life cycle GHG emissions to the overall annual operational emissions of CP-HPS Plan. The materials analyzed in this report include materials for 1) residential and non-residential buildings and 2) site infrastructure.

1.1 Background on Life Cycle Analysis

LCA is a method developed to evaluate the mass balance of inputs and outputs of systems and to organize and convert those inputs and outputs into environmental themes or categories. In this case, the LCA is related to GHG emissions associated with the different stages of a life cycle. The LCA field is still relatively new, and while there are general standards for goals and general practices for LCAs[1] the specific methodologies and, in particular, the boundaries chosen for the LCA makes inter-comparison of various studies difficult. Simple choices such as the useful life of a building or road, for example, can change the LCA outcome substantially. Additionally, the geographic location, climatic zone and building type significantly influence patterns of energy consumption (and energy efficiency) and therefore determine life cycle GHG emissions, which makes comparisons among different studies difficult.

The calculations and results presented in this report are estimates and should be used only for a general comparison to the overall GHG emissions estimated in the Climate Change Technical Report prepared by ENVIRON for CP-HPS Plan. LCA emissions vary based on input assumptions and assessment boundaries (e.g., how far back to trace the origin of a material). Assumptions made in this report are generally conservative. However, due to the open-ended nature of LCAs, the analysis is not exact and may be highly uncertain.

2 Emissions Estimates

2.1 Life Cycle GHG Emissions from Building Materials

ENVIRON estimated the life cycle GHG emissions for building materials by conducting an analysis of available literature on life cycle analyses (LCA) for buildings. According to these studies, approximately 75 - 97% of GHG emissions from buildings are associated with energy usage during the operational phase; the other 3 - 25% of the GHG emissions are due to building material manufacture and transport. Based on the GHG emissions from the operation of CP-HPS Plan buildings[2], 3% to 25% corresponds to 1,352 – 14,568 tonnes CO_2 per year, as shown in Table 1. The specific LCA studies used are discussed in the next section.

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[1] ISO 14044 and ISO 14040

[2] Climate Change Technical Report: Candlestick Park-Hunters Point Shipyard Redevelopment Plan Phase II.

With the current energy generation mix in the US which relies heavily on fossil fuel based sources, focusing on energy efficiency measures (which ultimately reduces lifetime GHG emissions) is more effective in reducing the overall GHG footprint than focusing on materials with low embodied energy. As the energy generation measures reduce their GHG intensity (shift away from fossil fuel to renewable fuels), material selection will be a more critical factor in a building's GHG emissions over its life cycle.

2.1.1 LCA Studies for Buildings

The LCA literature studies tend to compare the energy used to make and transport building materials, or the embodied energy, with the operational energy use. In this manner, the relative importance of the embodied energy can be assessed. ENVIRON discusses several studies that compare the embodied energy and the operational energy.

A life cycle assessment of a 66,000 ft^2 sustainably-designed university building[3] in the US Mid-west[4] estimated that the GHG emissions associated with its energy use over a 100-year time horizon to be 135,000 metric tones of carbon dioxide equivalent (CO_2e), 96.5% of which result from operations phase activities, 3% from material production (of which ⅓ is cement production) and 0.5% from transportation and decommissioning combined. The study also notes that the GHG emissions closely matches the distribution of life cycle energy distributions, indicating that operational energy requirements are the key factor determining overall GHG emissions, especially when considering fossil fuel based energy generation. This building has a longer estimated life than CP-HPS Plan buildings, which would lead to a lower comparison of embodied energy to operational energy.

A study of single-family homes in the US Mid-west,[5] one built using standard construction techniques and the second incorporating energy efficiency measures, reached similar conclusions. Over the life cycle of the homes (assumed to be 50 years), the conventional home uses 15,000 MMBTU and the energy efficient configuration uses 6,000 MMBTU of energy, representing a 60% reduction in overall energy. As GHG emissions closely match the distribution of life cycle energy distributions, the energy efficient variant resulted in 63% fewer emissions. Of the total energy use over the structure's life cycle, 91% of the conventional house total energy results from energy consumed in the use stage (e.g., operating energy). This value drops to 74% in the energy efficient home as the energy embodied in the building materials stays the same or is slightly higher than that in the conventional home and operating energy is reduced.

August 2009.

[3] Includes 4 floors of classroom and open-plan offices and 3 floors of hotel rooms, in this evaluation used as a surrogate for a generic commercial structure.

[4] Scheuer, C., G.A. Keoleian, and P. Reppe. (2003) Life cycle energy and environmental performance of a new university building: Modeling challenges and design implications. *Energy and Buildings*, **35**(10): p. 1049.

[5] Keoleian, G.A., S. Blanchard, and P. Reppe. (2000) Life-cycle energy, costs, and strategies for improving a single-family house. *Journal of Industrial Ecology*, **4**(2): p. 135.

Similarly, a review of 60 case studies of homes from nine European countries in a variety of climates[6] indicated that operating energy represents the largest part of energy demand by a building during its life cycle. In one evaluation the operating energy is reported as between 92 - 95% for conventional construction and 72 - 90% for low-energy buildings[7] (which are also consistent with other literature references[8]). Sartori and Hestnes[6] also note that buildings constructed with energy efficiency measures may have a higher energy (and concomitant GHG emissions) embodied by the materials used in construction (e.g., more insulation, higher thermal mass), but over the lifespan of the building the overall energy use (operating and embodied energy) is dramatically lower due to the large reductions in operating energy. As an example, the embodied energy was estimated to be 1171 kWh/m^2 for a conventional house and 1391 kWh/m^2 for a passive, energy efficient home, an increase of 220 kWh/m^2 or 19%. Over the lifetime of the building, however, the total energy (operating and embodied) of the conventional house was approximately 22,500 kWh/m^2, while the passive house was roughly 5,500 kWh/m^2, a four-fold decrease in the total energy over an assumed 80 year life cycle.

2.1.2 Energy Efficiency vs. Embodied Energy in Buildings

From our analysis of these assessments, we note the following major conclusions:

- To minimize GHG lifetime emissions, optimization of energy efficiency (both thermal and electrical) for the operational phase of a building should be the primary emphasis for design, especially when the energy supplied is generated from fossil fuel sources.
- Passive design measures such as the orientation of structure to maximize solar heating and daylighting as well as natural ventilation; heavy construction to increase the thermal mass of the structure with materials that have a high capacity for absorbing heat and change temperature slowly; and solar control like window shading[9] should be emphasized[10,11,12] as they have a negligible increase in embodied energy (GHG emissions from material production) and can reduce total energy substantially.[13]
- Active energy efficiency measures (e.g., mechanical ventilation, artificial cooling, free cooling) may as much as double the embodied energy of the structure, but can halve overall energy usage.

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[6] Sartori, I. and A.G. Hestnes. (2007) Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Buildings*, **39**(3): p. 249.

[7] Winther, B.N. and A.G. Hestnes. (1999) Solar versus green: The analysis of a Norwegian row house. *Solar Energy*, **66**(6): p. 387.

[8] Adalberth, K., A. Almgren, and E.H. Petersen. (2001) Life Cycle Assessment of Four Multi-Family Buildings. *International Journal of Low Energy and Sustainable Buildings*, **2**.

[9] United Nations Environment Program 2007 Buildings and Climate Change report whole-house system measures are recommended for the Mediterranean and desert climate zones.

[10] Browning, W.D. and J.J. Romm. (1998) *Greening the Building and the Bottom Line*. Snowmass, Colorado: Rocky Mountain Institute.

[11] United Nations Environment Program. (2007) *Buildings and Climate Change: Status, Challenges and Opportunities.*

[12] US Department of Energy Building Technologies Program. (2007) www.eere.energy.gov/buildings/. October.

[13] Sartori, I. and A.G. Hestnes. (2007) Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Buildings*, **39**(3): p. 249.

- With the current energy generation mix in the US which relies heavily on fossil fuel based sources, focusing on energy efficiency measures (which ultimately reduces lifetime GHG emissions) is more effective in reducing the overall GHG footprint than focusing on materials with low embodied energy. As the energy generation measures reduce their GHG intensity (shift away from fossil fuel to renewable), material selection will be a more critical factor in a building's GHG emissions over its life cycle.

One cannot evaluate the life cycle emissions of a building product independent of the impact that the building product has on energy use. For example, studies that evaluate the relative embodied energy and GHG emissions associated with the production of structural materials such as steel, concrete or wood generally indicate that the wood products have the lowest GHG emissions as it is produced from a renewable resource that may actually remove CO_2 during its production phase and sequester it during its use phase.[14,15] However, these studies do not account for the effect of the material on overall building energy efficiency, which is often heavily dependent on the climate in which the building is located. In desert climates, the thermal mass of the structure is important for energy savings, as the thermal mass cools at night and keep the house cool during the day during hot weather and conversely heats during the day keeps the house warm during the evening during cool weather. To increase thermal mass, concrete is much more effective than wood. In other types of climates (cooler with less solar heating), wood with insulation has a greater impact at improving overall building efficiency.

For some building products or systems, the net energy savings during the operational portion of the building's life cycle are comparable. If this is the case, then the alternative with the lowest embodied GHG emissions will result in the lowest life cycle GHG emissions.

Building materials with high replacement rates, like carpeting and wiring, can often have a high contribution to the overall GHG emissions as their impact is dependent on renovation schedules. For example, if two building materials have the same embodied energy but one is replaced every 5 years and the second is replaced every 25 years then the first will have five times the embodied energy over the lifetime of the building. As such Scheuer et al.[16] indicate that "[d]esign strategies that maximize the service life of building materials should be maximized." These strategies include designing the structure for minimal material use and choosing materials with low embodied energy, high recycled content, and long life spans.

From our analysis of these product or system specific assessments, we note the following major conclusions:

- Products or systems which have the greatest impact in improving overall building energy efficiency over the building's life cycle should be selected to minimize life cycle GHG

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[14] Borjesson, P. and L. Gustavsson. (2000) Greenhouse gas balances in building construction: Wood versus concrete from life-cycle and forest land-use perspectives. *Energy Policy*, **28**(9): p. 575.

[15] Lenzen, M. and G. Treloar. (2002) Embodied energy in buildings: Wood versus concrete - Reply to Borjesson and Gustavsson. *Energy Policy*, **30**(3): p. 249.

[16] Scheuer, C., G.A. Keoleian, and P. Reppe. (2003) Life cycle energy and environmental performance of a new university building: Modeling challenges and design implications. *Energy and Buildings*, **35**(10): p. 1049.

emissions. These alternatives may not necessarily have the lowest embodied GHG emissions.

- When evaluating products or systems that have similar impacts on overall building energy efficiency, alternatives with the lowest embodied GHG emissions should be selected to minimize GHG emissions.
- Materials with high replacement rates (e.g., carpeting, wiring) tend to have higher embodied energy due to their short life cycle, therefore minimizing embodied GHG emissions is most critical for these types of products or systems to minimize overall GHG emissions. Materials with low replacement rates (e.g., piping, air ducts) tend to have lower embodied energy over the life cycle of the building, therefore differences in overall GHG emissions between several alternatives are likely to be small.

2.2 GHG Emissions from Manufacture of Infrastructure Materials

ENVIRON evaluated the embodied energies of materials likely to be found in the infrastructure (roads, storm drains, utilities, gas, electricity, cable) of the CP-HPS Plan. The embodied energies of different materials vary based upon the transportation distance and manufacturing processes. A material that is locally-sourced may require a large amount of energy to be produced and, on the contrary, a material with a relatively low energy intensity may be sourced from farther away. ENVIRON assumed that concrete will be among the dominant material used in the infrastructure and estimated the embodied energies of this material. The manufacture of this material results in overall CO_2 emissions of 56,139 tonnes.

2.2.1 Embodied Energy in Infrastructure

ENVIRON used volumes of virgin concrete as provided by MacTech for CP-HPS, resulting in the predicted material amounts shown in Table 3. The embodied energy in concrete for roads and sidewalks based on assuming 25% flyash and no steel reinforcement is 0.076 pound CO_2 per pound of concrete[17]. The embodied energy in concrete for bridges and parking structures based on assuming 15% flyash and 1.5% steel reinforcement is 0.182 pound CO_2 per pound of concrete[18]. One-time emissions from concrete manufacture for infrastructure materials are estimated to be 56,139 tonnes CO_2.

2.3 Transportation of Materials for Infrastructure

ENVIRON estimated the emissions from the transportation of the infrastructure. ENVIRON selected distances based on an expected trip distance of local manufacturers of cement to the CP-HPS Plan[19]. Using the infrastructure material quantities specified in Table 3, ENVIRON

[17] This was estimated using the Athena Impact Estimator along with related databases which can be found here: http://www.athenasmi.org/tools/impactEstimator/

[18] This was estimated using the Athena Impact Estimator along with related databases which can be found here: http://www.athenasmi.org/tools/impactEstimator/

[19] The distance for concrete and asphalt assumes the use of a local source 100 miles from Candlestick Park-Hunters Point Shipyard Redevelopment Plan Phase II.

estimated emissions of 12,524 tonnes CO_2 from the transportation of the concrete and asphalt in the infrastructure.[20] Details of the calculations are outlined in Table 3.

2.3.1 Calculation of Emissions from Transportation of Materials for Buildings

Although each particular shipper operates with greater or lesser efficiencies, ENVIRON assumed an average GHG emission rate per tonne-mile[21] for each mode of transportation. Although it is likely that more dense material has a slightly lower GHG shipping intensity than does less dense material, this analysis developed a single emission factor per tonne-mile of material moved, regardless of density, for each mode of transportation.

2.3.1.1 Emissions associated with transporting the material

Emission factors were calculated from DOE EERE energy intensity indicators.[22] EERE data is presented in terms of energy per mile traveled. These were converted using AP-42 conversion factors[23] for energy in different types of fuel, and California Climate Action Registry (CCAR) General Reporting Protocol (GRP)[24] emission factors for mass of CO_2 emitted per gallon of fuel. Trains and trucks are assumed to run on diesel. These emission factors are listed in Table 3. The emission factors developed above were multiplied by the distances traveled by each type of transportation.

2.4 Summary of Emissions from Buildings and Infrastructure

Table 4 presents the summary of the life cycle greenhouse gas (GHG) emissions associated with the building materials used in the construction of the CP-HPS Plan. The life cycle GHG emissions include the embodied energy from the materials manufacture and the energy used to transport those materials to the site. The materials analyzed include materials for 1) residential and non-residential buildings and 2) site infrastructure. This report calculates the overall life cycle emissions from construction materials to be 3,068 – 16,285 tonnes per year, or 2 – 10% of the overall CP-HPS Plan project emissions. Aspects of this project such as the emphasis on the use of local construction materials are expected to drive the life cycle emissions toward the lower end of the range.

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[20] For the estimates of emissions from material transportation, ENVIRON conservatively assumed that the entire concrete mix, not just cement, is transported from the source locations to the development site.

[21] A tonne-mile refers to the amount of material (in tonnes) moved a distance of one mile.

[22] Grams CO_2 per tonne-mile. See http://intensityindicators.pnl.gov/trend_data.stm Transportation sector data.

[23] AP-42 conversions available at http://www.epa.gov/ttn/chief/ap42/appendix/appa.pdf

[24] The GRP is available online at http://www.climateregistry.org/resources/docs/protocols/grp/GRP_3.1_January2009.pdf

Table 1
Life Cycle Greenhouse Gas (GHG) Emissions From Materials[1] Used for Buildings
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

GHG Emissions from Energy Usage Associated with Non-Residential Buildings[2]	Embodied Energy as Percentage of Overall Energy[3]	
	3%	25%
(tonnes CO_2 / year)		
43,705	1,352	14,568

Notes:
1. All materials were analyzed. See references below for more details.
2. Represents CO2 emissions from electricity and natural gas use. From the Candlestick Point-Hunters Point Shipyard Phase II Development Plan Climate Change Report.
3. Percentages are based upon LCA studies below. The studies compared energy used in the manufacture and transport of materials to energy use from electricity and natural gas. Varying lifetimes of buildings were assumed in each study. As buildings become more energy efficient, the portion of GHGs from embodied energy increases.

Abbreviations:
CO_2 = carbon dioxide
GHG = greenhouse gas
LCA = life cycle analysis

Sources:

Scheuer, C., G.A. Keoleian, and P. Reppe. (2003) Life cycle energy and environmental performance of a new university building: Modeling challenges and design implications. *Energy and Buildings* , **35**(10): p. 1049.
Keoleian, G.A., S. Blanchard, and P. Reppe. (2000) Life-cycle energy, costs, and strategies for improving a single-family house. *Journal of Industrial Ecology* , **4**(2): p. 135.
Sartori, I. and A.G. Hestnes. (2007) Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Buildings* , **39**(3): p. 249.

Winther, B.N. and A.G. Hestnes. (1999) Solar versus green: The analysis of a Norwegian row house. *Solar Energy* , **66**(6): p. 387.

Adalberth, K., A. Almgren, and E.H. Petersen. (2001) Life Cycle Assessment of Four Multi-Family Buildings. *International Journal of Low Energy and Sustainable Buildings* , **2**.

Table 2
Quantities of Infrastructure Materials
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Type of Infrastructure	Concrete Volume[1] (cu ft)		Concrete Weight[2] (lbs)		Concrete Emission Factor[3]	Concrete Emissions (tonnes CO_2)	
	HP	CP	HP	CP	(lbs CO_2/lb concrete)	HP	CP
Roads and Sidewalks	2,750,000	2,130,000	398,750,000	308,850,000	0.076	13,746	10,647
Bridge	114,453	0	16,595,685	0	0.182	1,373	0
Parking Structures	1,485,513	1,046,295	215,399,385	151,712,775	0.182	17,821	12,552

Notes:
1. Material volumes provided by MacTech.
2. Density of infrastructure concrete is 145 lbs per cubic feet.
3. Infrastructure concrete embodied carbon is based on estimates from Athena Impact Estimator assuming: 25% fly ash for roads and sidewalks and no steel reinforcement; 15% fly ash for bridge and parking structures and 1.5% steel reinforcement.

Abbreviations:
cu ft = cubic foot
lb = pound

Sources:
Athena Impact Estimator along with related databases which can be found here: http://www.athenasmi.org/tools/impactEstimator/

Table 3
Greenhouse Gas (GHG) Emissions from Transportation of Infrastructure Raw Materials
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Material	Total Mass Transported	Distance from Source Location[2,3]	Mass-Distance[4]	Emission Factor[5]	Emissions to Transport to Construction Site[6]	
		Local Source Cement	Local Source Cement	Truck	Local Source Cement	Total
	(tonnes material)	(miles)	(tonne-miles)	(grams CO_2/ tonne-mile)	(tonnes CO_2)	
Infrastructure	495,009	100	49,500,891	253	12,524	12,524

Notes:

1. The entire mass of concrete is considered because the concrete mix is transported from the source locations.

2. Distances from source to project location estimated using Google Maps.
3. Assumes all concrete aggregate originates from a local source.

4. Mass distance is the mass of material multipled by the distance traveled. ENVIRON assumed that the concrete come from local sources.

5. Emission factors for truck calculated from DOE EERE energy intensity indicators. EERE data is presented in Btu / ton mile. These were converted using AP-42 conversion factors for energy in different types of fuel, and CCAR GRP emission factors for mass CO_2 emitted per gallon of fuel. Trucks are assumed to run on diesel.

6. Emissions calculated by multiplying the mass-distance by the emission factor. Because of the close proximity of the source locations to the Project, ENVIRON conservatively assumed that all materials will be transported by truck.

Sources:
DOE EERE energy intensity indicators. http://intensityindicators.pnl.gov/trend_data.stm Transportation sector data
AP42 conversions available at http://www.epa.gov/ttn/chief/ap42/appendix/appa.pdf

Table 4
Summary of Life Cycle Greenhouse Gas (GHG) Emissions from Buildings, Infrastructure
Candlestick Point-Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Emissions Source[1]		Emissions from Manufacture of Materials[3]	Emissions from Transportation of Materials[4]	Total Emissions	Assumed Lifetime of Emissions Source[5]	Total Annualized Emissions[6]	Total Annual Emissions[7]	LCA Fraction of Total Emissions[8]
		(tonnes CO_2)			(years)	(tonnes CO_2 / year)	(tonnes CO_2 / year)	(%)
Buildings[2]	Low Estimate	54,068		54,068	40	1,352	157,104	0.9%
	High Estimate	582,737		582,737		14,568		9%
Infrastructure		56,139	12,524	68,663		1,717		1.1%
TOTAL		122,731 - 651,400		122,731		3,068 - 16,285		2% - 10%

Notes:
1. ENVIRON estimated LCA emissions from two sources: buildings, and infrastructure.
2. Emissions from buildings are shown as a range from a low to a high estimate based on the range presented in Table 1. The values in Table 1 are multiplied by the assumed lifetime of 40 years to yield total emissions in tonnes CO_2.
3. Emissions from the manufacture of materials for infrastructure are from Table 2.
4. Emissions from the transportation of materials for infrastructure are from Table 3.
5. The assumed lifetime of emissions source may be adjusted; here ENVIRON has assumed a conservatively short lifetime of 40 years.
6. Total emissions are divided by the assumed lifetime of emissions sources to yield the total annualized emissions.
7. From the Climate Change Report.
8. The LCA fraction of total emissions is calculated by dividing the total annualized emissions by the total emissions from Candlestick Point-Hunters Point Shipyard Phase II Development Plan.

Abbreviations:
CO_2 = carbon dioxide
LCA = life cycle assessment

Sources:
Values are calculated using Tables 1 through 3 and the emissions presented in ENVIRON's Candlestick Point-Hunters Point Shipyard Phase II Development Plan Climate Change Report.

Appendix T1 CP/HP Distict Heating and Cooling Description, Revised August 20, 2009

To	Therese Brekke, Lennar Urban	Reference number	
cc	Jean Rogers, Arup	File reference	
From	Martin Howell, Arup	Date	August 20, 2009
Subject	HP/CP - District heating and cooling description – Revised August 20, 2009		

The following is a summary of information regarding the integration of central heating and cooling plants into Hunters Point and Candlestick Point. These systems are to be included in the EIR as options.

BAU Option – All heating and cooling is generated at the individual building level

District Energy Option – All heating and cooling energy is generated at the district level and distributed to individual buildings

General Site Description – District Heating and Cooling Option

District heating and cooling plants have been identified as an option for providing site wide heating and cooling energy. Two potential locations for these systems have been identified, one serving Hunters Point and a second serving Candlestick Point. The location identified for the district plant serving Hunter's Point is in the parking structure adjacent to the R&D facilities. The most probable location for the district plant serving Candlestick Point is in the parking structure adjacent to the regional retail center. Distribution infrastructure sill also be required. Each central plant facility will likely consist of two separate stories. The first story provides an enclosure for the boilers, chillers, pumps and other ancillary equipment. The upper story (or roof) provides a location for the heat rejection units and boiler flue exhaust both of which have to discharge externally. These emissions will have an impact on local environmental quality which is described below. Below is a figure that identifies the proposed central plant locations and pipe distribution network.

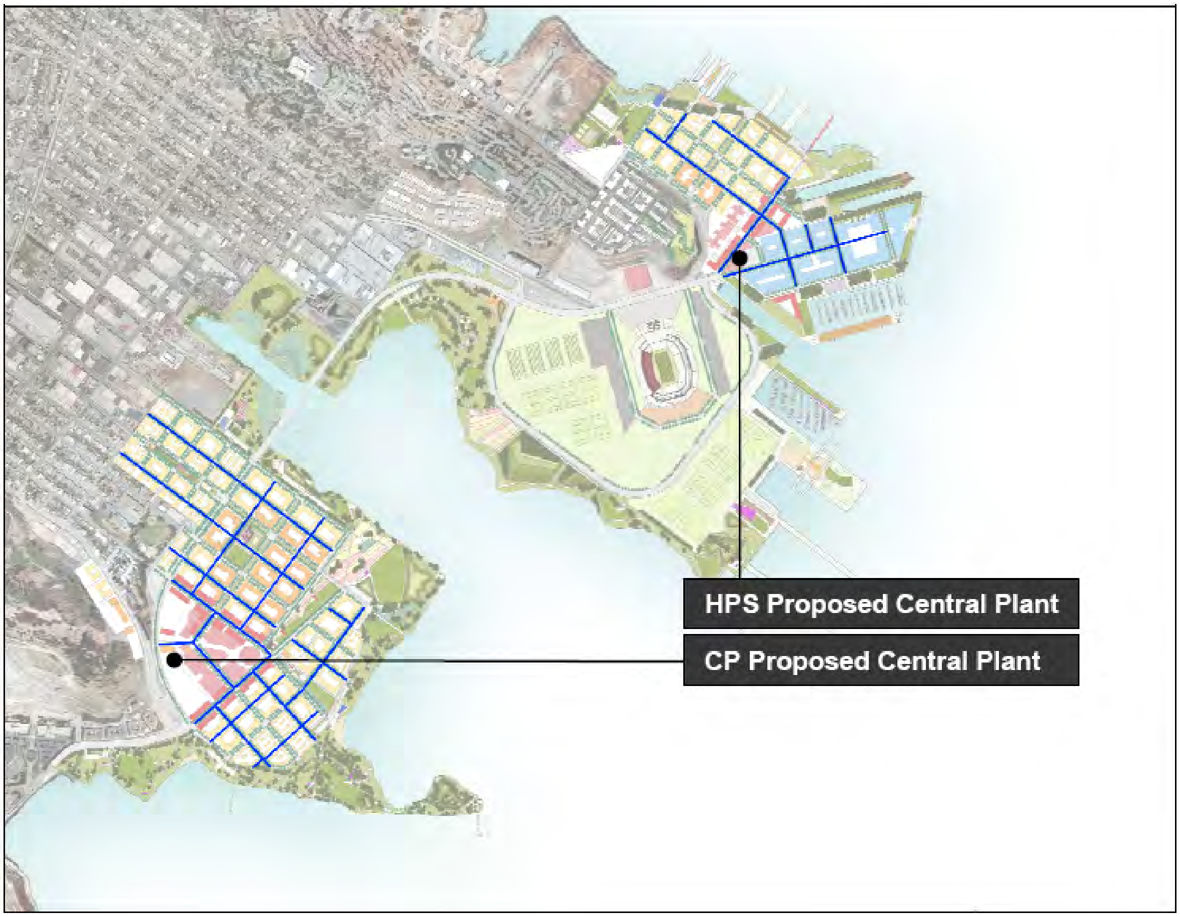


Figure – Proposed Central Plant Locations

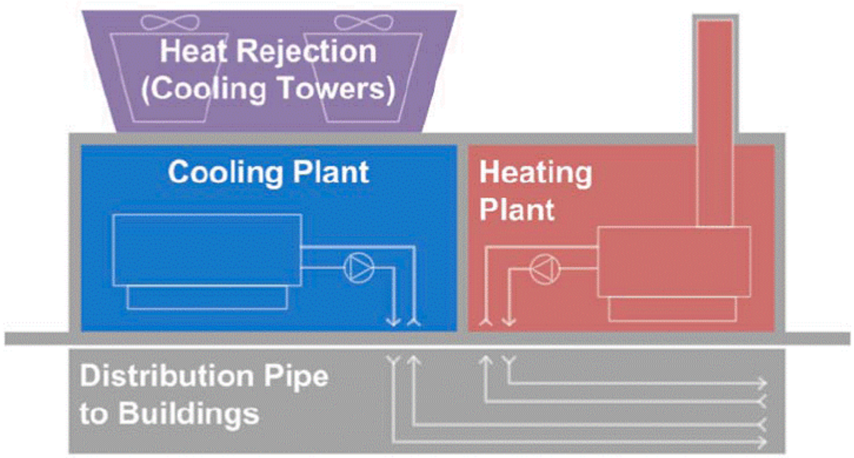
Major Plant Equipment for the District Heating and Cooling Option

Heating would be provided by natural gas boilers providing either steam or hot water. In addition to natural gas as the primary fuel source, electricity will be required for base of plant operation and distribution. The heat will then be distributed through underground piping networks to each building or customer. Steam is distributed through the backpressure created by the steam. Hot water is distributed through electrically driven pumping systems. The most likely medium for distribution will be low temperature hot water (<250 degrees Fahrenheit). Other base of plant equipment including expansion devices, air elimination, and water treatment will also be required for the heating plant.

Cooling may be generated by several sources including natural gas fired, steam fired, or electrically driven chillers. The most likely and energy efficient option would be the use of electrically driven chillers for chilled water generation and water cooled cooling towers for heat rejection. Several electric centrifugal chillers will be required to generate chilled water. The heat extracted from the waters is then transferred to the cooling towers where the heat is rejected to the ambient air through the evaporation process. Electrically driven pumping systems are used for transferring heat form the chillers to the cooling towers and for distributing the chilled water to the development. Other base of plant equipment including expansion devices, air separation devices, and water treatment equipment will be required for the cooling plant.

The configuration of the heating and cooling plant is most likely to be a 2-story stacked system to reduce the overall building footprint. The cooling plant and heating plant will be enclosed structures. The heating plant will requires ambient air for fuel combustion which may enter from an exterior wall or through the roof. The boiler will also have a flue where combustion exhaust is emitted to the ambient air. The best location for these flues are through the roof. A diagram of the stacked central plant system and major components has been included below. Cooling towers require significant volumes of ambient air for the heat rejection process. For this reason cooling towers are generally placed outdoors. Stacking the cooling towers on the roof will minimize the overall building footprint, but increase the structural requirements of the building due to the significant weight of the cooling towers.

Figure: Stacked Central Plant for Heating and Cooling Energy Generation



Based on preliminary heating and cooling load estimates for the entire site (and assuming minimum energy compliance scenario), the area for each plant will likely be 60,000 to 85,000 square feet each, depending on the specific equipment used. The heating and cooling plants will likely require a 15-20 feet story height to allow for equipment size and clearances. The cooling towers will have a similar height and will discharge vertically. The preliminary heating and cooling capacities used for these estimates have been identified in the table below.

Table: Preliminary Cooling and Heating Loads

Load Type	Hunters Point Shipyard	Candlestick Point	Totals*
Cooling Load (tons)	14,090	11,822	20,730
Heating Load (kBtu/hr)	91,511	184,213	220,579

*Diversity has been applied to the total development values.

Assuming a stacked configuration, the cooling towers would be located above the cooling plant reducing the building footprint to 40,000-65,000 square feet. This assumes the following breakdown for each of the major plant components:

- Cooling Towers: 15,000-25,000 square feet (8,000 to 12,000 tons cooling)
- Chiller Plant: 20,000-30,000 square feet (8,000 to 12,000 tons cooling)
- Boiler Plant: 20,000-35,000 square feet (75 Mbtu-150 Mbtu heating)

If dry cooling towers or combination wet/dry cooling towers are used (to eliminate or minimize visual plumes as described in the environmental impacts section below), an additional 30% of area is required for the cooling tower plant. Combination wet/dry cooling towers will also have an increase in height of about 30%

over typical. The total area required for the optional cooling towers will be 60,000-93,000 square feet, or a stacked building footprint of 40,000-78,000 square feet.

Distribution Infrastructure

Cooling and heating will be distributed through hydronic piping networks. These networks will be made up of supply and return, insulated piping located in utility trenches below grade. The location and depth of the pipe for this system is consistent with other low pressure water utility piping. Connections to buildings will include meters for accounting and billing purposes.

Heating energy will be distributed in the form of hot water via a pipe distribution network. The peak hot water flow capacity of the central plant will be about 10,000 and 5,000 gallons per minute for Hunter's Point and Candlestick point respectively. The main hot water pipe sizes will be approximately 18 and 12 inches in diameter.

Cooling energy will be distributed in the form of chilled water via a pipe distribution network. The peak chilled water flow capacity of the central plant will be about 30,000 and 25,000 gallons per minute for Hunter's Point and Candlestick point respectively. The main hot water pipe sizes will be approximately 36 and 30 inches in diameter.

Each building or customer would be provided with a point of connection to the distribution loop. This point of connection would include meters from which the energy consumption of each service (heating or cooling) will be determined. Metering devices and point of connection may happen just outside the building or just within the building. The point of connection would require access by the district energy system operators.

Environmental Impact

Air Quality

The major systems having potential impacts to air quality or the natural gas fired boilers used for generating hot water and the cooling towers used to reject heat to the atmosphere.

The emissions form the boiler systems include several criteria pollutants identified by the United States Environmental Protection Agency (US EPA). These criteria pollutants are regulated through National Ambient Air Quality Standards (NAAQS)[1], California Ambient Air Quality Standards (CAAQS)[2], and Bay Area Air Quality Management District (BAAQMD) Rules and Regulations[3]. The boilers and associated equipment will all be designed and operated in conformance with the most stringent requirements of each of these regulating bodies. The boilers used in the district energy system will be classified as large boilers (>2,000,000 BTU capacity). These boilers are regulated for both nitrogen oxides (NOx) and carbon monoxide (CO). In general, the emissions standards for large boilers are more stringent than those for small boilers.[4] By meeting and possibly exceeding these emissions standards through the use of more efficient boiler technologies and centralized control, the emissions from criteria pollutants will be less than the BAU Option. In addition, the boilers used in the District Energy Option would incorporate the best available control technology, which is currently estimated to be about 8 ppmv for nitrogen oxides.

Cooling tower emissions include water vapor, drift and blowdown. Of these three emission sources, drift has the most significant impact to air quality. Drift occurs when droplets of water are carried out of the cooling tower through the tower exhaust air. Evaporated water that provides for the heat dissipation process is a pure water source and not a regulated source emission, but drift contains the same concentration of impurities as the cooling tower water. These impurities include dissolved solids which are particulate matter <10 microns (PM10) a regulated emission. Drift eliminators are baffle-like devices that capture these water droplets and can reduce drift to below 0.1%. Drift eliminators and alternative cooling tower water treatment practices will be implemented so as to minimize drift and its potential impacts on air quality. In addition, the cooling towers will use the best modern practices in their operation.

In general, the overall energy demand of this centralized system will be approximately 2% lower than the BAU option of each building utilizing its own separate cooling and heating plant. This is primarily accomplished through efficient equipment and increased system diversity.

Water Quality

The cooling tower water blowdown may have potential water quality impacts. Blowdown is a process of dissolved solids control in which cooling tower water is discharged and replaced it with makeup water in order to dilute the dissolved solids. Increased concentrations of dissolved solids are produced as a result of the evaporation process. This is the most common method of dissolved solids control. The cooling tower installation will be designed, constructed, and operated based on local water quality regulations so as to minimize impact on water quality. The incorporation of alternative cooling tower water treatment practices will also aid in reducing the impact.

Noise

Having the plant in a central location will have large equipment that will have larger environmental noise. In the District Energy Option, this noise source will be generated in the parking structure adjacent to the urban center rather than at each building. Therefore, the District Energy plant will reduce widespread ambient environmental noise emissions over the BAU case and the central location will provide for greater ease in the acoustic treatment of these systems.

Noise from cooling towers is generally the most difficult to treat as this type of equipment must be located outdoors to allow for the intake and exhaust of ambient air. Noise from a cooling tower is generated by the impact of falling water, movement of air by fans, fan and motor vibrations caused within the structure and by motors, and fan accessories. This noise is typical for all cooling tower sizes. Since the size of the cooling towers is greater and the amount of air flowing through the towers is also larger, the local noise generated by these units will be higher in the District Energy Option. In the BAU case, cooling towers or similar heat rejection devices will be placed at each building. Although the noise generated by larger cooling towers is greater than that of a smaller tower, the ability to provide noise mitigation for multiple cooling tower locations is much more difficult for the building level BAU Option. In addition, the cooling tower location will be adjacent to the urban center rather than within, reducing overall ambient noise within the more densely occupied urban centers.

Noise generated from boilers, chillers and distribution equipment are more easily treated acoustically than cooling towers. The larger equipment will generate greater noise than smaller distributed equipment, but will be centrally located and acoustically treated. There will be no major acoustical impacts for this type of equipment in the District Energy Option as compared to the BAU Option.

Visual Impacts

Cooling towers are likely to have a visual plume. The plume, discharge air form the cooling tower, is made up of saturated air and warmer than ambient. When this warm saturated discharge air mixes with the ambient air, the air is cooled and water condenses forming a visual plume. These water droplets are pure water and free of pollutants or contaminants, contradictory to the perception of the general public that the plume is a hazardous pollutant being released into the atmosphere.

Ambient temperature conditions, discharge temperature conditions, volume of discharge air and velocity of discharge air are all factors that will determine the amount of condensation that occurs and the visibility of the plume. The plume can present a visual hazard if it interferes with roads or airports and may cause the formation of fog and even icing of roadways at low ambient temperatures.

Visual plumes will occur at this location some portion of the year without mitigation. Visual plume mitigation technologies, including combination wet/dry cooling towers, can be used if the visual plume is an issue. These towers may increase equipment cost by as much as 3 times and require slightly more energy use per unit of cooling; however, use of the dry cooling tower portion will reduce overall water consumption. Combination wet/dry cooling towers are generally larger than typical water only cooling towers.

Additional environmental benefits of the centralized vs distributed system include:

- Increased potential for incorporation of renewable energy systems leading to reduced GHG emissions for the developments.
- Smaller overall equipment sizes due to the diversified end uses being served.
- Simpler noise control – the noisiest equipment is removed from each building and noise can be treated in a single location within the parking garage.

Additional Benefits

All of the above benefits will be available to both the vertical and horizontal aspects of the developments. In addition, the following benefits can be attributed directly to vertical developers;

- Increase in usable floor area in buildings – it is estimated that this could be in the region of 3% for larger buildings due to the elimination of cooling and heating equipment.
- A district system can offer a plug and play path to help meet any sustainable goals that a vertical developer or future building owners / tenants may have – for example net zero energy.
- Better control over the aesthetics of buildings – no need to find routes or locations for boiler flues and heat rejection equipment on the exterior of the buildings.
- A reduction in building level maintenance.
- Has the potential to make roof spaces cleaner leading to improved views from adjacent buildings and the opportunity to incorporate renewable technologies or green roofs at a building level.

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[1]National Ambient Air Quality Standards (NAAQS) are defined by the United States Environmental Protection Agency.

[2]California Ambient Air Quality Standards (CAAQS) are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of regulations.

[3]Bay Area Air Quality Management District (BAAQMD) provides rules and regulations for air quality in 16 specific air quality zones in the Bay Area Region of Northern California. These rules and regulations are more stringent than CAAQS and NAAQS for large boiler installations.

[4]BAAQMD Regulation 9 Rule 7 governs emissions for Large Boilers (>2,000,000 Btu input energy) which are considered for the District Energy Option. The boilers are likely to be load following, more than 5,000,000 BTU/hr and less than 75,000,000. Therefore the maximum allowable emissions limit for oxides of nitrogen is 15 parts per million by volume (ppmv) and the maximum allowable emissions limit for carbon monoxide is 400 parts per million by volume (ppmv). BAAQMD Regulation 9 Rule 6 governs emissions for Small Boilers (>75,000 and <2,000,000 BTU input energy) which are likely to be provided in the BAU Option. The boilers are likely to have input energy ratings between 400,000 BTU/hr and 2,000,000 BTU/hr. Therefore, the maximum allowable emissions limit for oxides of nitrogen under this rule are 20 ppm after January 1, 2013. Carbon monoxide is not regulated under this rule.

Appendix T2 ARUP MBR Decentralized Wastewater Treatment EIR Description, August 19, 2009

To	Therese Brekke	Reference number	13187/RRJ
cc	Jean Rogers, Stephen Proud	File reference	
From	Rowan Roderick-Jones Manish Dalia	Date	August 19, 2009
Subject	MBR Decentralized Wastewater Treatment – EIR description		

Lennar has recently requested that Arup undertake a brief analysis regarding the potential implementation of a decentralized wastewater treatment option for the CP/HPS project. Lennar has requested that this option be presented as the alternative option for the Project Description in the EIR. This report provides the basis for an EIR project description.

1 Decentralized Wastewater Treatment Option Description

The decentralized wastewater treatment option entails utilizing a distributed network of membrane bioreactors (MBRs) to treat wastewater on-site rather than transferring wastewater to the Southeast Water Pollution Control Plant. This would allow the project to generate 1.05 MGD (includes 5% loss from the total 1.1 MGD of anticipated sanitary flow) of reclaimed water in the "Business-as-usual" (BAU) water demand scenario, meeting 73% of the total 1.35 MGD potential reclaimed water demands. For the "Sustainable Case" water demand scenario, 0.91 MGD of reclaimed water would be produced, meeting 100% of the 0.89 MGD reclaimed water demands.

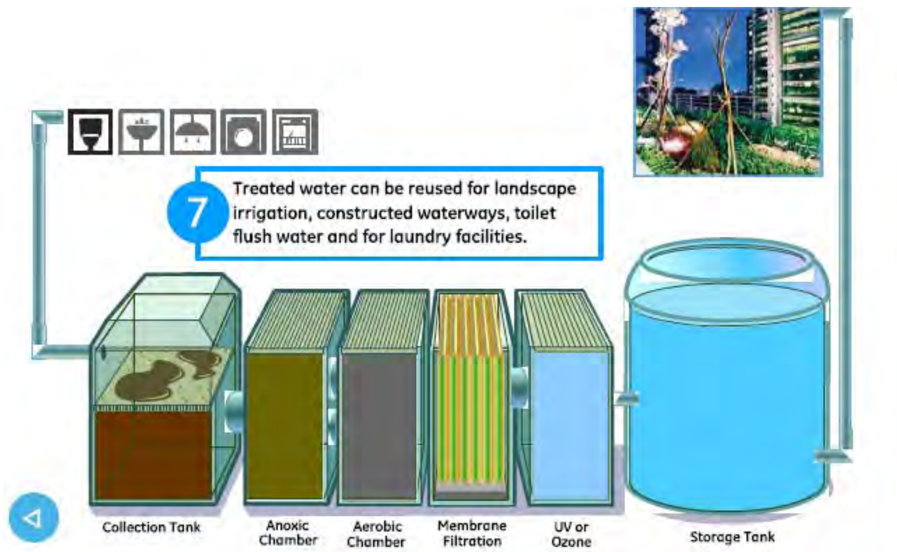
The description in this section includes:

- an overview of the MBR treatment technology
- a description of the project implementation strategy including:
  - capacity and number of facilities
  - above and below-ground area requirements
  - draft sewage collection and reclaimed water distribution areas
- an estimate of environmental implications including:
  - energy
  - solid and liquid waste
  - air quality
  - noise
  - odor
  - chemicals and hazardous materials
  - traffic
  - visual resources

1.1 MBR Treatment Technology

MBRs represent one of the newest technologies in wastewater treatment. The following generally describes the major wastewater treatment steps for an MBR facility and their function within the wastewater treatment stream. Figure 1 illustrates a generic MBR process, which is described in further detail below.

Figure 1 – Generic MBR Process Diagram (Courtesy of GE/Zenon)



Source: GE Water/Zenon

1.1.1 Wastewater Treatment System

1. Grit Screen - Wastewater will first flow through the Grit Screen to remove large debris and trash.
2. Collection Tank - A Collection Tank with aeration and circulation will allow wastewater to be stored prior to treatment and will aid in maintaining a constant flow of wastewater through the treatment system even during times of peak flow.
3. Screening - Screening will remove the smaller debris, and other non sludge materials that cannot be processed through the MBR.
4. Anoxic Chamber - The anoxic chamber will remove nitrate-nitrogen ($N\text{-}NO_3$) from the wastewater.
5. Aerobic Chamber – Oxygen will be introduced to the wastewater in order to remove solids, and decrease ammonia-nitrogen ($N\text{-}NH_3$). The sludge is removed from this system and pumped to a sludge holding tank. Backwash from this process is recirculated back to the Anoxic Chamber.
6. Membrane Filtration – Pressure is used to push wastewater through membranes to remove smaller particles and remaining pollutants. Backwash from the Membranes recirculates to the aerobic Chamber.

7. Disinfection – Disinfection is required to reuse wastewater for non-potable purposes. Disinfection can occur by either UV, mixed oxidant, ozonation, chlorination, or chloramination. This study assumes disinfection by UV.
8. Storage Tank – A storage tank with aeration and circulation will be used to store water before it can be pumped to a larger storage reservoir, or prior to reuse. During Peak Flow events this storage will be crucial to avoid overloading the pumps while not halting the MBR treatment process.
9. Pumping System – A pump will be used to pressurize the recycled water distribution lines Additional pumps may be required at other locations in the distribution system.

1.1.2 Sludge Handling System

A sludge holding tank will be used to store sludge from the MBR process prior to processing or removal from the site. Sludge from MBRs tends to have a water content of about 70% and a bulk density of 45 lbs per cubic foot. A typical 100,000 gpd MBR facility treating municipal wastewater effluent from a per capita equivalent population of about 2100 people would produces about 25 cubic feet or 1115 lbs wet weight of sludge per day. A sludge holding tank would typically have the capacity to store up to a week of sludge and would have a volume of 175 cubic feet or 6 cubic yards.

After the sludge holding tank there are a variety of options for the sludge generated on site.

1. Aerobic Sludge Digester – An aerobic sludge digester can be implemented on a site wide basis to detoxify sludge and break down solids into gases. The treated biosolids will be mixed with polymers to neutralize any remaining toxins. This sludge could then be spread on drying beds before being hauled away to a disposal facility.
2. Anaerobic Sludge Digester – An anaerobic sludge digester can be implemented on site to produce energy. These systems generally require a very large amount of sludge to be cost effective and produce enough energy. Therefore, this would have to be a site-wide system and may require collecting other organic waste streams within the project such as fats, oils, and grease (FOGs) and green landscaping waste, or even importing sludge from outside the project area.
3. Sludge Polymer Mixer – Technology can be implemented such that sludge can be mixed with polymers such that it is not toxic and can be stored and transported to a typical landfill facility.
4. Sludge Hauling – The sludge could be hauled to an off-site treatment and disposal area. Another option is to pump sludge using a trunk line to the Southeast Water Pollution Control Plant for treatment and disposal.
5. Sludge Recycling - Sludge/biosolids may be recycled on-site via mixing with soil amendments for use as fertilizer. Sacramento has a biosolids recycling facility in which they treat and prepare biosolids to be used as fertilizer for agricultural lands. The recycling of biosolids could be incorporated into the City's composting program in which waste from homes and green waste from landscaping are used to create soil amendments.

1.1.3 Operation and Maintenance

Long term operations and maintenance (O&M) of a typical package MBR plant consist of energy consumption, cleaning chemical consumption, membrane replacement and costs associated with sludge handling. Table 1 provides typical long term O&M requirements for a 100,000 gallons per day (gpd) (0.1 MGD) package plant from GE/Zenon. Quantitative estimates of maintenance requirements associated with sludge handling have not been included and would depend largely on the method used.

Table 1: Long-term operations and maintenance requirements –100,000 gpd MBR plant

Energy Consumption	**kWh/year**
Permeate BP Pumps	1,847
Membrane Blowers	21,788
Recirculation Pumps	4,797
Compressors	3,819
Anoxic Mixers	15,650
Process Blowers	90,977
Pressurization Pumps*	67,525
Total	**206,404**
Cleaning Chemical Consumption	**Lbs/Year**
Hypochlorite	244
Citric Acid	789
Membrane Replacement	**Annualized Cost**
Annualized Cost of Membrane Replacement	$2,461

*Assumes 90 hp pump operating 3 hours per day

Source: GE/Zenon

Note that the annual energy cost of 206,404 kWh is equivalent to **5,654 kWh** per MGD of water treated and includes power requirements for distribution of reclaimed water.

Modern MBR systems are automated allowing minimal on-hand operator presence. Operations and maintenance updates are sent to the plant manager’s wireless device and to a technical support station run by the MBR manufacturer.

1.1.4 Area Requirements

MBRs require both above- and below-ground footprints.

A typical 100,000 gpd MBR system would require approximately 6,250 square feet of above-ground footprint to house the treatment plant components, distribution line pressurization pumps and chemical storage area.

Pre-treatment wastewater and product water equalization tanks and sludge storage tanks can be located below ground to reduce the overall dedicated footprint of the facility. Tanks can be sited beneath parking spaces or driveways rather than structures. The estimated below ground footprint requirement for the same 100,000 gpd facility is approximately 30,000 square feet. This includes a small area, approximately 150 square feet, for a sludge storage tank with a 1 week holding capacity of 6 cubic yards.

1.2 Project Implementation Strategy

The following section describes a conceptual plan for implementing distributed MBRs at the CPHPS site. The primary purpose of this plan is to produce reclaimed water meeting Title 22 standards for both indoor and outdoor reuse.

The distributed wastewater treatment option of CPHPS consists of eleven 100,000 gpd (0.1 MGD) plants distributed across the site. These plants will treat a total of 1.1 MGD of wastewater and produce conservatively about 1.05 MGD of reclaimed water. Water in sludge and other losses account for the balance.

Each distributed plant would be installed using two standard 50,000 gpd MBR units. This will allow for expansion to full capacity at locations serving development areas with different phasing schedules. The sanitary collection areas for each 100,000 gpd facility are estimated based on predicted sanitary flow by phasing as well as topography. Lift stations associated with the collection of sanitary flows have not been located nor sized. A more detailed analysis of sanitary flows by parcel as well as sewer pipe invert elevations would be required to finalize the collection area delineation, location, and size of lift station.

Table 2 summarizes the number of 100,000 gpd MBR sites required by phase for the project. Note that Phase 1 has 0.07 MGD excess capacity, making up for the deficiency in individual capacities in the subsequent phases. Figure 2 below provides generalized locations for each of the eleven MBR plants.

Table 2 - MBR's Required by Phase for the Sustainable Case Flows

	Approx. Flows[1] (MGD)	100,000 GPD MBR Sites Required*	Space Required Above Ground (sqft)	Space Required Below Ground (sqft)	Total Required Space (sqft)	Total Required Space (acres)
Phase 1	0.33	4*	25,000	120,000	145,000	3.3
Phase 2	0.44	4	25,000	120,000	145,000	3.3
Phase 3	0.21	2	12,500	60,000	72,500	1.7
Phase 4	0.12	1	6,250	30,000	36,250	0.8
Total	1.1	11	68,750	330,000	398,7500	9.1

1 . Source: Arup, 2009. CPHPS Water Demand Memorandum. Prepared for Lennar, July 20, 2009.

1.2.1 Product water distribution

Product water (reclaimed water) from the MBR facilities would be distributed through a site wide system of pressurized mains. Unlike the sanitary collection system, the distribution system would be connected between MBRs locations in order to maximize flexibility between point of production and point of use. Targeted end uses for reclaimed water and their approximate average daily consumption rates include irrigation of public open spaces (0.35 MGD), residential and non-residential irrigation, water features and other exterior uses (0.50 MGD,) residential and non-residential toilet and urinal flushing (0.25 MGD), mechanical cooling and process water (0.25 MGD). The total combined BAU demand for reclaimed water is estimated to be 1.35 MGD. Additional potential uses include supply water for wetland habitat restoration sites. Based on the estimated supply and demands, it is not anticipated that any water would be available to distribute outside of the project area.

Figure 2 – Concept Sewage Collection Areas and Generalized MBR Locations.
Based on phasing diagram (Lennar June 2009). MBR locations not to scale.

1.3 Environmental Implications

1.3.1 Energy

As previously discussed, the estimated energy demand for typical MBR system is about 5,650 kWh per 1 MGD treated. Therefore, the total energy demand for treating and distributing 1.1 MGD of wastewater at CPHPS would be about 6,215 kWh/day.

1.3.2 Solid and Liquid Wastes

The MBR facilities create two products, sludge and reclaimed water. There will be no wastewater discharges from the MBR facilities. All product water will be distributed via reclaimed water pipelines to end uses throughout the development.

The distributed MBR facilities will producetotal of approximately 3,675 pounds dry weight and 12,245 pounds wet weight of sludge per day. The total volume of sludge produced is estimated to be 10 cubic yards per day. As previously discussed there are a number of options for sludge processing and disposal. Because drying and spreading on-site is not considered practical for odor and spatial reasons, it is recommended that sludge be hauled to an off-site processing facility.

1.3.3 Air Quality

Quantitative data on air emissions from MBR facilities was not available. Emissions from sludge hauling as discussed above would also need to be accounted for.

1.3.4 Noise and vibrations

No quantitative data for noise and vibration intensity was available for MBR facilities. However, a case study from Carneros Inn in Napa County provides qualitative evidence that noise and vibration from MBR facilities can be minimized through proper housing of equipment.

1.3.5 Odor

Odors from MBR facilities can be easily mitigated by using odor control devices such as scrubbers and ensuring that the tanks, treatment works and buildings are well sealed.Treated air can be routed to a location where sensitive receptors are less likely to be present.

1.3.6 Chemicals and hazardous materials

As previously mentioned, hypochlorite and citric acid are required during normal operation and maintenance of the MBR. It is estimated that a total of 268 lbs of hypochlorite and 868 lbs of citric acid will be required on an annual basis at the 11 proposed facilities at CPHPS. These chemicals can be delivered on an annual or semiannual basis.

1.3.7 Traffic

A single sludge hauling truck with about 20 cubic yards capacity would make one trip roughly every 2 days to remove sludge from the combined facilities.

1.3.8 Visual

The above-ground machinery of the treatment plant would be housed within 1 storey structures for protection from the weather and to facilitate maintenance. This structure can be aesthetically treated to disguise the building’s use. A good example of aesthetic housing is the Carneros Inn MBR in Napa Valley, located within a barn-like structure as shown below. Vehicle and heavy machinery access is also an important consideration because the facility will require maintenance and components will need to be replaced over time. Access to the sludge storage facility will also be required to allow for periodic removal, whether the facility is above or below ground.

Figure 3: MBR Facility Structure at the Carneros Inn, Napa Valley

2 References

C.L. Wallis-Lage, S.D. Levesque, Cost Effective & Energy Efficient MBR Systems, Black & Veatch, available at http://bvwater.files.wordpress.com/2009/05/abstract_siw09_wallis-lage.pdf

Appendix T3 ARUP CP-HPII EIR Write-Up Automated Waste Collection System, September 3, 2009

ARUP

To	Lennar Therese Brekke	Reference number
cc	Jean Rogers	File reference
From	Orion Fulton	Date September 3, 2009
Subject	CP-HPII Revised EIR Write Up - Automated Waste Collection System	

The following summarizes the basic function, construction and environmental impact of the automated waste collection system (AWCS) proposed for CP-HPII. The conceptual system contemplated here is based the estimated waste numbers from the July 2009 Draft Sustainability Plan and would handle three separate waste streams per City of San Francisco Regulations: recyclables, compostables, and trash. Waste data tables can be found at the end of this memo.

System Description

Operation Process

The AWCS system for CP-HPII would be designed to allow for the source separation loading of recyclables, compostables, and trash into various types of loading points located throughout the development at ground level and in buildings. Material will be temporarily stored at the loading point/inlet until being automatically removed from these points and delivered to a central waste handling facility on a 60 mile per hour air stream within a set of transport pipes. At the final collection point, each type of material will be captured and diverted into one of three containers for compaction before being hauled off site.

Please see the figure attached to this memo for a plan view illustration of a conceptual system for CP-HPII.

Loading points/Inlets
Material will be entered into the system through various types of loading stations. In high rise and mid level buildings, each waste stream will be loaded into a dedicated, centrally located chute via a loading door on each floor. Material will collect at the base of the chute. When a discharge sequence is initiated, a gate will be opened at the base of the chute to allow the material to drop into the moving air stream. In single family dwellings material will be loaded into ground loading stations. Stations will be located in a centralized location to allow utilization by multiple dwellings. These stations allow material to collect inside the loading station. The system will generate a discharge sequence utilizing an underground gate to drop material into the moving air stream. Ground loading stations can also be installed in public areas where traditional trash cans would typically be located. For all types of loading points, discharge sequences will be initiated on a set schedule. If material reaches a high level sensor in the loading points a sequence will be initiated outside of the set schedule.

Piping network
Underground piping will be heavy wall steel with an erosion and corrosion protection system. When piping goes above ground lighter gauge stainless or galvanized steel may be utilized. Stainless pipe is installed in area exposed to outside (salty) air. Galvanized steel may be utilized in interior spaces.

Air intake

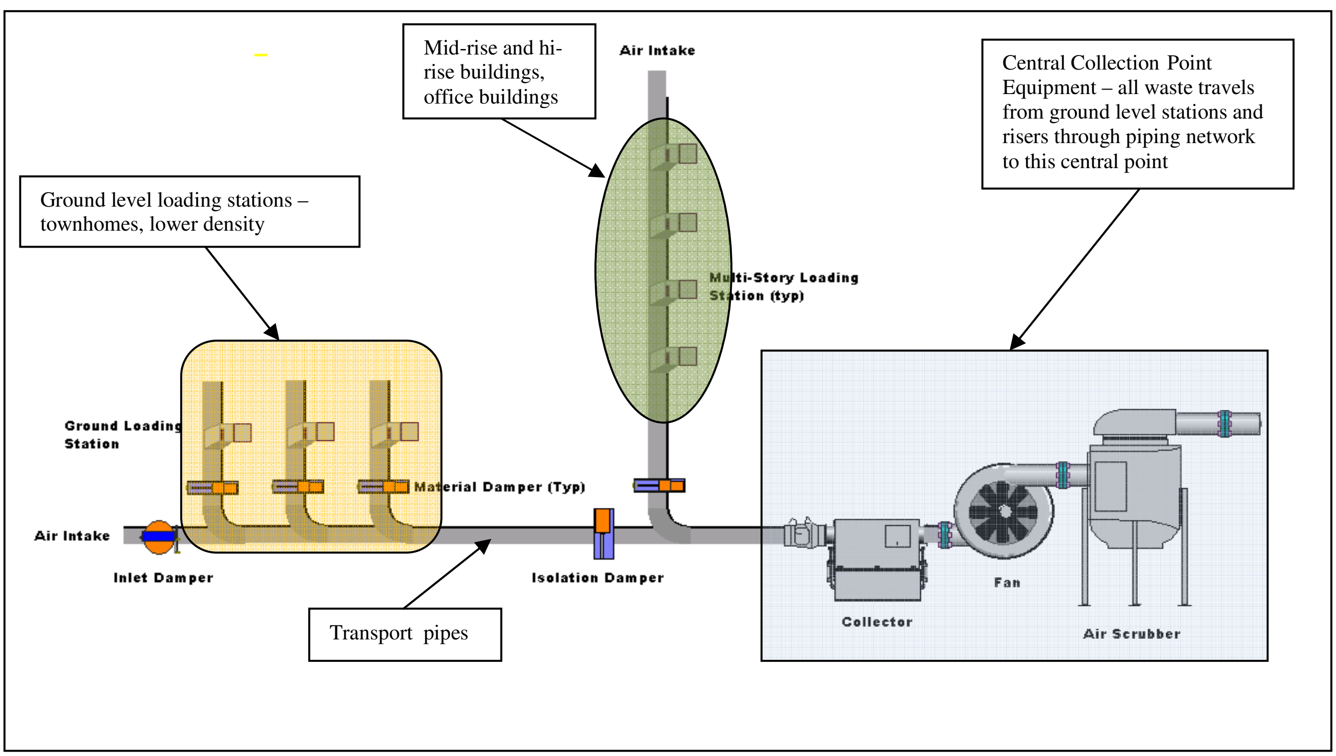
Air inlets provide a means for air to be drawn into the pneumatic tubing allowing the airflow necessary for material transport. An air inlet may or may not include an inlet damper. This is dependent on location and orientation.

In-line dampers
In-line dampers are used to close off unused branches of material transport piping during the operation of an alternate individual branch. This allows airflow to be restricted only to the piping in use.

Final collection point
Material will be delivered to a central waste handling facility. This building will house fan units, air scrubbers, cyclone waste separators, compactors and containers. Each type of material will be delivered to its own cyclone separator. After delivery, material will fall into a compactor feed hopper and then will be pushed (and compacted) into a 40 cubic yard container. When containers are full they will be disconnected from the compactor and moved to a staging location. An empty container will be quickly moved into place and connected to the compactor. The containers will be moved using an automated rail-based or other automated positioning system. The staged (full) containers will be located so they can be loaded onto haul off trucks when available. The central waste handling facility will be approximately 15,000 to 20,000 square feet and no more than 35 feet in height. The facility can be located completely or partially underground, below a building or parking deck or in any other location that suits the development's objectives. Sound insulation can be provided around the fan and/or collection area to minimize ambient noise from the facility. Solar power can be utilized to operate compactors and/or any portion of the control system.

Air scrubbers
Discharge air will be scrubbed to remove particulate matter and odor. The scrubbers force the exhaust air to pass through a screen of water that will knock out particles and provide odor neutralization. The scrubber water will be filtered and recycled.

Figure 1: Summary of AWCS Components



Construction Process

Through coordinated installation sequence, a network of buried 20" diameter steel pipe would be installed in the assigned right-of-way during Phase 1 of the project. Branch piping would be installed to planned end locations and, wherever possible, branch piping stub-outs will be installed for future connection. Based on material volume projections, loading stations would be located as needed within multi-story buildings and outdoor areas. Buried maintenance access vaults would be installed at branch locations to allow permanent access to underground piping when needed. Equipment room and the collection area may initially be installed at agreed upon temporary locations and later relocated to a permanent facility.

Environmental Impact

Air

Air (wet) scrubbers would be designed and operated to remove any airborne particulate matter and odor that might be conveyed to the outside air. The air scrubbers work by creating a contained mist of water that the air exhaust passes through trapping dust and particulate matter which, in turn, is drained to a collection reservoir and ultimately discharged to the sanitary sewer system.

No equipment used would have associated air emissions. All exhausted air from within the system will be scrubbed to meet applicable BAAQMD requirements, if any.

Water

The only water use for the system is on the wet scrubber as described above. After filtering, the wastewater is released via a pipe connected to the sanitary sewer. The wastewater does not contain hazardous materials; the contaminants would be no different than ordinarily discharged to the sewer system from normal household use. Wastewater does not enter the groundwater.

The AWCS operates under negative pressure and if there were a breach in the line ground water could enter the system. In the unlikely event of a pipe breach, the AWCS control system would identify the loss of air pressure, including loss due to a break in the pipe, and immediately isolate the affected area from the rest of the system by closing dampers at each end of the affected area, allowing the remainder of the system to continue operating while the broken pipe is repaired.

It is unlikely there would be material at rest in the line at the time of a breach – materials are pulled through the line at roughly 60 miles per hour. Even if material were traveling through the section of pipe that experienced a break, the material would most likely not fall out of the pipe due to the negative pressure, and instead continue through the system to the Collection Facility where the water and waste materials would be handled using standard operating procedures.

Noise

The only noteworthy noise created from the system would be due to the suction fans located in the central Collection Facility. At maximum operating speeds (RPMs), fans typically produce between 100 and 125 dB depending on octave range (measured 10 ft from unit). Fan noise and impact would be minimized by location and acoustical considerations on walls and ceilings. Silencers and other methods would be incorporated into the exhaust pipe to reduce noise levels to 85 dB or less. These fans will not be located in inside buildings, but would be located only at the final collection point(s). The final collection point would be housed in a building that is designed to mitigate noise.

There would be no appreciable noise associated with ground level loading stations, which would generally be located outside.

At the bottom of risers in buildings, there would be some noise from air intake. These intakes typically would be located in garages in as discrete an area as possible. The noise associated with an air intake is less than that of an air conditioning compressor, is limited to times when the risers are being emptied into the horizontal piping network and will likely generate intermittent and brief noise in the 55-70 dB level.

Because of the substantial reduction in truck traffic with the AWCS, residents and visitors will experience a corresponding large reduction in noise levels associated with less truck movement and usage.

Energy

System energy consumption is mostly due to fan motor power draw and air compressor horsepower. The fans are controlled by variable frequency drives and operated at high power only on demand. Moving parts on the system are electro/pneumatic; each uses only about ½ watt and a fraction of a cfm of air flow per actuation. Total system energy consumption is estimated to average approximately 2-4 kWh per month per permanent resident depending on the ultimate design of the system.

The AWCS system should have a net positive impact on energy usage due to the substantial reduction of truck usage at CP-HPII.

Traffic

Trash truck traffic is reduced significantly in the commercial and residential areas since they only need to travel to a centralized collection facility. Preliminary estimates predict at least a 70% reduction in truck traffic compared to the traditional waste collection approach. Using traditional collection methods, it is estimated that 10-13 trash trucks will be needed at CP-HPII each day for an estimated 7-8 hours per day.[1] This estimate is based on the total estimated tonnage of 22,454 tons produced annually[2] and could easily increase once the final design is established and reviewed by the City's waste hauler. In addition, it is very likely that up to additional 2 trucks will be necessary under the traditional collection method at the stadium after a game on game days. The average total number of hours of trash truck traffic at Hunter's Point per day using traditional collection methods will fall within the 100+ hours per day range. The AWCS should reduce the number of hours of circulation by at least 70%, assuming 7-9 ton load per hauling load from the Collection Facility. The reduction in truck traffic should substantially and meaningfully reduce emissions, congestion, danger and noise at Hunter's Point.

Greenhouse Gas Emissions and Other Particulate Matter

Due to the substantial reduction in truck traffic, CP-HPII will benefit from a corresponding reduction in greenhouse gases. Specifically, diesel and biodiesel trucks emit large amounts of CO_2. Diesel trucks emit roughly 22.2 lbs of CO_2 per gallon of fuel consumed; biodiesel trucks emit roughly 20% less or roughly 17.8 lbs per gallon of fuel consumed.[3] The AWCS system would decrease truck traffic by at least 70%, as stated above, which would result in a comparative reduction in CO_2 emissions.

In addition to greenhouse gases, trash trucks emit large amounts of NO_X and other PM. It is assumed that trash trucks emit 0.020 grams of NO_X per hour of brake horsepower 0.014 grams of Hydrocarbon non methane per hour of brake horsepower and 0.011 grams of PM per hour of brake horsepower.[4]

A trash truck has 230 brake horsepower.

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[1] Estimates based on waste data provided in the July 2009 Draft Sustainability Plan, included at the end of this memo.
[2] CPHPS Sustainability Plan, July 2009, Arup, page 106, see table below
[3] Calculations reported by Recology, City of San Francisco's current waste hauler.
[4] Ibid.

Energy consumed by the system fan motors will be hydropower delivered by the SFPUC, so there would be no significant indirect greenhouse gas emission impacts from this energy usage.

Greenhouse gases will be substantially reduced with the use of an AWCS.

Public Health

In addition to the climate and clean air benefits listed above, there would be substantial public health benefits derived from the use of the AWCS. Specifically, the public would have limited exposure to trash on the streets in general and the attendant rodent problem associated with exposed trash. Moreover, the AWCS is completely sealed so the collection point would also be relatively free of rodents.

CP-HPII Waste Summary by Land Use

Zone	Total Annual Waste Generation (tons)
Residential	10,832
Commercial	7,212
Hotel	296
Stadium	4,114
Total	22,454

Appendix T4

ENVIRON, Updated Air Quality Analysis Candlestick Point–Hunters Point Shipyard Phase II Development Plan—Updated Variants 2A and 3 (Tower Variant D), Alternative 2, and Subalternative 4A, April 26, 2010

ENVIRON

April 26, 2010

MEMORANDUM

To: Alison Rondone, PBS&J
Michael Rice, PBS&J
Kimberly Avila, PBS&J

Cc: Therese Brekke, Lennar Urban

From: Michael Keinath, ENVIRON
Elizabeth Miesner, ENVIRON
Shari Libicki, ENVIRON

Subject: Updated Air Quality Analysis
Candlestick Point-Hunter's Point Shipyard Phase II Development Plan – Updated Variants 2A and 3 (Tower Variant D), Alternative 2, and Subalternative 4A

On March 1 and 8, 2010, ENVIRON received information from PBS&J regarding the revised Variant 2A, Variant 3 (Tower Variant D), Alternative 2 and Subalternative 4A for the Candlestick Point-Hunter's Point Shipyard Phase II Development Plan (CP-HPS). This memorandum discusses the impact of the revised variants and alternatives with respect to the ambient air quality (AAQ) human health risk assessments (HHRA) presented as Appendix H of the Draft Environmental Impact Report (DEIR).

Below we list our understanding of the changes to the variants and alternatives as well as a brief discussion of how those impacts may affect our previous analyses:

- Variant 2A update proposes a shift of 275 residential units from Candlestick Point (CP) to Hunter's Point Shipyard (HPS) and an additional 500,000 square feet of Research and Development (R&D) buildings to HPS. Since Variant 2A has changes to the location of the R&D areas, we evaluated this new location with respect to the impact this location would have on new residents located adjacent to the new R&D area. Since the R&D uses also increase in square footage, the traffic associated with this Variant was evaluated by Fehr & Peers. We evaluated the traffic with respect to the traffic $PM_{2.5}$ and cumulative risk analysis presented in the air quality section (Section III.H) of the Final EIR. These new analyses are discussed in the next section.

- Variant 3 (Tower Variant D) changes the size of floor plates and tower locations. Since Variant 3 (Tower Variant D) does not result in any change in number of dwelling units or square footage of non-residential space, there will be no changes to the impacts discussed in the DEIR.

- Alternative 2 is a no bridge scenario which could be applied to the Project or any of the Variants. As the footprint of development, the total amount of development, and the land uses provided with Alternative 2 would be virtually the same as the Project or any of the

Variants, air quality impacts of Alternative 2 would also be the same as the Project or Variants.

- o Subalternative 4A allows for historic preservation of buildings. This alternative does not result in any total square footage change in R&D space, only use of historic buildings for R&D uses with an increase in the height of new R&D buildings to accommodate this use. As the land use plan is the same as the Project, there will be no change from the impacts discussed for the Project or its Variants.

Variant 2A Update

Compared to the Project, Variant 2A proposes an additional 500,000 square feet of R&D at Hunter's Point Shipyard (in an area designated by the HPS Redevelopment Plan as Hunter's Point South), located to the west of residential uses that would be constructed instead of the 49ers Stadium. For the purposes of this analysis of Variant 2A, we refer to this area of 500,000 square feet of R&D as "Stadium R&D," which is the R&D areas south of Crisp Road in the Hunter's Point South region. The HPS Redevelopment Plan states "no Laboratory, Life Sciences, Light Industrial, and/or Green Technology uses containing a facility that emits regulated toxic air contaminants shall be permitted within 350 feet of any residential use south of Crisp Road in Hunters Point South."

Since this additional R&D, the Stadium R&D, is located in an area not previously evaluated in the DEIR, we evaluate it here considering the 350-foot restriction presented in the HPS Redevelopment Plan. Additionally, this R&D increase in square footage causes an increase in traffic associated with this Variant, which we also evaluate to update the traffic $PM_{2.5}$ and cumulative analyses presented in our technical memorandum dated April 20, 2010 and entitled "Cumulative Risk Impact and San Francisco Health Code Article 38 Analyses, Candlestick Point – Hunter's Point Shipyard Phase II Redevelopment Project."

Location of Additional R&D

We evaluated the additional 500,000 square feet of R&D using the methodology described in DEIR Appendix H1, Attachment III: Analysis of Toxic Air Contaminant (TAC) Emissions from Stationary Sources in Research & Development (R&D) Areas (herein referred to as "App. H1-III").

Land use designations, as shown in the Final EIR, were used in this analysis to identify the locations of the Stadium R&D and residential nearby receptors. As discussed in App. H1-III, in order to determine the number of potential TAC emission sources, this additional Stadium R&D area was subdivided into twelve roughly one acre sites (shown in Figure 1, attached), which is consistent with the minimum size of a parcel based on the expected uses at the Project. For this analysis, it was assumed that each site contained one air emission source located at the centroid of each site; however, this evaluation also considered the HPS Redevelopment Plan which states that facilities south of Crisp Road that emit regulated air toxics shall not be permitted within 350 feet of any residential land use in HPS South. Figure 1 shows the locations of the parcels which meet the restriction on TAC sources. Specifics of the source parameters for each source as well as the air dispersion modeling methodology are presented in App. H1-III. Additionally, the specific approaches described in App. H1-III have been developed into mitigation measures AQ-6.1 and AQ-6.2. This analysis assumes these two mitigation measures are adopted.

As shown in Figure 2, with the 350 feet buffer area, areas which exceed the health risk threshold (10 in a million) do not extend beyond the boundary of the R&D area into areas zoned for residential use. Further evaluation may be warranted if land use in the vicinity of the Project is modified or if the placement of the stationary sources do not conform to the assumptions made in this screening-level analysis.

Traffic Modification

The traffic changes for Variant 2A were evaluated with respect to the traffic $PM_{2.5}$ and cumulative risk analysis presented in the air quality section (Section III.H) of the Final EIR.

The traffic data provided by Fehr & Peers shows that, compared to the Project, Variant 2A will generate slightly more traffic on the Hunter's Point Shipyard side of the Project. This is expected since Variant 2A assumes additional R&D and housing unit on HPS, which results in additional weekday traffic. There appear to be approximately 10% increases in traffic on Innes and Evans Avenues. Other streets including Palou, Revere, Thomas, and Van Dyke Avenues each have approximately 5%-10% of traffic increases. However, there is the same or slightly decreased traffic on the Candlestick Point side of the Project. The only exception is Ingerson Avenue, which has an 18% traffic increase.

We evaluated the potential impact of the traffic changes to health risk from cumulative sources. The previous cumulative risk impact analysis shows that the highest cumulative cancer risk at the residential receptors at the Hunter's Point Shipyard is 0.9 in a million for the Project scenario. The 10% traffic increase will lead to a cumulative cancer risk of about 1.0 in a million, which is well below the threshold of 100 in a million. Similarly, for the evaluation of the Project traffic, the highest cumulative $PM_{2.5}$ concentration at the residential receptors at the Hunter's Point Shipyard is approximately 0.022 ug/m^3. The 10% increase will lead to a $PM_{2.5}$ concentration of 0.024 ug/m^3, which is well below the San Francisco Health Code Article 38 threshold of 0.2 $\mu g/m^3$. Therefore, housing at HPS would not be required to install filtration, which is consistent with the findings for the Project.

On the Candlestick Point side of the Project, since traffic on Ingerson Avenue is small compared to the traffic on other nearly streets (e.g., Gilman Ave, or Jametown Avenue), the impact of its traffic increase will be counteracted by the traffic decrease from other streets. Overall, there will not be a significant change to health risks or hazards or $PM_{2.5}$ concentrations for Variant 2A.

Therefore, compared to the Project, Variant 2A will have a similar cumulative risk impact.

Attachments:

Figure 1 – Locations of Potential TAC Source
Figure 2 – Locations of Potential Exceedances

ENVIRON

6001 Shellmound St., Suite 700, Emeryville, CA 94608

Locations of Potential TAC Sources
Variant 2A - Housing
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure

1

Drafter: Date: Contract Number: Approved: Revised:

ENVIRON

6001 Shellmound St., Suite 700, Emeryville, CA 94608

Locations of Potential Exceedances
Variant 2A - Housing
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
San Francisco, California

Figure

2

Drafter: Date: Contract Number: Approved: Revised:

Appendix T5 ENVIRON, Updated Greenhouse Gas Emissions Calculation for Candlestick Point–Hunters Point Shipyard Phase II Development Plan—Variants 2A and 3 (Tower Variant D), Alternative 2, and Subalternative 4A, March 12, 2010

March 12, 2010

MEMORANDUM

To: Alison Rondone, PBS&J
Michael Rice, PBS&J
Kimberly Avila, PBS&J

Cc: Therese Brekke, Lennar Urban

From: Shari Libicki, ENVIRON
Jennifer Schulte, ENVIRON
Kai Zhao, ENVIRON

Subject: Updated Greenhouse Gas Emissions Calculation for Candlestick Point-Hunters Point Shipyard Phase II Development Plan – Variants 2A, 3 (Tower Variant D), Alternative 2, and Subalternative 4A

On March 1 and 8, 2010, ENVIRON received from PBS&J information regarding the revised Variant 2A, Variant 3 (Tower Variant D), Alternative 2 and Subalternative 4A for the Candlestick Point-Hunter's Point Shipyard Phase II Development Plan (CP-HPS). This memorandum discusses the effect of these variants and alternatives with respect to climate change and greenhouse gas (GHG) emissions. Variant 2A proposes a shift of 275 residential units from Candlestick Point (CP) to Hunter's Point Shipyard (HPS) and an additional 500,000 square feet of Research and Development (R&D) buildings to HPS. Since Variant 2A has changes in the number of dwelling units and non-residential square footage, there will be changes to the GHG emissions associated with this Variant. These changes are discussed in the next section. Variant 3 (Tower Variant D) changes the size of floor plates[1] and tower locations. Since Variant 3 (Tower Variant D) does not result in any change in number of dwelling units or square footage of non-residential space, there will be no changes to the GHG emissions associated with this Variant compared to the Project. Alternative 2 is a no bridge scenario which could be applied to the Project or any of the Variants. No changes in the GHG emissions reported for the Project, Variants 1, 2 or 2A are anticipated if there is no bridge[2]. Subalternative 4A allows for historic preservation of buildings. This alternative does not result in any total square footage change in R&D space. Since Subalternative 4A does not result in any change in number of dwelling units or square footage, there will be no changes to the GHG emissions associated with this Alternative compared to the Project, Variants 1, 2 or 2A.

[1] ENVIRON understands that the increase in floor plate size does not impact the overall footprint of the towers. This change affects the overall aesthetic of the building, but does not change any characteristics associated with energy use per dwelling unit.
[2] ENVIRON utilized an average trip length estimated by Fehr and Peers based on the Caltrans Household Travel Survey for San Francisco County. ENVIRON assumes that there would be no change in average trip length estimated from this source if no bridge was built. The analysis is unable to capture any changes in trip length that may result from changes to travel paths as a result no bridge.

Emissions Update Variant 2A

The greenhouse gas (GHG) emissions associated with the residential, non-residential, mobile, municipal, area, and waste disposal sources are affected by the revision to Variant 2A and have been updated accordingly using the same emissions calculation methodology presented in the original Climate Change Technical Report prepared on October 15, 2009. This section of this memo lists and explains the changes to the emissions calculation in detail and references the similar tables prepared for Variant 2 in the Climate Change Technical Report. The appropriate tables for Variant 2A are included at the end of this memorandum.

a. Residential Sources

Table 3-12: CO2 Emissions from Electricity and Natural Gas Usage in Residential Dwelling Units with Renewable Portable Standard

Updates: The number of dwelling units in CP was reduced from 6,244 to 5,969 and the number of dwelling units in HPS was increased from 4,000 to 4,275.

b. Non-Resid ential Sources

Table 3-19: Electricity Usage and Resulting GHG Emissions for Non-Residential Building Types

Updates: The R&D square footage was increased from 2,500,000 to 3,000,000 square feet to account for the proposed addition of 500,000 square feet.

c. Mobile Sources

Table 3-24: Greenhouse Gas Emissions from Vehicles for the Year 2020: Variant 2 with Paveley Standards

Table 4-4: Greenhouse Gas Emissions from Vehicles for the Year 2020: No Action Taken for Variant 2

Updates: The residential and non-residential unadjusted daily one-way trips for CP and HPS were updated based on the revised number of residential dwelling units and R&D square footage as provided by the traffic consultants in an email dated March 3, 2010.

d. Area Sources

Table 3-29: GHG Emissions from Area Sources-Hearth Fuel Combustion: Variant 2

Updates: The quantities of dwelling units for CP and HPS with fireplaces was updated.

e. Municipal Sources

Table 3-30: GHG Emission Factors for Municipal Sources: Variant 2 with Renewable Portfolio Standard

Table 4-7: GHG Emission Factor for Municipal Sources: No Action Taken Variant 2

Updates: The quantities of water and wastewater for CP and HPS were updated based on the estimated water volume provided to ENVIRON on March 8, 2010 from PBS&J for Variant 2A.

f. Waste Disposal

Table 3-32: GHG Emissions from Waste Disposal: Variant 2

Updates: The number of residential units of CP was reduced from 6,244 to 5,969, and the number of residential units was increased for HPS from 4,000 to 4,275.

g. Construction

The GHG emissions associated with construction activities are determined by the overall numbers of construction hours and total worker, vendor, and material/waste transportation trips and are independent of the construction phase length. As the total number of hours and trips are not expected to change considerably for Variant 2A, the GHG emissions associated with construction activities were not revised.

As presented in the revised Table 3-40, the total annualized GHG emissions of Variant 2A after this revision (i.e. 164,163 tonnes per year) are less than 4% higher than those compared to the Project (i.e. 157,104 tonnes per year). With mitigation, Variant 2A-related operational emissions of 161,596 tonnes per year result in 4.6 tonnes CO_2e per service population per year based on a service population of 35,498 (this accounts for 23,869 net new residents and all 11,629 jobs). This is equal to the Bay Area Air Quality Management District (BAAQMD) draft GHG CEQA thresholds published in December of 2009 of 4.6 metric tonnes per service population.

The operational emissions for Variant 2A were compared to ARB Scoping Plan No Action Taken Scenario which assumes the site would be developed without implementation of conceptual design features and using regulations in place at the time of the Scoping Plan development. Compared to the original technical report, the revised Table 4-10 shows a small change of the percentage improvement of GHG emissions over no action taken compared to the Project (i.e. from 51% to 49%). Variant 2A shows large reductions in GHG emissions due to the mitigation measures that would be implemented. The comparison of Variant 2A GHG emissions to the ARB Scoping Plan No Action Taken scenario is shown in Table 4-10. This shows that due to the improvement in electricity carbon intensity and energy efficiency of the buildings residential GHG emissions would have a 20 percent reduction in emissions and non-residential buildings would have a 17 percent reduction in emissions. Municipal sources are anticipated to be 7 percent lower than the ARB Scoping Plan No Action Taken as a result of reductions in electricity carbon intensity. Mobile source emissions associated with Variant 2A are a result of trip reductions in automobiles and vehicle emission efficiency regulations resulting in 57 percent reductions compared to the ARB Scoping Plan No Action Taken scenario.

Emissions associated with new public transportation added to the development would have a 40 percent reduction due to the use of diesel-hybrid buses. Since transportation is one of the largest emissions categories in both the statewide and local GHG emissions inventory, the amount of reduction is substantial in the overall reductions anticipated for Variant 2A Furthermore, most of the other larger categories also result in substantial reductions in emissions. This indicates that the Housing/R&D Variant would not impede the achievement of San Francisco's GHG emission reduction ordinance nor the statewide emission reductions required under AB 32. Therefore, Variant 2A is less than significant with respect to the cumulative impacts of climate change and GHG emissions.

Appendix T6 **LCW Consulting, CP-HPS Phase II Development Plan Transportation Study—Project Variant 2A, March 15, 2010**

LCW Consulting

Memo

To: Bill Wycko, San Francisco Planning Department, MEA

From: Luba C. Wyznyckyj, LCW Consulting
Chris Mitchell, Eric Womeldorff, Fehr & Peers

Date: March 15, 2010

Re: CP-HPS Phase II Development Plan Transportation Study – Project Variant 2A

This memorandum is a supplement to the *Candlestick Point-Hunters Point Shipyard Phase II Development Plan Transportation Study* (November 2009) that was prepared to address the impacts associated with a new Variant 2A: the Housing/R&D variant. The memorandum summarizes the results of the transportation analysis conducted for Variant 2A: Housing/R&D, and compares Variant 2A to the Project. Variant 2A would be similar to Variant 2 analyzed in the Transportation Study, with the exception that an additional 275 residential units would be shifted from Candlestick Point to Hunters Point Shipyard, and an additional 500,000 gsf of R&D uses would be provided in HPS. For comparison purposes, the tables included in this memorandum provide information for the Proposed Project, Variant 2 and Variant 2A.

The travel demand and impact methodologies for analysis of Variant 2A are the same as described for the Project, Project Variants and Alternatives to the Project in the Transportation Study in Chapter 4 (Development of Future Conditions and Significance Criteria) of the Transportation Study. Referenced Project Mitigations Measures are described in detail in Chapter 7 (Mitigation Measures) of the Transportation Study on pages 358 to 375.

The memorandum presents the Variant 2A project description and travel demand, presents a summary of project impacts by topic (i.e., traffic, transit, bicycle, pedestrian, parking, loading, emergency vehicle access, air traffic, construction, and arena impacts), and presents a summary of the mitigation measures applicable to Variant 2A.

1. PROJECT VARIANT 2A DESCRIPTION

Variant 2A assumes that the 49ers stadium would not be constructed at Hunters Point Shipyard, and, that instead the 49ers would move to the City of Santa Clara. The land use program would be the same as for the Project, with the exception that:

- 4,275 residential units, rather than 2,650 units, would be developed at Hunters Point Shipyard;
- An additional 500,000 square feet, for a total of 3,000,000 square feet of R&D would be developed at Hunters Point Shipyard;
- 6,225 residential units, rather than 7,850 units, would be developed at Candlestick Point Shipyard.

Table 1 summarizes the land use assumptions for the Project, Project Variant 2, and Project Variant 2A. **Table 2** presents a comparison of the transportation network improvements for the Project, Project Variant 2, and Project Variant 2A.

Table 1
Summary of Project and Project Variants – Land Use Program

	Project	**Project Variant 2 (Housing Variant)**	**Project Variant 2A (Housing/R&D Variant)**
Hunters Point Shipyard			
Residential (units)	2,650	***4,000***	***4,275***
Neighborhood Retail (gsf)	125,000	125,000	125,000
Research & Development (gsf)	2,500,000	2,500,000	***3,000,000***
Artists Studios (gsf) [1]	255,000	255,000	255,000
Community Services (gsf)	50,000	50,000	50,000
Marina (slips)	300	300	300
Park (acres)	238	238	238
Stadium (seats)	69,000	--	--
Candlestick Point			
Residential (units) [2]	7,850	***6,500***	***6,225***
Neighborhood Retail (gsf)	125,000	125,000	125,000
Regional Retail (gsf)	635,000	635,000	635,000
Office (gsf)	150,000	150,000	150,000
Hotel (rooms)	220	220	220
Community Services (gsf)	50,000	50,000	50,000
Park (acres)	147	147	147
Arena (seats)	10,000	10,000	10,000

Notes:
1. Project and Variants includes 225,000 sf of existing artist studio space that would be renovated and replaced.
2. Project and Variants include existing 256 units at Alice Griffith housing complex that would be replaced.

Source: San Francisco County Redevelopment Agency, Lennar Urban.

Table 2 Summary of Transportation Improvements - Project and Project Variants			
Improvement	**Project**	**Project Variant 2 (Housing Variant)**	**Project Variant 2A (Housing/R&D Variant)**
Harney Widening	X X		X
New and Improved Roadways	X X		X
Streetscape Improvements	X X		X
Yosemite Slough Bridge	X X		X
New Signals			
Palou/Griffith	X X		X
Palou/Hawes	X X		X
Palou/Ingalls	X X		X
Palou/Jennings	X X		X
Palou/Keith	X X		X
Palou/Lane	X X		X
Carroll/Ingalls	X X		X
Thomas/Ingalls	X X		X
A. Walker Dr/Carroll	X X		X
A. Walker Dr/Gilman	X X		X
A. Walker Dr/Ingerson	X X		X
A. Walker Dr/Harney	X X		X
Pennsylvania/25th	X X		X
Evans/Jennings/Middlepoint	X X		X
Intersection Improvements			
Evans/Jennings/Middlepoint	X X		X
Palou/Griffith/Crisp	X X		X
Carroll/Ingalls	X X		X
Thomas/Ingalls	X X		X
Transp Management System			
Extended & New Bus Routes	X X		X
BRT Service	X X		X
Harney/Geneva BRT/TPS	X X		X
Hunters Point Transit Center	X X		X
BRT Stops	X X		X
Palou Avenue TPS	X X		X
Bay Trail & Bicycle Improvements	X X		X
Pedestrian Improvements	X X		X
TDM Plan	X X		X

Source: Lennar Urban, Fehr & Peers.

Variant 2A assumes the same roadway and transit improvements as the Project, including construction of the Yosemite Slough bridge. The bridge would be narrower than the bridge included as part of the Project, with a 39-foot wide right-of-way to accommodate two 11-foot wide BRT lanes, a sidewalk, and a Class I bicycle path.

As with the Project, Variant 2A would implement a Transportation Demand Manage plan as described in Project Mitigation Measure 1, and a Transit Operating Plan as described in Project Mitigation Measure 7.

2. PROJECT TRAVEL DEMAND

Table 3 presents the daily person trip generation for the Project, Variant 2, and Variant 2A.

Table 3
Daily Person Trip Generation Summary
Project, Project Variant 2, and Project Variant 2A

Scenario	Hunters Point Shipyard	Candlestick Point	Total
Project	65,168	154,483	219,651
Project – Variant 2 (Housing)	77,056	141,933	218,989
Project – Variant 2A (Housing/R&D)	82,103	138,221	220,323

Note:
Does not include travel demand associated with stadium or arena events.
Source: Fehr & Peers.

Table 4 summarizes the daily, weekday AM and PM peak hour, and Sunday PM peak hour person trip generation for the Project, Variant 2, and Variant 2A.

Table 4
Person Trip Generation Summary
Project, Project Variant 2, and Project Variant 2A

Scenario	Hunters Point Shipyard	Candlestick Point	Total
Project			
Weekday Daily	65,168	154,483	219,651
Weekday AM	5,834	7,749	13,5583
Weekday PM	6,441	13,971	20,412
Sunday PM	4,839	13,289	18,128
Project – Variant 2 (Housing)			
Weekday Daily	77,056	141,933	218,989
Weekday AM	6,691	6,798	13,489
Weekday PM	7,511	12,848	20,359
Sunday PM	5,773	12,348	18,121
Project – Variant 2A (Housing/R&D)			
Weekday Daily	82,102	138,221	220,323
Weekday AM	7,439	6,604	14,042
Weekday PM	8,188	12,539	20,727
Sunday PM	6,087	12,153	18,240

Source: Fehr & Peers.

Table 5 presents trip generation by mode for the weekday AM and PM peak hours, while **Table 6** presents this information for the Sunday PM peak hour.

Table 5
Weekday AM and PM Peak Hour Trips By Mode
Project, Project Variant 2, and Project Variant 2A

	Person Trips					Vehicle Trips
	Auto	**Transit**	**Bicycle**	**Internal /Linked**	**Total**	
WEEKDAY AM PEAK						
Project						
Hunters Point Shipyard	3,078	845	121	1,789	5,833	1,924
Candlestick	3,696 966	___ 144	___ 2,942	_____	7,748 2,310	_____
Total	*6,774*	*1,811*	*265*	*4,731*	*13,581*	*4,234*
Project – Variant 2						
Hunters Point Shipyard	3,271	904	129	2,388	6,692	2,044
Candlestick	3,502	904 136	___ 2,257	_____	6,799 2,189	_____
Total	*6,773*	*1,808*	*265*	*4,645*	*13,491*	*4,233*
Project – Variant 2A						
Hunters Point Shipyard	3,718 1,027		147	2,547	7,439	2,324
Candlestick	3,455 888	___ 134	___ 2,126	_____ 6,603	_____ 2,160	_____
Total	*7,173*	*1,915*	*281*	*4,673*	*14,042*	*4,483*
WEEKDAY PM PEAK						
Project						
Hunters Point Shipyard	3,463	1,001	138	1,839	6,441	2,164
Candlestick	7,861 1,889	_____ 302	___ 3,920	_____	13,972 4,913	_____
Total	*11,324*	*2,890*	*440*	*5,759*	*20,413*	*7,077*
Project – Variant 2						
Hunters Point Shipyard	3,739	1,082	149	2,540	7,510	2,337
Candlestick	7,708 1,817	_____ 295	___ 3,028	_____ 12,848	______ 4,817	_____
Total	*11,447*	*2,899*	*444*	*5,568*	*20,358*	*7,154*
Project – Variant 2A						
Hunters Point Shipyard	4,204 1,224		168	2,592	8,188	2,628
Candlestick	7,667 1,801	_____ 293	___ 2,778	_____ 12,539	______ 4,792	_____
Total	*11,872*	*3,024*	*461*	*5,370*	*20,727*	*7,420*

Source: Fehr & Peers.

Table 6 Sunday PM Peak Hour Trips By Mode Project, Project Variant 2, and Project Variant 2A						
	Person Trips					Vehicle Trips
	Auto	Transit	Bicycle	Internal /Linked	Total	
Project						
Hunters Point Shipyard	2,674	518	99	1,548	4,839	1,666
Candlestick	7,460	1,379	273	4,176	13,288	4,663
Total	*10,134*	*1,897*	*372*	*5,724*	*18,127*	*6,329*
Project – Variant 2						
Hunters Point Shipyard	2,765	704	107	2,196	5,772	1,728
Candlestick	7,287	1,538	273	3,250	12,348	4,554
Total	*10,052*	*2,242*	*380*	*5,446*	*18,120*	*6,282*
Project – Variant 2A						
Hunters Point Shipyard	3,031	773	117	2,166	6,087	1,894
Candlestick	7,649	1,152	272	3,081	12,154	4,780
Total	*10,680*	*1,925*	*389*	*5,247*	*18,241*	*6,674*

Source: Fehr & Peers.

Parking Demand

Table 7 presents the residential and non-residential parking demand for the Project, Project Variant 2, and Project Variant 2A.

Table 7 Parking Demand – Project, Project Variant 2, and Project Variant 2A				
Scenario/Project Area	**Residential**	**Non-Residential**		**Total Demand [1]**
	Long Term Demand	**Long Term Demand**	**Short-Term Demand**	
Project				
Hunters Point Shipyard	3,110	3,818	996	7,924
Candlestick Point	9,212	1,475	2,622	13,309
Total	*12,322*	*5,293*	*3,618*	*21,233*
Project – Variant 2 (Housing)				
Hunters Point Shipyard	4,694	3,811	911	9,416
Candlestick Point	7,627	1,480	2,787	11,894
Total	*12,321*	*5,291*	*3,698*	*21,310*
Variant. 2A – (Housing/R&D)				
Hunters Point Shipyard	5,016	4,508	980	10,504
Candlestick Point	7,305	1,180	2,787	11,272
Total	*12,321*	*5,688*	*3,767*	*21,776*

Source: CHS Consulting, LCW Consulting.

Loading Demand

Table 8 presents the number of trucks generated on a daily basis, and the demand for loading dock spaces during the peak hour of loading activities.

Table 8
Loading Demand – Project, Project Variant 2, and Project Variant 2A

Scenario/Project Area	Daily Truck Generation	Peak Hour Loading Dock Space Demand
Project		
Hunters Point Shipyard	713	41
Candlestick Point	507	29
Total	*1,220*	*70*
Project – Variant 2 (Housing)		
Hunters Point Shipyard	766	44
Candlestick Point	458	27
Total	*1,224*	*71*
Project – Variant 2A (Housing/R&D)		
Hunters Point Shipyard	713	41
Candlestick Point	507	29
Total	*1,220*	*70*

Source: LCW Consulting.

3. TRAFFIC IMPACTS

Intersection Operations

Tables 9 and 10 present a comparison of the intersection LOS analysis for the existing, 2030 No Project, and 2030 Project, Project Variant 2 and Project Variant 2A conditions for the weekday AM and PM peak hours, respectively. **Table 11** presents this comparison for Sunday PM peak hour conditions. **Table 12** presents the summary table of Project traffic impacts for Project, Project Variant 2, and Project Variant 2A.

Table 9
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Weekday AM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project (Alt 1)		Project		Project – Variant 2 (Housing)		Project–Variant 2A (Housing/R&D)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Third St/25th St	14 B		**>80/1.43**	**F**	**>80/1.54**	**F**	**>80/1.53**	**F**	**>80/1.62**	**F**
2	Third St/Cesar Chavez St	36 D		**>80/1.61**	**F**	**>80/1.63**	**F**	**>80/1.63**	**F**	**>80/1.65**	**F**
3	Third St/Cargo Way	23 C		**>80/1.36**	**F**	**>80/1.90**	**F**	**>80/1.90**	**F**	**>80/1.92**	**F**
4	Third St/Evans Ave	35 C		**>80/1.41**	**F**	**>80/1.43**	**F**	**>80/1.44**	**F**	**>80/1.48**	**F**
5	Third St/Oakdale Ave	17 B		21	C	25	C	24	C	24	C
6	Third St/Palou Ave	15 B		**>80/1.77**	**F**	**>80/1.91**	**F**	**>80/1.97**	**F**	**>80/2.13**	**F**
7	Third St/Revere Ave	19 B		35	C	51	D	46	D	48	D
8	Third St/Carroll Ave	12 B		12	B	23	C	19	B	18	B
9	Third St/Paul Ave	27 C		**>80/1.23**	**F**	**>80/2.00**	**F**	**>80/1.89**	**F**	**>80/1.88**	**F**
10	Third St/Ingerson Ave	5 A		5	A	6	A	6	A	6	A
11	Third St/Jamestown Ave	13 B		29	C	**>80/1.03**	**F**	**77/0.99**	**E**	53 D	
12	Third/Le Conte/US 101 nb off	11 B		50	D	50	D	50	D	50	D
13	25th St/Illinois St	7 A 14			B	13	B	13	B	14	B
14	25th St/Pennsylvania Ave	9 A 26			D	29	C	29	C	29	C
15	Cesar Chavez/Penns/I-280	**78**	**E**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**
16	Cesar Chavez St/Evans Ave	21 C		**>80/1.92**	**F**	**>80/1.91**	**F**	**>80/1.92**	**F**	**>80/1.93**	**F**
17	Cesar Chavez St/Illinois St	13 B		25	C	34	C	24	C	25	C
18	Bayshore Blvd/Paul Ave	21 C		**61/1.56**	**E**	**>80/2.64**	**F**	**>80/2.63**	**F**	**>80/2.66**	**F**
19	Bayshore/Hester/US 101 sb off	28 C		**>80/1.34**	**F**	**>80/1.36**	**F**	**>80/1.36**	**F**	**>80/1.36**	**F**
20	Bayshore Blvd/Tunnel Ave	19 B		**>80/2.00**	**F**	**>80/2.05**	**F**	**>80/2.05**	**F**	**>80/2.05**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.

Source: Fehr & Peers.

Table 9 (continued)
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Weekday AM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 2 (R&D)		Project – Variant 2A (Housing/R&D)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
21	Bayshore Blvd/Bacon St	**76**	**E**	**>80/4.05**	**F**	**>80/4.08**	**F**	**>80/4.18**	**F**	**>80/4.18**	**F**
22	Bayshore Blvd/Arleta St	25 C		**>80/1.21**	**F**	**>80/1.23**	**F**	**>80/1.23**	**F**	**>80/1.23**	**F**
23	Bayshore Blvd/Leland Ave	21 C		**>80/1.24**	**F**	**>80/1.26**	**F**	**>80/1.26**	**F**	**80/1.26**	**E**
24	Bayshore Blvd/Visitacion Ave	17 B		**>80/1.55**	**F**	**>80/1.56**	**F**	**>80/1.56**	**F**	**>80/1.56**	**F**
25	Bayshore Blvd/Sunnydale Ave	20 C		**>80/1.32**	**F**	**>80/1.34**	**F**	**>80/1.34**	**F**	**>80/1.34**	**F**
26	Tunnel Ave/Blanken	11 B		43	D	**>80/1.06**	**F**	**>80/1.06**	**F**	**>80/1.07**	**F**
27	Geneva/U.S. 101 SB Ramps [3]	10 A		**>80/2.17**	**F**	**>80/2.31**	**F**	**>80/2.31**	**F**	**>80/2.33**	**F**
28	Harney/U.S. 101 NB Ramps [3]	8 A		**>80/1.20**	**F**	**>80/1.35**	**F**	**>80/1.35**	**F**	**>80/1.36**	**F**
29	Harney Way/Jamestown Ave [4]	8 A		12	B	20	B	22	B	23	C
30	Crisp Ave/Palou Ave [4]	11.4 (nb)	B	**57/0.99**	**E**	44 D		42	D	46	D
31	Ingalls St/Thomas Ave [4]	11.3 (wb)	B	19.0 (wb)	C 22		C	22	C	23	C
32	Ingalls St/Carroll Ave [4]	8 A		15	B	28	C	28	C	29	C
33	Ingalls St/Egbert Ave	8 A		8	A	9	A	9	A	9	A
34	A.Walker/Gilman Ave [4]	9.1 (sb)	A	**>60 (eb)**	**F**	30 C		31	C	30	C
35	Amador St/Cargo Way	28 C		**65/1.06**	**E**	54 D		**56/1.02**	**E**	**61/1.04**	**E**
36	Bayshore Blvd/Cortland Ave	19 B		37	D	**>80/1.18**	**F**	**>80/1.18**	**F**	**>80/1.19**	**F**
37	Bayshore Blvd/Oakdale Ave	30 C		43	D	51	D	50	D	50	D
38	Bayshore/Alemany/Industrial	44 D		**>80/1.00**	**F**	**>80/1.05**	**F**	**>80/1.04**	**F**	**>80/1.04**	**F**
39	Bayshore/US 101 nb off to Cesar	43 D		**74/0.91**	**E**	**>80/0.94**	**F**	**>80/0.93**	**F**	**>80/0.95**	**F**
40	Bayshore Blvd/Silver Ave	50 D		**>80/1.58**	**F**	**>80/1.70**	**F**	**>80/1.75**	**F**	**>80/1.77**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 9 (continued)
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Weekday AM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 2 (Housing)		Project – Variant 2A (Housing/R&D)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore Blvd/Blanken Ave	12 B		**>80/1.48**	**F**	**>80/1.51**	**F**	**>80/1.51**	**F**	**>80/1.51**	**F**
42	San Bruno Ave/Paul Ave	20 B		**>80/1.21**	**F**	**>80/1.23**	**F**	**>80/1.23**	**F**	**>80/1.23**	**F**
43	San Bruno Ave/Silver Ave	75 E		**>80/1.43**	**F**	**>80/1.41**	**F**	**>80/1.41**	**F**	**>80/1.42**	**F**
44	San Bruno/Mansell/101 sb off	17 C		**>80/1.08**	**F**	**>80/1.11**	**F**	**>80/1.11**	**F**	**>80/1.11**	**F**
45	San Bruno/Silliman/101 sb off	24 C		**>80/1.08**	**F**	**>80/1.08**	**F**	**>80/1.07**	**F**	**>80/1.07**	**F**
46	Innes Ave/A.Walker Drive [4]	8.6 (sb)	A	5	A	6	A	5	A	5	A
47	Innes Ave/Earl St	8.5 (sb)	A	17.3 (sb)	C	13.3 (sb)	B	15.0 (sb)	B	15.6 (sb)	C
48	Evans Ave/Jennings St	9 A		**>80/1.96**	**F**	28 C		30	C	35	C
49	Bayshore Blvd/Geneva Ave	24 C		**>80/1.39**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**
50	Bayshore/Guadalupe Pkwy	16 B		21	C	21	C	21	C	21	C
51	Bayshore Blvd/Valley Dr	23 C		20	C	20	C	20	C	20	B
52	Bayshore Blvd/Old County Rd	28 C		40	D	39	D	39	D	39	D
53	Sierra Pt/Lagoon Way	12 B		**>80/1.85**	**F**	**>80/1.85**	**F**	**>80/1.85**	**F**	**>80/1.85**	**F**
54	Ingalls St/Palou Ave [4]	9 A		16	B	18	B	18	B	18	B
55	Keith St/Palou Ave [4]	9 A		10	A	9	A	10	A	9	A
56	Third/Williams/Van Dyke	22 C		18	B	30	C	29	C	29	C
57	Third St/Jerrold Ave	22 C		49	D	**>80/0.74**	**F**	**>80/0.73**	**F**	**>80/0.73**	**F**
58	Evans/Napoleon/Toland	37 D		**>80/1.45**	**F**	**>80/1.50**	**F**	**>80/1.50**	**F**	**>80/1.51**	**F**
59	Harney/Executive Park East	9.1 (sb)	A	25	C	25	C	25	C	25	C
60	Harney/Thomas Mellon	-- --		30	C	34	C	34	C	34	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 10
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Weekday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project (Alt 1)		Project		Project – Variant 2 (Housing)		Project – Variant 2A (Housing/R&D)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Third St/25th St	16 B		**>80/2.45**	**F**	**>80/2.92**	**F**	**>80/2.93**	**F**	**>80/2.97**	**F**
2	Third St/Cesar Chavez St	31 C		**>80/1.56**	**F**	**>80/1.76**	**F**	**>80/1.75**	**F**	**>80/1.77**	**F**
3	Third St/Cargo Way	20 B		**>80/1.44**	**F**	**>80/1.74**	**F**	**>80/1.74**	**F**	**>80/1.77**	**F**
4	Third St/Evans Ave	34 C		**>80/1.36**	**F**	**>80/1.53**	**F**	**>80/1.56**	**F**	**>80/1.61**	**F**
5	Third St/Oakdale Ave	19 B		30	C	**60/1.12**	**E**	**60/1.12**	**E**	**62/1.12**	**E**
6	Third St/Palou Ave	30 C		**>80/4.71**	**F**	**>80/5.99**	**F**	**>80/6.07**	**F**	**>80/6.00**	**F**
7	Third St/Revere Ave	31 C		37	D	**>80/1.14**	**F**	**>80/1.14**	**F**	**>80/1.15**	**F**
8	Third St/Carroll Ave	14 B		14	B	**75/0.93**	**E**	**67/0.92**	**E**	**63/0.92**	**E**
9	Third St/Paul Ave	24 C		**>80/1.37**	**F**	**>80/3.36**	**F**	**>80/3.32**	**F**	**>80/3.41**	**F**
10	Third St/Ingerson Ave	5 A		7	A	43	D	52	D	54	D
11	Third St/Jamestown Ave	14 B		30	C	**>80/6.64**	**F**	**>80/6.15**	**F**	**>80/1.48**	**F**
12	Third/Le Conte/US 101 nb off	11 B		24	C	23	C	23	C	23	C
13	25th St/Illinois St	7 A 14			B	14	B	14	B	15	B
14	25th St/Pennsylvania Ave	12 B		**>80/1.42**	**F**	40 D		40	D	40	D
15	Cesar Chavez/Penns/I-280	39 D		**>80/1.36**	**F**	**>80/1.37**	**F**	**>80/1.37**	**F**	**>80/1.37**	**F**
16	Cesar Chavez St/Evans Ave	21 C		**>80/1.83**	**F**	**>80/1.84**	**F**	**>80/1.84**	**F**	**>80/1.85**	**F**
17	Cesar Chavez St/Illinois St	19 B		22	C	23	C	23	C	23	C
18	Bayshore Blvd/Paul Ave	17 B		**>80/2.00**	**F**	**>80/2.90**	**F**	**>80/2.93**	**F**	**>80/2.93**	**F**
19	Bayshore/Hester/US 101 sb off	13 B		**>80/1.25**	**F**	**>80/1.28**	**F**	**>80/1.28**	**F**	**>80/1.28**	**F**
20	Bayshore Blvd/Tunnel Ave	16 B		**>80/2.30**	**F**	**>80/2.51**	**F**	**>80/2.51**	**F**	**>80/2.51**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.

Source: Fehr & Peers.

Table 10 (continued)
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Weekday PM Peak Hour – 2030 Conditions

	Intersection	**Existing**		**No Project**		**Project**		**Project – Variant 2 (Housing)**		**Project – Variant 2A (Housing/R&D)**	
		Delay [1]	**LOS** [2]	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
21	Bayshore Blvd/Bacon St	22 C		**>80/1.87**	**F**	**>80/1.91**	**F**	**>80/1.95**	**F**	**>80/1.97**	**F**
22	Bayshore Blvd/Arleta St	25 C		**>80/1.36**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**	**>80/1.39**	**F**
23	Bayshore Blvd/Leland Ave	22 C		**>80/1.58**	**F**	**>80/1.67**	**F**	**>80/1.67**	**F**	**>80/1.67**	**F**
24	Bayshore Blvd/Visitacion Ave	15 B		**>80/1.43**	**F**	**>80/1.47**	**F**	**>80/1.47**	**F**	**>80/1.47**	**F**
25	Bayshore Blvd/Sunnydale Ave	19 B		**>80/1.15**	**F**	**>80/1.19**	**F**	**>80/1.19**	**F**	**>80/1.19**	**F**
26	Tunnel Ave/Blanken	9 A		**>80/1.46**	**F**	**>80/1.45**	**F**	**>80/1.45**	**F**	**>80/1.46**	**F**
27	Geneva/U.S. 101 SB Ramps [3]	9 A		**>80/2.94**	**F**	**>80/3.25**	**F**	**>80/3.25**	**F**	**>80/3.26**	**F**
28	Harney/U.S. 101 NB Ramps [3]	8 A		**>80/1.43**	**F**	**>80/1.74**	**F**	**>80/1.74**	**F**	**>80/1.75**	**F**
29	Harney Way/Jamestown Ave [4]	8 A		**40/1.03**	**E**	41 D		41	D	44	D
30	Crisp Ave/Palou Ave [4]	11.6 (nb)	B	**58/0.97**	**E**	54 D		55	D	**67/1.05**	**E**
31	Ingalls St/Thomas Ave [4]	11.5 (wb)	B	27.9 (wb)	C	33	C	33	C	37	D
32	Ingalls St/Carroll Ave [4]	8 A		17	C	38	D	38	D	42	D
33	Ingalls St/Egbert Ave	8 A		9	A	9	A	9	A	9	A
34	A.Walker/Gilman Ave [4]	9.2 (sb)	A	**>80 (eb)**	**F**	36 D		36	D	36	D
35	Amador St/Cargo Way	24 C		**60/1.05**	**E**	**59/1.04**	**E**	**60/1.05**	**E**	**66/1.08**	**E**
36	Bayshore Blvd/Cortland Ave	25 C		**>80/1.48**	**F**	**>80/1.87**	**F**	**>80/1.87**	**F**	**>80/1.87**	**F**
37	Bayshore Blvd/Oakdale Ave	26 C		33	C	55	D	**55/1.05**	**E**	**55/1.05**	**E**
38	Bayshore/Alemany/Industrial	**58/**	**E**	**>80/1.23**	**F**	**>80/1.18**	**F**	**>80/1.18**	**F**	**>80/1.18**	**F**
39	Bayshore/US 101 nb off to Cesar	48 D		**>80/0.88**	**F**	**>80/0.91**	**F**	**>80/0.91**	**F**	**>80/0.92**	**F**
40	Bayshore Blvd/Silver Ave	50 D		**>80/2.64**	**F**	**>80/2.91**	**F**	**>80/2.91**	**F**	**>80/2.91**	**F**

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 10 (continued)
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Weekday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 2 (Housing)		Project – Variant 2A (Housing/R&D)	
		Delay [1]	**LOS** [2]	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
41	Bayshore Blvd/Blanken Ave	11 B		**>80/1.33**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**	**>80/1.40**	**F**
42	San Bruno Ave/Paul Ave	20 B		**>80/2.10**	**F**	**>80/2.71**	**F**	**>80/2.75**	**F**	**>80/2.77**	**F**
43	San Bruno Ave/Silver Ave	46 D		**>80/1.46**	**F**	**>80/1.56**	**F**	**>80/1.57**	**F**	**>80/1.59**	**F**
44	San Bruno/Mansell/101 sb off	33 D		**64/1.15**	**F**	**>80/1.22**	**F**	**>80/1.20**	**F**	**>80/1.22**	**F**
45	San Bruno/Silliman/101 sb off	20 B		38	D	38	D	38	D	38	D
46	Innes Ave/A.Walker Drive [4]	8.7 (sb)	A	5	A	6	A	6	A	6	A
47	Innes Ave/Earl St	8.6 (sb)	A	23.1 (sb)	C	19.4 (sb)	C	19.7 (sb)	C	22.7 (sb)	C
48	Evans Ave/Jennings St	10 A		**>80/2.41**	**F**	31 C		33	C	38	C
49	Bayshore Blvd/Geneva Ave	25 C		**>80/1.73**	**F**	**>80/1.76**	**F**	**>80/1.76**	**F**	**>80/1.76**	**F**
50	Bayshore/Guadalupe Pkwy	14 B		50	D	49	D	49	D	49	D
51	Bayshore Blvd/Valley Dr	16 B		40	D	40	D	40	D	40	D
52	Bayshore Blvd/Old County Rd	29 C		**>80/1.10**	**F**	**>80/1.13**	**F**	**>80/1.13**	**F**	**>80/1.13**	**F**
53	Sierra Pt/Lagoon Way	16 C		**>80/4.38**	**F**	**>80/4.38**	**F**	**>80/4.38**	**F**	**>80/4.38**	**F**
54	Ingalls St/Palou Ave [4]	9 A		16	B	22	C	22	C	25	C
55	Keith St/Palou Ave [4]	9 A		8	A	8	A	8	A	8	A
56	Third/Williams/Van Dyke	22 C		17	B	**>80/0.98**	**F**	**>80/0.98**	**F**	**>80/0.99**	**F**
57	Third St/Jerrold Ave	23 C		**>80/0.72**	**F**	**>80/0.88**	**F**	**>80/0.89**	**F**	**>80/0.89**	**F**
58	Evans/Napoleon/Toland	46 D		**>80/1.53**	**F**	**>80/1.61**	**F**	**>80/1.62**	**F**	**>80/1.63**	**F**
59	Harney/Executive Park East	8.9 (sb)	A	25	C	26	C	27	C	26	C
60	Harney/Thomas Mellon	-- --		19	B	26	C	26	C	26	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 11
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project (Alt 1)		Project		Project – Variant 2 (Housing)		Project – Variant 2A (Housing/R&D)	
		Delay [1]	**LOS [2]**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
1	Third St/25th St	13 B		**63/0.57**	**E**	**58/0.70**	**E**	**61/0.74**	**E**	**63/0.75**	**E**
2	Third St/Cesar Chavez St	23 C		31	C	**66/0.73**	**E**	**>80/0.78**	**F**	**>80/0.78**	**F**
3	Third St/Cargo Way	17 B		30	C	30	C	33	C	34	C
4	Third St/Evans Ave	32 C		**57/0.65**	**E**	**59/0.87**	**E**	**67/0.91**	**E**	**69/0.93**	**E**
5	Third St/Oakdale Ave	15 B		14	C	15	B	15	B	15	B
6	Third St/Palou Ave	29 C		**>80/0.92**	**F**	**>80/4.03**	**F**	**>80/2.51**	**F**	**>80/2.92**	**F**
7	Third St/Revere Ave	22 C		20	B	24	C	24	C	25	C
8	Third St/Carroll Ave	9 A 10			B	**55/0.66**	**E**	**60/0.65**	**E**	**56/0.64**	**E**
9	Third St/Paul Ave	21 C		**64/0.73**	**E**	**>80/1.89**	**F**	**>80/1.82**	**F**	**>80/1.83**	**F**
10	Third St/Ingerson Ave	3 A		3	A	27	C	27	C	27	C
11	Third St/Jamestown Ave	21 C		24	C	**>80/1.24**	**F**	**>80/1.14**	**F**	**>80/1.14**	**F**
12	Third/Le Conte/US 101 nb off	12 B		14	B	13	B	14	B	14	B
13	25th St/Illinois St	7 A 10			A	10	A	10	A	10	A
14	25th St/Pennsylvania Ave	10 A		**45/1.01**	**E**	34 C		34	C	35	C
15	Cesar Chavez/Penns/I-280	28 C		**61/0.65**	**E**	**60/0.65**	**E**	**60/0.65**	**E**	**60/0.51**	**E**
16	Cesar Chavez St/Evans Ave	15 B		18	B	19	B	19	B	19	B
17	Cesar Chavez St/Illinois St	14 B		18	B	18	B	18	B	18	B
18	Bayshore Blvd/Paul Ave	12 B		14	B	54	D	55	D	55	D
19	Bayshore/Hester/US 101 sb off	14 B		14	B	14	B	14	B	14	B
20	Bayshore Blvd/Tunnel Ave	8 A 53			D	**60/1.59**	**E**	**60/1.59**	**E**	**60/1.59**	**E**
21	Bayshore Blvd/Bacon St	13 B		17	B	31	C	31	C	30	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.

Source: Fehr & Peers,

Table 11 (continued)
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 2 (Housing)		Project – Variant 2A (Housing/R&D)	
		Delay [1]	**LOS** [2]	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
22	Bayshore Blvd/Arleta St	12 B		54	D	49	D	49	D	49	D
23	Bayshore Blvd/Leland Ave	24 C		41	D	38	D	38	D	38	D
24	Bayshore Blvd/Visitacion Ave	18 B		**64/0.98**	**E**	**70/1.03**	**E**	**69/1.02**	**E**	**69/1.02**	**E**
25	Bayshore Blvd/Sunnydale Ave	15 B		55	D	55	D	55	D	55	D
26	Tunnel Ave/Blanken	19 B		30	C	51	D	51	D	51	D
27	Geneva/U.S. 101 SB Ramps [3]	8 A		**>80/2.04**	**F**	**>80/2.34**	**F**	**>80/2.36**	**F**	**>80/2.38**	**F**
28	Harney/U.S. 101 NB Ramps [3]	8 A		54	D	**>80/1.36**	**F**	**>80/1.28**	**F**	**>80/1.29**	**F**
29	Harney Way/Jamestown Ave [4]	9 A		22	C	24	C	24	C	25	C
30	Crisp Ave/Palou Ave [4]	7 A		37	D	46	D	44	D	46	D
31	Ingalls St/Thomas Ave [4]	11.1 (sb)	B 11.8	(wb)	B 26		C	25	C	26	C
32	Ingalls St/Carroll Ave [4]	9.9 (wb)	A	9	A	28	C	27	C	28	C
33	Ingalls St/Egbert Ave	7 A		8	A	8	A	8	A	8	A
34	A.Walker/Gilman Ave [4]	7 A		**72.5 (eb)**	**F**	36 D		36	D	36	D
35	Amador St/Cargo Way	8.9 (sb)	A	21	C	20	B	20	C	20	C
36	Bayshore Blvd/Cortland Ave	28 C		23	C	25	C	25	C	25	C
37	Bayshore Blvd/Oakdale Ave	17 B		21	C	21	C	21	C	21	C
38	Bayshore/Alemany/Industrial	24 C		40	D	52	D	51	D	51	D
39	Bayshore/US 101 nb off to Cesar	35 D		25	C	26	C	26	C	26	C
40	Bayshore Blvd/Silver Ave	25 C		19	B	26	C	26	C	26	C

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 11 (continued)
Intersection LOS
Project, Project Variant 2, and Project Variant 2A – Sunday PM Peak Hour – 2030 Conditions

	Intersection	Existing		No Project		Project		Project – Variant 2 (Housing)		Project – Variant 2A (Housing/R&D)	
		Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
41	Bayshore Blvd/Blanken Ave	9 A		51	D	**68/1.16**	**E**	**68/1.16**	**E**	**68/1.16**	**E**
42	San Bruno Ave/Paul Ave	16 B		39	D	**>80/1.46**	**F**	**>80/1.36**	**F**	**>80/1.36**	**F**
43	San Bruno Ave/Silver Ave	41 D		**>80/1.29**	**F**	**>80/1.40**	**F**	**>80/1.37**	**F**	**>80/1.37**	**F**
44	San Bruno/Mansell/101 sb off	16 C		27	D	**38/1.00**	**E**	**36/0.98**	**E**	**35/0.98**	**E**
45	San Bruno/Silliman/101 sb off	17 B		**78/0.36**	**E**	**70/0.37**	**E**	**77/0.36**	**E**	**77/0.36**	**E**
46	Innes Ave/A.Walker Drive [4]	8.5 (sb)	A	4	A	6	A	5	A	5	A
47	Innes Ave/Earl St	8.5 (sb)	A	9.9 (sb)	A	10 (sb)	B	10.5 (sb)	B 10.7	(sb)	B
48	Evans Ave/Jennings St	8 A		33	D	20	C	20 C		20	C
49	Bayshore Blvd/Geneva Ave	20 C		44	D	43	D	43	D	43	D
50	Bayshore/Guadalupe Pkwy	10 B		9	A	9	A	9	A	9	A
51	Bayshore Blvd/Valley Dr	11 B		10	A	10	A	10	B	10	A
52	Bayshore Blvd/Old County Rd	26 C		43	D	42	D	42	D	42	D
53	Sierra Pt/Lagoon Way	8 A		43	D	**44/1.01**	**E**	**44/1.01**	**E**	**44/1.01**	**E**
54	Ingalls St/Palou Ave [4]	8 A		16	B	22	C	20 C		20	C
55	Keith St/Palou Ave [4]	8 A		10	B	7	A	8	A	7	A
56	Third/Williams/Van Dyke	22 C		14	B	23	C	23	C	23	C
57	Third St/Jerrold Ave	21 C		23	C	31	C	34	C	35	C
58	Evans/Napoleon/Toland	32 C		**57/0.50**	**E**	**60/0.57**	**E**	**60/0.58**	**E**	**60/0.58**	**E**
59	Harney/Executive Park East	8.8 (eb)	A	18	B	22	C	15	B	15	B
60	Harney/Thomas Mellon	-- --		15	B	19	B	15	B	15	B

Notes:
1. Delay in seconds per vehicle. For Side Street STOP-controlled intersections, delay and LOS presented for worst approach. Worst approach indicated in ( ).
2. Intersections operating at LOS E or LOS F conditions highlighted in **bold** and overall intersection volume-to-capacity (v/c) ratio is presented.
3. Year 2030 analysis includes signalization as part of Executive Park Development or new Harney Interchange.
4. Year 2030 analysis includes signalization as part of Project.
Source: Fehr & Peers.

Table 12 Summary of Impacts at Intersections Operating at LOS E or LOS F				
	Intersection	**Project**	**Project Variant 2 (Housing)**	**Project Variant 2A (Housing/R&D)**
1	Third St/25th St	SC/PI	SC/PI	SC/PI
2	Third St/Cesar Chavez St	SC/PI	SC/PI	SC/PI
3	Third St/Cargo Way	SC/PI	SC/PI	SC/PI
4	Third St/Evans Ave	SC/PI	SC/PI	SC/PI
5	Third St/Oakdale Ave	PI	PI	PI
6	Third St/Palou Ave	SC/PI	SC/PI	SC/PI
7	Third St/Revere Ave	PI	PI	PI
8	Third St/Carroll Ave	PI	PI	PI
9	Third St/Paul Ave	SC/PI	SC/PI	SC/PI
10	Third St/Ingerson Ave	--	--	--
11	Third St/Jamestown Ave	PI	PI	PI
12	Third/Le Conte/US 101 nb off	--	--	--
13	25th St/Illinois St	--	--	--
14	25th St/Pennsylvania Ave	--	--	--
15	Cesar Chavez/Penns/I-280	SC/PI	SC/PI	SC/PI
16	Cesar Chavez St/Evans Ave	NSC	SC/PI	SC/PI
17	Cesar Chavez St/Illinois St	--	--	--
18	Bayshore Blvd/Paul Ave	PI	PI	PI
19	Bayshore/Hester/US 101 sb off	NSC	NSC	NSC
20	Bayshore Blvd/Tunnel Ave	NSC	NSC	NSC
21	Bayshore Blvd/Bacon St	SC/PI	SC/PI	SC/PI
22	Bayshore Blvd/Arleta St	NSC	NSC	NSC
23	Bayshore Blvd/Leland Ave	NSC	NSC	NSC
24	Bayshore Blvd/Visitacion Ave	SC/PI	SC/PI	SC/PI
25	Bayshore Blvd/Sunnydale Ave	SC/PI	SC/PI	SC/PI
26	Tunnel Ave/Blanken	PI	PI	PI
27	Geneva/U.S. 101 SB Ramps	SC/PI	SC/PI	SC/PI
28	Harney/U.S. 101 NB Ramps	SC/PI	SC/PI	SC/PI
29	Harney Way/Jamestown Ave	--	--	--
30	Crisp Ave/Palou Ave	--	--	PI
31	Ingalls St/Thomas Ave	--	--	--
32	Ingalls St/Carroll Ave	--	--	--
33	Ingalls St/Egbert Ave	--	--	--
34	A.Walker/Gilman Ave	--	--	--
35	Amador St/Cargo Way	SC/PI	SC/PI	SC/PI
36	Bayshore Blvd/Cortland Ave	PI	PI	PI
37	Bayshore Blvd/Oakdale Ave	--	PI	PI
38	Bayshore/Alemany/Industrial	SC/PI	SC/PI	SC/PI
39	Bayshore/US 101 nb off to Cesar	PI	PI	PI
40	Bayshore Blvd/Silver Ave	NSC	NSC	NSC
47	Innes Ave/Earl St	--	--	--
48	Evans Ave/Jennings St	--	--	--
49	Bayshore Blvd/Geneva Ave	SC/PI	SC/PI	SC/PI
50	Bayshore/Guadalupe Pkwy	--	--	--

Table 12 (continued) Summary of Impacts at Intersections Operating at LOS E or LOS F			
Intersection	**Project**	**Project Variant 2 (Housing)**	**Project Variant 2A (Housing/R&D)**
51 Bayshore Blvd/Valley Dr	-- -- --		
52 Bayshore Blvd/Old County Rd	NSC NSC NSC		
53 Sierra Pt/Lagoon Way	NSC NSC NSC		
54 Ingalls St/Palou Ave [4]	-- -- --		
55 Keith St/Palou Ave [4]	-- -- --		
56 Third/Williams/Van Dyke	PI PI PI		
57 Third St/Jerrold Ave	PI PI PI		
58 Evans/Napoleon/Toland	SC/PI SC/PI SC/PI		
59 Harney/Executive Park East	-- -- --		
60 Harney/Thomas Mellon	-- -- --		

Notes:
1. PI – Project Impact. Project results in a change in intersection operations from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives, or from LOS E under 2030 No Project conditions to LOS F with the Project, Project Variants or Alternatives.
2. NSC – No Significant Contribution. Project would not contribute significantly to intersections operating at LOS E or LOS F under 2030 No Project conditions. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to intersections that would be operating at LOS E or LOS F under 2030 No Project conditions, resulting in a Project Impact.
Source: Fehr & Peers.

Under Project Variant 2A conditions, 41 of the 60 study intersections would operate at LOS E or LOS F conditions during the weekday AM or PM, or Sunday PM peak hours. At 12 of the 41 intersections the Project Variant 2A would result in project-specific impacts (i.e., project trips would cause intersections expected to operate at LOS D or better under 2030 No Project conditions to operate at LOS E or F, or intersections operating at LOS E under 2030 No Project conditions to deteriorate to LOS F conditions). At the remaining 29 of the 41 intersections that would operate at LOS E or LOS F, Project Variant 2A contributions were determined to be less than significant at 9 intersections, and significant at 20 intersections (as identified in Table 12). Development associated with Project Variant 2A would therefore result in impacts at 32 intersections (12 project-specific and 20 with significant contributions to LOS E or LOS F conditions).

Mitigation measures were identified for the following six intersections:

26. Tunnel/Blanken
27. Geneva/U.S. 101 Southbound Ramps (Alana/Beatty)
28. Harney/U.S. 101 Northbound Ramps (Alana/Harney/Thomas Mellon)
30. Crisp/Palou/Griffith
35. Amador/Cargo
49. Bayshore/Geneva

26. Tunnel/Blanken – At the signalized intersection of Tunnel/Blanken (currently unsignalized and required to be signalized as part of the Visitacion Valley Redevelopment), the intersection operating conditions would worsen in the AM peak hour from LOS D under 2030 No Project conditions to LOS F with Project Variant 2A. In the PM peak hour, the intersection would operate at LOS F under 2030 No Project and Project Variant 2A conditions.

> ***Project Variant 2A Mitigation Measure 3*:** Implement Project Mitigation Measure 2 to reconfigure the northbound and southbound approaches to the intersection of Tunnel/Blanken to provide left turn lanes adjacent to shared through/right lanes. With implementation of Project Mitigation Measure 2, operations at this intersection would improve, but not to acceptable LOS D or better conditions in the AM and PM peak hours. Therefore, project-related impacts at this intersection would remain *significant and unavoidable*.

27. Geneva/U.S. 101 Southbound Ramps (existing Alana/Beatty)
28. Harney/U.S. 101 Northbound Ramps (existing Alana/Harney/Thomas Mellon)
Project Variant 2A would contribute significantly to cumulative impacts at these intersections.

> ***Project Variant 2A Mitigation Measure 4*:** Implement Project Mitigation Measure 3. The SFCTA shall coordinate with the City of Brisbane and Caltrans to ensure that Project-generated vehicle trips are accounted for the Harney Interchange analyses and design. S ince implementation of Project Mitigation Measure 5 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Therefore, the Variant 2A-related impacts at these intersections would remain *significant and unavoidable.*

30. Crisp/Palou/Griffith – The intersection of Crisp/Palou is currently unsignalized, but would be signalized with implementation of Project Variant 2A. With Project Variant 2A, the intersection of Crisp/Palou would worsen in the PM peak hour from LOS E under 2030 No Project conditions (as an unsignalized intersection) to LOS F with Project Variant 2A (as a signalized intersection).

> ***Project Variant 2A Mitigation Measure 5***: Restripe the southbound approach to provide a dedicated left-turn lane and a shared through/right-turn lane. On-street parking would be prohibited on Griffith Street between Palou Avenue and Oakdale Avenue. Implementation of this improvement would be the responsibility of SFMTA and DPW, and shall be implemented as part of Hunters Point Shipyard Phase 3 roadway network improvements. The Project Applicant, in collaboration with the City, shall monitor traffic conditions at completion of Phase 2, Phase 3 and Phase 4 to determine whether the intersection operations would warrant reconfiguration and when it should be implemented. Based on the monitoring, if the City determines reconfiguration is warranted, the Project Applicant shall be required to fund the cost of reconfiguration. The SFMTA and DPW shall design and implement the measure as necessary. With

implementation of Project Variant 2A Mitigation Measure 5, this intersection would operate at acceptable LOS D or better in the AM and PM peak hours, and therefore with its implementation, project-related impacts at this intersection would be *less than significant*.

35. Amador/Cargo/Illinois – Project Variant 2A would contribute significantly to cumulative impacts at this intersection.

***Project Variant 2A Mitigation Measure 6*:** Implement Project Mitigation Measure 4. SFMTA shall conduct a feasibility study of the intersection with the Port of San Francisco to determine the feasibility of reconfiguring the southbound approach on Illinois Street to provide a dedicated left turn lane and a dedicated right turn lane. With implementation of Project Mitigation Measure 5**,** operations at this intersection would improve to acceptable levels. However, since a feasibility study would be required, implementation of Mitigation Measure 4 is uncertain, and therefore, Variant 2A-related impacts at this intersection would remain *significant and unavoidable.*

49. Bayshore/Geneva – Project Variant 2A would contribute significantly to cumulative impacts at this location.

***Project Variant 2A Mitigation Measure 7*:** Implement Project Mitigation Measure 5. The SFMTA and SFCTA shall coordinate with the City of Brisbane to ensure that projected traffic volumes are accounted for in the design of the Geneva Avenue Extension. Since implementation of Project Mitigation Measure 5 would be under the jurisdiction of the City of Brisbane, the implementation of the mitigation measure is uncertain. Therefore, the Project Variant 2A-related impacts at this intersection would remain *significant and unavoidable.*

The Project discussion did not identify any feasible mitigation measures for 26 of the 32 intersections that would be impacted by Project Variant 2A, which include the following:

1. Third/25th
2. Third/Cesar Chavez
3. Third/Cargo
4. Third/Evans
5. Third/Oakdale
6. Third/Palou
7. Third/Revere
8. Third/Carroll
9. Third/Paul
11. Third/Jamestown
15. Cesar/Pennsylvania/I-280

16. Cesar/Evans
18. Bayshore/Paul
21. Bayshore/Bacon
24. Bayshore/Visitacion
25. Bayshore/Sunnydale
36. Bayshore/Cortland
37. Bayshore/Oakdale
38. Bayshore/Alemany/Industrial
39. Bayshore/U.S. 101 northbound off to Cesar
42. San Bruno/Paul
43. San Bruno/Silver
44. San Bruno/Mansell/U.S. 101 Southbound Off-ramp
56. Third/Williams/Van Dyke
57. Third/Jerrold
58. Evans/Napoleon/Toland

At the 26 intersections where feasible mitigation measures have not been identified, Variant 2A impacts would remain *significant and unavoidable.*

Traffic spillover effect for Variant 2A would be *significant and unavoidable*, as with the Project. Project and cumulative impacts on Harney Way would be the same as the Project, and widening of Harney Way, as described in Project Mitigation Measure 3, would also apply to Variant 2A.

Freeway Operations

Tables 13 through 15 present the results of the freeway mainline and weaving section analysis for conditions with the Project conditions for the AM and PM, and Sunday peak hours, respectively. **Table 16** presents a summary table of project impacts for Project, Project Variant 2, and Project Variant 2A.

Tables 17 through 19 present the results of the freeway mainline and weaving section analysis for conditions with the Project conditions for the AM and PM, and Sunday peak hours, respectively. **Table 20** presents a summary table of project impacts for Project, Project Variant 2, and Project Variant 2A. **Tables 21 through 23** present the results of the freeway diverge (off-ramp) queue storage analysis.

Table 13
Mainline and Weaving Segment LOS
Project, Project Variant 2, and Project Variant 2A Conditions – Weekday AM Peak Hour

Mainline Segment	Existing		No Project (Alt 1)		Project		Project-Var. 2 (Housing)		Project-Var. 2A (Housing/R&D)	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB - Cesar Chavez to Vermont	**E**	**44.6**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Harney Way to Third/Bayshore	D	33.8	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Sierra Point to Harney Way	D	33.8	**E**	**40.5**	**E**	**44.0**	**E**	**43.9**	**E**	**44.5**
SB – I-80 Merge to Cesar Chavez	D	33.4	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Third/Bayshore to Harney Way	**E**	**43.0**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Harney/Geneva to Sierra Point	**E**	**42.2**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB – Alemany Off to Alemany On	**E**	**39.1**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**>45**
SB – Alemany On to Alemany Off C		23.9	D	34.6	D	34.6 D		34.6	D	34.6
Weaving Segment	LOS	Service Vol. (pc/l)	LOS	Service Vol. (pc/l)	LOS	Service Vol. (pc/l)	LOS	Service Vol. (pc/l)	LOS	Service Vol. (pc/l)
I-280										
NB – 25th Street to Mariposa Street	**E**	**1,680**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**
SB – Mariposa Street to 25th Street	B	810	**E**	**1,710**	**E**	**1,710**	**E**	**1,710**	**E**	**1,690**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
3. Segments operating at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 14
Mainline and Weaving Segment LOS
Project, Project Variant 2, and Project Variant 2A Conditions - Weekday PM Peak Hour

Mainline Segment	**Existing**		**No Project (Alt 1)**		**Project**		**Project-Var. 2 (Housing)**		**Project-Var. 2A (Housing/R&D)**	
	LOS [1]	**Density [2] (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**
U.S. 101										
NB - Cesar Chavez to Vermont	D	26.8	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Harney Way to Third/Bayshore	**E**	**42.3**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB – Sierra Point to Harney Way	**E**	**42.9**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – I-80 Merge to Cesar Chavez	D	33.8	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Third/Bayshore to Harney Way	**E**	**36.0**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB – Harney/Geneva to Sierra Point	**E**	**36.8**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB – Alemany Off to Alemany On C		23.9	D	33.3	D	33.3 D		33.3	D	33.3
SB – Alemany On to Alemany Off	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
Weaving Segment	**LOS**	**Service [3] Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**
I-280										
NB – 25th Street to Mariposa Street	C	1,350	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**
SB – Mariposa Street to 25th Street	**E**	**1,630**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**	**F**	**>1,900**

Notes:
1. Segments operating at LOS E or LOS F conditions highlighted in **bold**
2. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
3. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
Source: Fehr and Peers.

Table 15 Mainline and Weaving Segment LOS Project, Project Variant 2, and Project Variant 2A Conditions - Sunday PM Peak Hour										
Mainline Segment	**Existing**		**No Project (Alt 1)**		**Project**		**Project-Var. 2 (Housing)**		**Project-Var. 2A (Housing)**	
	LOS 1	**Density 2 (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**
U.S. 101										
NB - Cesar Chavez to Vermont	C 20.6		D	32.3	D	33.7 D		34.0	D	34.1
NB – Harney Way to Third/Bayshore C		22.0	D	30.4	D	32.3 D		32.4	D	32.4
NB – Sierra Point to Harney Way	C	21.9	D	27.3	D	31.4 D		31.0	D	31.0
SB – I-80 Merge to Cesar Chavez	D 28.8		D	33.3	D	34.1 D		34.0	D	33.7
SB – Third/Bayshore to Harney Way C		21.4	D	32.0	D	34.3 D		34.4	D	34.1
SB – Harney/Geneva to Sierra Point C		21.2	C	24.9	D	28.6 D		28.4	D	28.4
I-280										
NB – Alemany Off to Alemany On B		15.6	C	21.6	C	21.6 C		21.6	C	21.6
SB – Alemany On to Alemany Off D		27.0	D	29.5	D	29.5 D		29.5	D	29.5
Weaving Segment	**LOS**	**Service 3, 4 Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**	**LOS**	**Service Vol. (pc/l)**
I-280										
NB – 25th Street to Mariposa Street	A	-	C	1,200 C		1,220 C		1,230	C	1,270
SB – Mariposa Street to 25th Street	A	-	C	1,310	C	1,300 C		1,320	C	1,260

Notes:

1. Segments operating at LOS E or LOS F conditions highlighted in **bold**
2. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
3. For weaving sections service volume is reported as the measure of effectiveness. pc/h = passenger cars per hour
4. Weaving segments with speeds greater than 50 mph are outside of the realm of the weaving analysis, and thus are assumed to operate at LOS A.

Source: Fehr and Peers.

Table 16
Summary of Impacts at Mainline and Weaving Segments Operating at LOS E or LOS F

Mainline Segment	Project	Project Variant 2 (Housing)	Project Variant 2A (Housing/R&D)
U.S. 101			
NB - Cesar Chavez to Vermont	NSC	NSC	NSC
NB – Harney Way to Third/Bayshore	NSC	NSC	NSC
NB –Sierra Point to Harney Way	**SC/PI**	**PI**	**PI**
SB – I-80 Merge to Cesar Chavez	**SC/PI**	NSC NSC	
SB – Third/Bayshore to Harney Way	**SC/PI**	**SC/PI**	**SC/PI**
SB – Harney/Geneva to Sierra Point	**SC/PI**	**SC/PI**	**SC/PI**
I-280			
NB – Alemany Off to Alemany On	NSC	NSC	NSC
SB – Alemany On to Alemany Off	NSC	NSC	NSC
NB – 25th Street to Mariposa Street	NSC	NSC	NSC
SB – Mariposa Street to 25th Street	NSC	NSC	NSC

Notes:
1. PI – Project Impact. Project results in a change in mainline segments from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives**.**
2. NSC – No Significant Contribution. Project would not contribute significantly to mainline segments operating at LOS E or LOS F under 2030 No Project conditions. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to mainline segment operating at LOS E or LOS F under 2030 No Project conditions, resulting in a Project Impact.

Table 17
Ramp Junction LOS
Project, Project Variant 2, and Project Variant 2A Conditions - Weekday AM Peak Hour

Ramp Location	**Existing**		**2030 No Project**		**Project**		**Project-Var. 2 (Housing)**		**Project-Var. 2 (Housing/R&D)**	
	LOS	**Density[1] (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**
U.S. 101										
NB on from Sierra Point Parkway C		27.0	C	27.5	D	30.4	D	30.3	D	30.7
NB on from Harney Way[2] C		20.2	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore	D	31.2	C 22.5		C	23.6	C	23.5	C	24.0
NB on from Alemany/Industrial	**E**	**36.4**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore/Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Bayshore/Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	C	24.1 D		28.8	C	24.1	C	24.1	C	24.1
SB on from Third/Bayshore	D	30.0	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Harney/Geneva[2] D		29.7	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Sierra Point/Lagoon	C	27.7	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
I-280										
NB off to Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Indiana/25th	D	33.4	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Pennsylvania/25th	C	23.6	**E**	**37.0**	**E**	**36.9**	**E**	**36.9**	**E**	**36.9**
SB on from Pennsylvania/25th	C	22.9	**E**	**36.3**	**E**	**36.1**	**E**	**36.3**	**E**	**36.3**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 18
Ramp Junction LOS
Project, Project Variant 2, and Project Variant 2A Conditions - Weekday PM Peak Hour

Ramp Location	Existing		2030 No Project		Project		Project-Var. 2 (Housing)		Project-Var. 2A (Housing/R&D)	
	LOS	Density[1] (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
U.S. 101										
NB on from Sierra Point Parkway	D	29.7	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Harney Way[2] D		30.0	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore	D	28.6	D 27.9		D	30.0	D	30.0	D	30.3
NB on from Alemany/Industrial	D	30.2	**E**	**35.9**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Bayshore/Cesar Chavez	B	19.6	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Bayshore/Cesar Chavez	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	C	24.5 D		29.6	D	32.6	D	32.7	D	32.4
SB on from Third/Bayshore	C	26.5	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Harney/Geneva[2] C		24.2	D	31.9	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Sierra Point/Lagoon	C 26.5		C	22.7	D	28.5	D	28.5	D	28.5
I-280										
NB off to Cesar Chavez	D	28.4	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
NB on from Indiana/25th	C	27.4	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Pennsylvania/25th	**E**	**36.7**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Pennsylvania/25th	**E**	**38.5**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 19 Ramp Junction LOS Project, Project Variant 2 and Project Variant 2A Conditions - Sunday PM Peak Hour										
Ramp Location	**Existing**		**2030 No Project**		**Project**		**Project-Var. 2 (Housing)**		**Project-Var. 2A (Housing/R&D)**	
	LOS	**Density[1] (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**	**LOS**	**Density (pc/mi/ln)**
U.S. 101										
NB on from Sierra Point Parkway B		19.3	C	22.5	C	25.3	C	25.1	C	25.1
NB on from Harney Way[2] B		19.5	D	33.0	**E**	**35.1**	**E**	**35.3**	**E**	**35.4**
NB on from Bayshore	B	16.8	C 21.9		C	22.4	C	21.9	C	22.4
NB on from Alemany/Industrial	C 23.5		C	24.6	C	25.6	C	24.6	C	25.8
NB on from Bayshore/Cesar Chavez	C	26.1	D	31.7	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB off to Bayshore/Cesar Chavez	**E**	**37.5**	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Cesar Chavez/Potrero	D	30.6	**F**	**>45**	**F**	**>45**	**F**	**>45**	**F**	**>45**
SB on from Alemany/San Bruno	B	17.3 C		21.2	C	22.5	C	22.5	C	22.3
SB on from Third/Bayshore	B	16.5 C		23.9	D	26.1	C	25.9	C	25.8
SB on from Harney/Geneva[2] B		18.7	C	24.8	D	29.8	D	29.5	D	29.5
SB on from Sierra Point/Lagoon	B 18.3		C	21.6	C	22.6	C	22.4	C	22.4
I-280										
NB off to Cesar Chavez	B	19.2	C	26.0	D	26.0	C	26.0	C	26.0
NB on from Indiana/25th	B	18.4 C		25.6	D	25.8	C	26.0	C	26.1
SB off to Pennsylvania/25th	C	27.0 D		30.7	D	30.9	D	31.1	D	31.1
SB on from Pennsylvania/25th	C	26.4 D		29.5	D	29.5	D	29.5	D	29.5

Notes:
1. Density of vehicles per segment. pc/mi/ln = passenger cars per mile per lane.
2. Cumulative 2030 No Project conditions assume the reconstruction of the Harney Way interchange, as well as the extension of Geneva Avenue from Bayshore Boulevard east to the reconstructed interchange.
3. Ramp junctions at LOS E or LOS F conditions highlighted in **bold**
Source: Fehr and Peers.

Table 20 Summary of Impacts at Ramp Junctions Operating at LOS E or LOS F			
Ramp Location	**Project**	**Project Variant 2 (Housing)**	**Project Variant 2A (Housing/R&D)**
U.S. 101			
NB on from Sierra Point Parkway	NSC	NSC	NSC
NB on from Harney Way[2]	SC/PI SC/	PI SC/	PI
NB on from Bayshore	--	--	--
NB on from Alemany/Industrial	PI	PI	PI
NB on from Bayshore/Cesar	SC/PI SC/	PI SC/	PI
SB off to Bayshore/Cesar Chavez	SC/PI	SC/PI	SC/PI
SB on from Cesar Chavez/Potrero	NSC	NSC	NSC
SB on from Alemany/San Bruno	--	--	--
SB on from Third/Bayshore	SC/PI SC/	PI SC/	PI
SB on from Harney/Geneva[2]	PI PI PI		
SB on from Sierra Point/Lagoon	NSC	NSC	NSC
I-280			
NB off to Cesar Chavez	SC/PI	SC/PI	SC/PI
NB on from Indiana/25th	SC/PI SC/	PI SC/	PI
SB off to Pennsylvania/25th	SC/PI SC/	PI SC/	PI
SB on from Pennsylvania/25th	NSC NSC NSC		

Notes:

1. PI – Project Impact. Project results in a change in ramp merge/diverge from LOS D or better under 2030 No Project conditions, to LOS E or LOS F with the Project, Project Variants, or Project Alternatives**.**
2. NSC – No Significant Contribution. Project would not contribute significantly to ramp merge/diverges operating at LOS E or LOS F under 2030 No Project conditions. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to ramp merge/diverges operating at LOS E or LOS F under 2030 No Project conditions, resulting in a Project Impact.

Table 21 Freeway Diverge Queue Storage Project, Project Variant 2, and Project Variant 2A Conditions - Weekday AM Peak Hour						
Ramp Location	**Ramp Storage**	**Existing**	**2030 No Project**	**Project**	**Project Variant 2 (Housing)**	**Project Variant 2A (Housing/R&D)**
		95^{th} % Queue[1]	**95^{th} % Queue**	**95^{th} % Queue**	**95^{th} % Queue**	**95^{th} % Queue**
U.S. 101						
NB off to Harney Way[2] 2,800		< 100	1,725	2,350 2,350		2,500
NB off to Bayshore/Cesar Chavez	750	400	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to San Bruno/Silliman	600	225	225	225	225	225
SB off to San Bruno/Mansell	650	< 100	< 100	<100	< 100	< 100
SB off to Bayshore/Hester	1,700	225	275	275	275	275
SB off to Harney/Geneva[2] 1,000		< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon	1,250	< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
I-280						
NB off to Cesar Chavez	2,500	1,500	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB on from Pennsylvania/25th	900	< 100	< 100	< 100	<100.0	100

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.
Source: Fehr & Peers.

Table 22
Freeway Diverge Queue Storage
Project, Project Variant 2, and Project Variant 2A Conditions - Weekday PM Peak Hour

Ramp Location	**Ramp Storage**	**Existing**	**2030 No Project**	**Project**	**Project Variant 2A (Housing)**	**Project. Variant 2A (Housing/R&D)**
		95^{th} % Queue[1]	**95^{th} % Queue**	**95^{th} % Queue**	**95^{th} % Queue**	**95^{th} % Queue**
U.S. 101						
NB off to Harney Way[2] 2,800		< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
NB off to Bayshore/Cesar Chavez	750	375	525	525	525	525
SB off to San Bruno/Silliman	600	325	425	425	425	425
SB off to San Bruno/Mansell	650	150	350	350	350	350
SB off to Bayshore/Hester	1,700	225	125	125	125	125
SB off to Harney/Geneva[2] 1,000		< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon 1,250		< 100	1,000	1,000 1,000	1,000	
I-280						
NB off to Cesar Chavez	2,500	650	900	900	900	900
SB on from Pennsylvania/25th	900	< 100	875	875 875 875		

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.
Source: Fehr & Peers.

Table 23
Freeway Diverge Queue Storage
Project, Project Variant 2, and Project Variant 2A Conditions - Sunday PM Peak Hour

Ramp Location	Ramp Storage	Existing	2030 No Project	Project	Project Variant 2 (Housing)	Project Variant 2A (Housing/R&D)
		95th % Queue[1]	95th % Queue	95th % Queue	95th % Queue	95th % Queue
U.S. 101						
NB off to Harney Way[2] 2,800		< 100	1,450	**Spillback** 2,575		Spillback
NB off to Bayshore/Cesar Chavez	750	275	350	350	350	350
SB off to San Bruno/Silliman	600	175	250	250	250	250
SB off to San Bruno/Mansell	650	< 100	< 100	100	100	100
SB off to Bayshore/Hester	1,700	300	300	325	325	350
SB off to Harney/Geneva[2] 1,000		< 100	**Spillback**	**Spillback**	**Spillback**	**Spillback**
SB off to Sierra Point/Lagoon	1,250	< 100	125	125	125	125
I-280						
NB off to Cesar Chavez	2,500	300	825	825	825	825
SB on from Pennsylvania/25th	900	< 100	150	175 200 200		

Notes:
1. Ramps where there is potential for spillback are highlighted in **bold.**
2. 95th percentile queue is the length of queue that has a probability of 5 percent or less of being exceeded during the peak hour.
3. 2030 No Project conditions assume the reconstruction of the Harney Way Interchange as well as the connection of Geneva Avenue to the reconstructed interchange.
Source: Fehr & Peers.

Mainline and Weaving Segments

Project Variant 2A would result in similar significant traffic impacts at freeway mainline segments as the Project, although the magnitude of impacts may be somewhat greater, due to the increased traffic generation compared to the Project. As described in the discussion of Project impacts in the Transportation Study pages 208 to 220, no feasible mitigation measures have been identified for the freeway segments expected to experience significant impacts under Project conditions. Therefore, the Project Variant 2A contributions to LOS E and LOS F freeway operating conditions would be considered *significant and unavoidable*.

Ramp Junctions

Project Variant 2A would result in similar significant traffic impacts to freeway ramp junctions as the Project, although the magnitude of impacts may be greater, due to increased traffic generation compared to the Project. As described in the discussion of Project impacts in the Transportation Study pages 220 to 222, no feasible mitigation measures have been identified for the freeway ramp junctions expected to experience significant impacts under Project conditions. Therefore, the Project Variant 2A contributions to deficient freeway operating conditions are considered *significant and unavoidable*.

The Project Variant 2A contributions to all off-ramps expected to experience significant traffic impacts associated with queuing under Project conditions would be the same as the Project. As described in the discussion of Project impacts in the Transportation Study, no feasible mitigation measures have been identified for the freeway off-ramps expected to experience significant impacts under Project conditions. Therefore, the Project Variant 2A contributions to freeway segments operating at LOS E or LOS F would be considered *significant and unavoidable*.

4. TRANSIT IMPACTS

Transit Capacity Utilization

Table 24 summarizes the capacity utilization for each of the three cordons for the weekday AM and PM peak hours for conditions with the Project, Project Variant 2, and Project Variant 2A. With the transit capacity increases proposed by the Project (see page 256 of the Transportation Study), the total transit travel demand on Muni under Project conditions could be accommodated for each of the three cordons during the AM and PM peak hours. All three cordons would operate at less than Muni's 85 percent capacity utilization standards.

Table 24 Ridership and Capacity Utilization at Study Area Cordons Project, Project Variant 2, and Project Variant 2A – Weekday AM and PM Peak Hours						
Peak Hour/Cordon	**Project**		**Variant 2 (Housing)**		**Variant 2A (Housing/R&D)**	
	Total Ridership	**Total Ridership**	**Total Ridership**	**% Util.**	**Total Ridership**	**% Util.**
AM Peak Hour						
East of Third Cordon						
Inbound	2,512	2,512	2,585 65%		2,540 64%	
Outbound	1,511	1,511	1,841 46%		1,573 39%	
North Cordon						
Inbound	2,457	2,457	2,490 70%		2,468 71%	
Outbound	2,145	2,145	2,257 64%		2,167 62%	
West Cordon						
Inbound	3,057	3,057	3,108 78%		3,073 77%	
Outbound	1,863	1,863	2,073 52%		1,901 48%	
PM Peak Hour						
East of Third Cordon						
Inbound	2,014	2,014	2,280 57%		2,089 52%	
Outbound	2,151	2,151	2,214 56%		2,179 55%	
North Cordon						
Inbound	2,664	2,664	2,889 81%		2,708 74%	
Outbound	2,237	2,237	2,299 65%		2,259 62%	
West Cordon						
Inbound	1,922	1,922	2,076 52%		1,958 49%	
Outbound	2,403	2,403	2,442 61%		2,418 60%	

Source: Fehr & Peers.

If Project-related transit capacity improvements are not provided, then only the capacity presented in **Table 72 in the Transportation Study** (page 256) for the 2030 No Project conditions would be available to accommodate Project and cumulative transit ridership. Under 2030 No Project conditions, the capacity utilization at the study area cordons is projected to exceed Muni's 85 percent capacity utilization standard. With the addition of Project-generated transit trips, the severity of the standard exceedance would increase, and would result in significant impacts. Because the final transit plan has not been formally approved by SFMTA, Project Mitigation Measure 7 is required to ensure the final Transit Plan will be prepared and implemented. With implementation of Project Mitigation Measure 7, the Project's impacts and the Project's contribution to cumulative impacts on transit capacity at the study area cordons would be *less than significant*.

Table 25 summarizes the capacity utilization for the downtown screenlines for the AM and PM peak hours for the Project conditions, and for Project Variant 2 and Variant 2A. As with the Project, Project Variant 2A would only add peak-direction riders through the southeast downtown screenline. Ridership on other screenlines would remain unchanged. With the addition of project trips, all downtown screenlines would continue to operate with Muni's 85 percent utilization standard. Therefore, Project impact on transit capacity at the Downtown Screenlines would be *less than significant.*

Table 25
Ridership and Capacity Utilization at Downtown Screenlines
Project and Project Variants – Weekday AM and PM Peak Hours

Peak Hour/Screenline	Project		Variant 2 (Housing)		Variant 2A (Housing/R&D)	
	Total Ridership	**Total Ridership**	**Total Ridership**	**% Util.**	**Total Ridership**	**% Util.**
AM Peak Hour						
Northeast	3,008	3,008	3,008	78%	3,008	78%
Northwest 8,949		8,949	8,949	75%	8,949	75%
Southeast 7,553		7,553	7,573	74%	7,603	75%
Southwest 7,674	_____ 7,674	_____ 7,674	_____ 76%		7,674 76%	
Total All Screenlines	27,184 27,184		27,204	75%	27,234	75%
PM Peak Hour						
Northeast	3,140	3,140	3,140	78%	3,140	78%
Northwest 8,155		8,155	8,155	75%	8,155	75%
Southeast 8,263		8,263	8,306	84%	8,312	83%
Southwest 8,829	_____ 8,829	_____ 8,829	_____ 82%		8,829 82%	
Total All Screenlines	28,387 28,387		28,430	80%	28,436	80%

Source: Fehr & Peers.

Table 26 summarizes the capacity utilization for the regional transit provider screenlines for the AM and PM peak hours for the Project conditions, and for Project Variant 2 and Variant 2A. As with the Project, Project Variant 2A would contribute relatively small ridership increases to regional transit compared to 2030 No Project conditions. Regional cordons would operate at the same percentage of capacity utilization with the Project and Project Variant 2A as under 2030 No Project conditions, with one exception. The capacity utilization for the South Bay would increase from 69 to 70 percent during the PM peak hour with the Project and Project Variant 2, and to 71 percent with Project Variant 2A, compared to the 2030 No Project scenario. The Project and Project Variant 2A would contribute slightly fewer trips to the South Bay cordon in the off-peak directions (southbound in the AM peak hour and northbound in the PM peak hour) than in the peak directions. Off-peak direction ridership would remain within available capacity in the AM and PM peak hours.

Similar to the Project, the increase in Project Variant 2A transit trips would not result in any cordon or screenline expected to operate within available capacity without the Project to exceed its capacity. Project Variant 2A contributions to regional transit providers operating at more than 100 percent capacity utilization (e.g., BART to East Bay, Golden Gate Transit to North Bay) would be minimal, about 0.1 percent. Therefore, the Project Variant 2A's impacts on transit capacity would be *less than significant*.

Table 26
Project Transit Trips and Capacity Utilization at Regional Screenlines
Project, Project Variant 2, and Project Variant 2A – Weekday AM and PM Peak Hours

Peak Hour/Screenline	Project		Variant 2 (Housing)		Variant 2A (Housing/R&D)	
	Total Ridership	**% Util.**	**Total Ridership**	**% Util.**	**Total Ridership**	**% Util.**
AM Peak Hour						
East Bay						
BART	36,202	185%	36,200	185%	36,204	185%
AC Transit	3,347	61%	3,347	61%	3,347	61%
Ferries	1,971	83%	1,971	83%	1,971	83%
subtotal	*41,520*	*151%*	*41,518*	*151%*	*41,522*	*151%*
North Bay						
Golden Gate Transit	2,621	106%	2,621	106%	2,621	106%
Ferries	1,647	97%	1,647	97%	1,647	97%
subtotal	*4,268*	*102%*	*4,268*	*102%*	*4,268*	*102%*
South Bay						
BART	12,416	89%	12,413	89%	12,420	89%
Caltrain	4,451	70%	4,449	69%	4,453	69%
SamTrans	799	75%	798	75%	800	75%
Ferries	152	51%	152	51%	152	51%
subtotal	*17,818*	*82%*	*17,812*	*82%*	*17,826*	*82%*
Total All Screenlines	***63,606***	***119%***	***63,598***	***119%***	***63,616***	***119%***
PM Peak Hour						
East Bay						
BART	30,268	154%	30,268	154%	30,277	154%
AC Transit	4,485	68%	4,485	68%	4,485	68%
Ferries	2,147	79%	2,147	79%	2,147	79%
subtotal	*36,900*	*128%*	*36,900*	*128%*	*36,908*	*128%*
North Bay						
Golden Gate Transit	2,513	114%	2,513	114%	2,514	114%
Ferries	1,630	96%	1,630	96%	1,630	96%
subtotal	*4,143*	*106%*	*4,143*	*106%*	*4,144*	*106%*
South Bay						
BART	10,707	76%	10,708	76%	10,708	77%
Caltrain	4,008	63%	4,013	63%	4,028	63%
SamTrans	404	43%	408	43%	425	43%
Ferries	75	25%	75	25%	75	25%
subtotal	*15,194*	***70%***	*15,204*	***70%***	*15,258*	***71%***
Total All Screenlines	***56,237***	***103%***	***56,247***	***103%***	***56,312***	***103%***

Source: Fehr & Peers.

Project Transit Delay

Table 27 summarizes the increases in transit travel times associated with the Project, Project Variant 2, and Project Variant 2A for each route within the study area, compared to 2030 No Project conditions. **Table 28** identifies the number of additional vehicles that would be required to meet the proposed headways.

Table 29 presents the summary table of project transit impacts for Project, Project Variants, and Alternatives to the Project. On **Table 29**, Project impacts (PI) were identified where the Project would result in an increase in ridership that would result in an exceedance of the capacity utilization standard, or an increase in transit delay such that additional transit vehicles would be required to maintain proposed headways**.**

During the AM peak hour Project Variant 2A would require additional transit vehicles on the same routes as the Project. During the PM peak hour, Project Variant 2A would require additional vehicles on the same routes as the Project, except that the Project Variant 2A would also require additional vehicles on the 48-Quintara-24th Street. The number of vehicles required for each peak hour for the Project and Project Variant 2A is shown in **Table 28**. Impacts associated with Project Variant 2A would be somewhat more extensive than those for the Project. Project Variant 2A would require 8 additional vehicles in the AM peak hour, and 12 additional vehicles in the PM peak hour. As with the Project, these vehicles would be in addition to those required to maintain 2030 No Project headways (as shown on Table 83 on page 292 of the Transportation Study).

Project transit Mitigation Measures 7 though 14.2 would be applicable for Project Variant 2A, and would reduce the impacts associated with Project Variant 2A by similar amounts as described for the Project. However, as with the Project, impacts on transit operations would remain *significant and unavoidable*.

Table 27 Project Increases to Transit Travel Time (minutes:seconds)[1, 2] Project, Project Variant 2, and Project Variant 2A – Weekday AM and PM Peak Hours							
Route	**Proposed Headway (min.)**	**Northbound/Eastbound**			**Southbound/Westbound**		
		Project	**Variant 2 (Hsng)**	**Variant 2A (Hsng/R&D)**	**Project**	**Variant 2 (Hsng)**	**Variant 2A (Hsng/R&D)**
AM Peak Hour							
9-San Bruno	10	**1:09**	**1:19**	**1:20**	**8:04**	**8:09**	**7:00**
23-Monterey 15		0:41	0:38	0:26	3:51	3:51	4:18
24-Divisadero 6		**5:34**	**5:24**	**5:52**	**2:44**	**3:04**	**3:24**
28L-19th Ave Ltd	5	**3:36**	**3:36**	**3:37**	**1:01**	**0:39**	**1:01**
29-Sunset 10		**4:39**	**6:15**	**6:12**	**9:55**	**8:28**	**8:19**
44-O'Shaughnessy 6		**5:53**	**5:54**	**6:40**	**6:16**	**6:14**	**6:09**
48-Quintara-24th St	15	**2:00**	**3:06**	**4:12**	**2:20**	**6:39**	**6:25**
54-Felton [3] 20		0:56	1:39	1:55	-0:17	-3:00	-1:59
T-Third 8		1:34	1:35	1:38 1:39		1:39	1:39
PM Peak Hour							
9-San Bruno	10	**4:03**	**3:55**	**3:06**	**6:49**	**6:49**	**6:25**
23-Monterey 15		0:56	0:58	0:53	1:57 1:57		1:28
24-Divisadero 6		**6:45**	**6:56**	**7:26**	**5:53**	**8:59**	**9:33**
28L-19th Ave Ltd	5	**2:59**	**2:59**	**2:59**	0:03 0:03		0:03
29-Sunset 10		**16:00**	**15:35**	**17:01**	**16:32**	**16:18**	**16:19**
44-O'Shaughnessy 6		**6:05**	**6:56**	**5:40**	**7:18**	**8:02**	**9:05**
48-Quintara-24th St	15	2:51	**7:21**	**5:38**	3:00	**5:26**	**6:31**
54-Felton [3] 20		**3:48**	**4:09**	**4:30**	**5:32**	**3:13**	**4:35**
T-Third 8		**2:57**	**2:50**	**3:08**	**2:33**	**2:32**	**2:39**

Notes:

1. Delays measured for each route between project site and key destination/transfer point away from the project. The study segment for each route is as follows:
   - 9-San Bruno: Bayshore Boulevard between Sunnydale Avenue and Jerrold Avenue
   - 23-Monterey: between Ingalls Street/Oakdale Avenue and the Glen Park BART Station
   - 24-Divisadero: between Hunters Point Shipyard and Mission Street
   - 28L-19th Avenue Limited: between Hunters Point Shipyard and Mission Street
   - 29-Sunset: between Candlestick Point and Mission Street
   - 44-O'Shaughnessy: between Hunters Point Shipyard and the Glen Park BART Station
   - 48-Quintara-24th St: between Hunters Point Shipyard and the 24th Street BART Station
   - 54-Felton: between Jerrold Avenue/Earl Street and Mission Street
   - T-Third: Third Street between Thomas Avenue and Jerrold Avenue (This segment represents the section of the T-Third route that does not provide exclusive right-of-way for transit and would be most affected by increased traffic congestion.)
2. Routes where the Project would increase travel times such that additional vehicles would be required highlighted in **bold**.
3. Due to roadway improvements proposed by the Project and differences between the No Project and Project land use assumptions at the Hunters Point Shipyard, there would be less traffic congestion along 54-Felton route in study area with the Project, than under 2030 No Project conditions.

Source: Fehr & Peers.

Table 28
Additional Muni Transit Vehicle Requirements
Project, Project Variant 2, and Project Variant 2A – Weekday AM and PM Peak Hours

Route	Project	Variant 2 (Housing)	Variant 2A (Housing/R&D)
AM Peak Hour			
9-San Bruno	**1**	**1**	**1**
23-Monterey 0		0	0
24-Divisadero	**1**	**2**	**2**
28L-19th Ave Ltd	**1**	**1**	**1**
29-Sunset	**1**	**1**	**1**
44-O'Shaughnessy	**2**	**2**	**2**
48-Quintara-24th Street	**1**	**1**	**1**
54-Felton [2] 0		0	1
T-Third 0	_	0	0
Total	***7***	***8***	***8***
PM Peak Hour			
9-San Bruno	**1**	**1**	**1**
23-Monterey 0		0	0
24-Divisadero	**3**	**2**	**2**
28L-19th Ave Ltd	**1**	**1**	**1**
29-Sunset	**3**	**3**	**3**
44-O'Shaughnessy	**2**	**2**	**2**
48-Quintara-24th Street	0	**1**	**1**
54-Felton	**1**	**1**	**1**
T-Third	**1**	**1**	**1**
Total	***12***	***12***	***12***

Note:
Transit vehicle requirements for Project and Project Variants are in addition to those required for the 2030 No Project condition (Alternative 1) identified in Table 83 on page 292 of the Transportation Study.
Source: Fehr & Peers.

Table 29
Summary of Transit Impacts – Capacity Utilization and Transit Operations

Intersection	Project	Project Variant 2 (Housing)	Project Variant 2A (Housing/R&D)
Capacity Utilization Analyses			
Cordons			
North	-- --		--
West	-- --		--
East of Third	-- --		--
Downtown Screenlines			
Northeast	NSC NSC		NSC
Northwest	NSC NSC		NSC
Southeast	NSC NSC		NSC
Southwest	NSC NSC		NSC
Regional Screenlines			
East Bay	NSC NSC		NSC
North Bay	NSC NSC		NSC
South Bay	NSC NSC		NSC
Transit Operations Analyses			
9-San Bruno	PI PI		PI
23-Monterey	SC/PI SC/PI		SC/PI
24-Divisadero	PI PI		PI
28L-Geneva Limited	PI PI		PI
29-Sunset	PI PI		PI
44-O'Shaughnessy	PI PI		PI
48-Quintara-24th Street	PI PI		PI
54-Felton	PI PI		PI
T-Third	PI PI		PI

Notes:
1. PI – Project Impact. Project results in an increase in ridership that would result in an exceedance of the capacity utilization standard, or an increase in transit delay such that additional transit vehicles would be required to maintain proposed headways.
2. NSC – No Significant Contribution. Project would not contribute significantly to transit ridership at locations where capacity utilization under 2030 No Project condition exceeds capacity utilization standards. Or if Project would not contribute significantly to poor intersection operations that would affect transit operations. No impacts.
3. SC/PI – Significant Contribution/Project Impact. Project would contribute significantly to poor intersection operations that, therefore, would contribute to significantly to transit delays that would result in the need for additional transit vehicles to maintain proposed headways.
Source: Fehr & Peers.

5. BICYCLE IMPACTS

Project Variant 2A would include additional development within Hunters Point Shipyard and would result in increased bicycle travel within and adjacent to the Project area. The bicycle trips associated with the increased development would be accommodated within the proposed street network, and impacts on bicycle circulation would *be less than significant*.

As with the Project, potential significant impacts on bicycle travel on Palou Avenue would occur under Project Variant 2A. Project Mitigation Measure 15 would be applicable to Project Variant 2A. Because a feasibility study of the relocation of Bicycle Routes #70 and #170 on Palou Avenue would be required, the implementation of Project Mitigation Measure 15 is uncertain, and therefore the Project Variant 2A impacts on bicycle circulation would remain *significant and unavoidable.*

6. PEDESTRIAN IMPACTS

Project Variant 2A would include additional development within Hunters Point Shipyard and would result in increased pedestrian travel within and adjacent to the Project area. The pedestrian trips associated with the increased development would be accommodated within the proposed sidewalk network, and impacts on pedestrian circulation would *be less than significant*.

7. PARKING IMPACTS

Table 30 summarizes the aggregate of the parking demand calculated for Project land uses, and also presents the maximum permitted parking supply per the parking standards detailed in the draft D4D standards as well as the proposed number of new on-street parking spaces that would be provided on new and reconfigured streets. [1] **Table 31** summarizes the parking demand, and the resultant parking shortfalls assuming Project parking supply for two scenarios: based on the maximum permitted draft D4D standards; and, assuming provision of no off-street spaces but that only the on-street parking spaces would be available. Since the D4D standards do not include minimum requirements (instead specify the maximum parking supply that would be permitted to be provided) it is possible that the Project could be constructed without any off-street parking. However, most development projects in San Francisco develop the maximum permitted supply, and therefore the comparison of the parking demand to the maximum permitted off-street supply and to no off-street supply presents the range of potential parking impacts.

[1] The Project would include some on-street parking in the project site for both commercial and general/residential uses. About 683 on-street spaces would be provided within Hunters Point Shipyard and 1,360 spaces within Candlestick Point for a total of 2,043 spaces.

Table 30
Summary of Parking Demand and Maximum Permitted Supply
Project, Project Variant 2, and Project Variant 2A

Scenario/Project Component	Demand [1] Residential Long Term	Demand [1] Non-Residential Long Term	Demand [1] Non-Residential Short Term	Demand [1] Total Demand	Supply [1] Maximum Permitted Off-Street [2]	Supply [1] New On-Street	Supply [1] Total Supply
Project							
Hunters Point Shipyard	3,110	3,818	996	7,924	6,678	683	7,361
Candlestick Point	9,212	1,475	2,622	13,309	10,196	1,360	11,556
Total	*12,322*	*5,293*	*3,618*	*21,233*	*16,874*	*2,043*	*18,917*
Variant 2 (Housing)							
Hunters Point Shipyard	4,694	3,811	911	9,416	7,778	1,298	9,076
Candlestick Point	7,627	1,480	2,787	11,894	8,846	1,360	10,206
Total	*13,321*	*5,291*	*3,698*	*21,310*	*16,624*	*2,658*	*19,282*
Variant 2A (Housing/R&D)							
Hunters Point Shipyard	5,016	4,508	980	10,504	8,703	1,428	10,131
Candlestick Point	7,305	1,180	2,787	11,272	8,571	1,360	9,931
Total	*13,321*	*5,688*	*3,767*	*21,776*	*17,274*	*2,788*	*20,062*

Notes:
1. Does not include stadium parking supply or game day demand.
2. Maximum number of spaces permitted per draft Design for Development standard for Candlestick Point Hunters Point Shipyard Phase II Development Plan.
Source: CHS Consulting, LCW Consulting.

Table 31 Summary of Parking Shortfalls for No Minimum and Maximum Permitted Supply [1, 2] Project, Project Variant 2, and Project Variant 2A					
Scenario/Project Component	**Total Demand**	**Minimum Supply**		**Maximum Supply**	
		Supply	**Shortfall**	**Supply**	**Shortfall**
Project					
Hunters Point Shipyard	7,924	683	- 7,241	7,361	- 563
Candlestick Point	13,309	1,360	- 11,949	11,556	- 1,753
Total	*21,233*	*2,043*	*- 19,190*	*18,917*	*- 2,316*
Variant 2 (Housing)					
Hunters Point Shipyard	9,416	1,298	- 8,118	9,076	- 340
Candlestick Point	11,894	1,360	- 10 534	10,206	- 1,688
Total	*21,310*	*2,658*	*- 18,652*	*19,282*	*- 2,028*
Variant 2A (Housing/R&D)					
Hunters Point Shipyard	10,504	1,428	- 9,076	10,131	- 373
Candlestick Point	11,272	1,360	- 9,912	9,931	- 1,341
Total	*21,776*	*2,788*	*- 18,988*	*20,062*	*- 1,714*

Notes:
1. Includes off-street and new on-street supply.
2. Does not include stadium parking supply or demand.
Source: CHS Consulting, LCW Consulting.

The development program for Variant 2A would be similar to the Project, however, about 1,625 residential units would be shifted from Candlestick Point to Hunters Point Shipyard, and an additional 500,000 gsf of R&D uses would be developed within Hunters Point Shipyard. Parking impacts would be similar to the Project. Compared with a maximum supply of about 20,062 spaces, the parking demand of 21,776 spaces would result in an excess demand of 1,714 spaces. As with the Project, Variant 2A would not significantly impact parking conditions.

As indicated in **Table 31,** if no off-street parking is developed, the parking shortfall would be substantially greater than if the maximum permitted supply is provided. The parking shortfall would be 18,988 spaces for Variant 2A. As noted above, if no parking is provided, drivers may park outside of the project area, or may switch to transit, carpool, bicycle or other modes of travel. Due to parking shortfalls, there may be impacts to pedestrians, bicycles and transit caused by parking on the sidewalks, double-parking, and parking at intersections or other illegal parking activities. However, parking impacts for Project Variant 2A would be *less than significant*.

8. LOADING IMPACTS

Table 32 summarizes the estimate of daily truck trips generated by the proposed land uses and the associated demand for loading dock spaces during the peak hour of loading activities (which generally occurs between 10:00 a.m. and 1:00 p.m.), and the estimated supply that would be provided per draft Design for Development. As for the Project, the estimated loading supply would be greater than the loading demand during the peak hour of loading operations. Within the Hunters Point Shipyard the loading demand and estimated supply would be similar, while within Candlestick Point the supply would substantially exceed the demand. This is due primarily to the calculation for retail uses, which has the most intensive loading demand. For the regional retail uses within Candlestick Point, loading facilities would be located to meet multiple tenants within the retail development. Overall, Project Variant 2A impacts related to loading operations would be *less than significant.*

Table 32
Summary of Loading Demand and Supply
Project, Project Variant 2, and Project Variant 2A

Scenario/Project Area	Daily Truck Generation	Peak Hour Loading Dock Space Demand	Supply [1, 2,]
Project			
Hunters Point Shipyard	713	41	42
Candlestick Point	507	29	59
Total	*1,220*	*70*	*101*
Project – Variant 2 (Housing)			
Hunters Point Shipyard	766	44	47
Candlestick Point	458	27	55
Total	*1,224*	*71*	*102*
Project – Variant 2A (Housing/R&D)			
Hunters Point Shipyard	881	51	53
Candlestick Point	448	25	54
Total	*1,329*	*77*	*107*

Notes:
1. Minimum number of loading spaces permitted per draft Design for Development standard for the CP-HPS Phase II Development Plan.
2. Does not include stadium loading facilities.
Source: LCW Consulting.

9. EMERGENCY VEHICLE ACCESS IMPACTS

Emergency vehicle access impacts under Project Variant 2A would be similar to the Project; impacts on emergency access would be *less than significant.*

10. AIR TRAFFIC IMPACTS

Air traffic impacts under Project Variant 2A would be similar to the Project; impacts on air traffic safety would be *less than significant.*

11. HAZARDS DUE TO DESIGN FEATURES

Impacts related to hazards under Project Variant 2A would be similar to the Project; *less than significant.*

12. CONSTRUCTION IMPACTS

Construction activities associated with Variant 2A would be similar to the Project. Variant 2A does not include construction of a new stadium at Hunters Point Shipyard, instead assumes an additional 500,000 square feet of R&D uses, and reallocation of 1,625 residential units from Candlestick Point to Hunters Point Shipyard. Depending on the phasing of the additional development, the Variant 2A may result in fewer construction traffic impacts between future years 2012 and 2017 when the new stadium is proposed to be constructed, and somewhat greater impacts in the years the additional R&D space or housing units would be constructed. Implementation of a traffic control plan would reduce the project's contribution to significant cumulative impacts of overlapping construction traffic. However, as with the Project, cumulative transportation impacts associated with construction activities would be considered *significant and unavoidable.*

Implementation of Project Mitigation Measure 16 would be applicable to Project Variant 2A. A Hunters Point Shipyard – Candlestick Point Construction Traffic Management Program would help minimize the Project Variants' construction-related transportation impacts and contribution to cumulative-construction related transportation impacts. However, since some disruption and increased delays could still occur even with implementation of the mitigation measure, and it is possible that significant construction-related transportation impacts on local and regional roadways could still occur. Localized construction-related transportation impacts would therefore remain *significant and unavoidable.*

13. STADIUM AND ARENA IMPACTS

Project Variant 2A does not include construction of a new stadium. Furthermore, the existing stadium at Candlestick Point would be demolished, and the 49er games would be played elsewhere. Game day impacts for Project Variant 2A are *not applicable*.

Project Variant 2A includes a 10,000-seat arena in the Candlestick Point area. Although most events would have less than 10,000 attendees, preliminary economic analysis has indicated that the arena could hold up to 250 events annually with an average attendance of 5,000. The transportation analysis examines the worst-case scenario, in which a 10,000-person event is held on a weekday evening.

Project Variant 2A would include somewhat more development in the Hunters Point area and development in the Candlestick Point area would be the similar to the Project, including construction of a 10,000-seat arena. Overall, since new facilities, including local streets and freeway facilities, would experience congested traffic prior to an arena event, traffic impacts associated with the new Arena during arena events would be *significant*. Implementation of Project Mitigation Measure 21 would be applicable to Project Variant 2A. However, even with the implementation of Project Mitigation Measure 21, the Project Variant 2A's impacts to the study roadway network during a sell-out event at the arena would be *significant and unavoidable*.

The transit demand with a sold-out arena event under the Project conditions were approaching, but not above, the amount of available transit capacity. However, since the amount of background transit demand under Variant 2A would be higher, it is possible that the added transit demand associated with a sold-out arena event would create demand for transit service greater than the capacity of the transit supply to the arena.

> ***Project Variant 2A Mitigation Measure 19***: SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area prior to large events at the arena. Routes 29-Sunset and 28L-19th Avenue Limited would already be operating near their maximum frequency. Therefore, this mitigation measure primarily applies to Route CPX. If headways on this route were increased to five-minute frequencies in the one to two-hours prior to an event at the arena, the hourly transit capacity toward the arena would increase by 380 passengers per hour, for a total of 2,658. This would likely be adequate capacity, but may still leave some routes over-capacity and others below-capacity. Therefore, additional shuttle service to key regional transit destinations, such as BART, Caltrain, and the T-Third light rail route shall also be provided by the arena operator.

With implementation of Project Variant 2A Mitigation Measure 19, the impacts to transit service during sell-out events at the arena would be reduced, but not to less-than-significant levels. In addition, traffic impacts during secondary events would not be mitigated, and would impact transit operations. Therefore, the impact on transit operations would remain *significant and unavoidable.*

14. MITIGATION MEASURES

Traffic

Project Variant 2A Mitigation Measure 1: Implement Project Mitigation Measure 1 – TDM Plan

Project Variant 2A Mitigation Measure 2: Implement Project Mitigation Measure 6 – Harney Way Widening

Project Variant 2A Mitigation Measure 3: Implement Project Mitigation Measure 2 – Improvements at Tunnel/Blanken

Project Variant 2A Mitigation Measure 4: Implement Project Mitigation Measure 3 – Harney Interchange Project Improvements

Project Variant 2A Mitigation Measure 5: At the intersection of Crisp/Palou/Griffith, restripe the southbound approach to provide a dedicated left-turn lane and a shared through/right-turn lane. On-street parking would be prohibited on Griffith Street between Palou Avenue and Oakdale Avenue. Implementation of this improvement would be the responsibility of SFMTA and DPW, and shall be implemented as part of Hunters Point Shipyard Phase 3 roadway network improvements. The Project Applicant, in collaboration with the City, shall monitor traffic conditions at completion of Phase 2, Phase 3 and Phase 4 to determine whether the intersection operations would warrant reconfiguration and when it should be implemented. Based on the monitoring, if the City determines reconfiguration is warranted, the Project Applicant shall be required to fund the cost of reconfiguration. The SFMTA and DPW shall design and implement the measure as necessary. With implementation of Project Variant 1 Mitigation Measure 5, this intersection would operate at acceptable LOS D or better in the AM and PM peak hours, and therefore with its implementation, project-related impacts at this intersection would be *less than significant*.

Project Variant 2A Mitigation Measure 6: Implement Project Mitigation Measure 4 – Improvements at Amador/Cargo/Illinois

Project Variant 2A Mitigation Measure 7: Implement Project Mitigation Measure 5 – Improvements at Bayshore/Geneva

Transit

Project Variant 2A Mitigation Measure 8: Implement Project Mitigation Measure 7 – Project Transit Operating Plan

Project Variant 2A Mitigation Measure 9: Implement Project Mitigation Measure 8.1 and 8.2 – 9-San Bruno Improvements

Project Variant 2A Mitigation Measure 10: Implement Project Mitigation Measure 9.1 and 9.2 – 23-Monterey, 24-Divisadero, and 44-O'Shaughnessy Improvements

Project Variant 2A Mitigation Measure 11: Implement Project Mitigation Measure 10.1 and 10.2 – 29-Sunset Improvements

Project Variant 2A Mitigation Measure 12: Implement Project Mitigation Measure 11.a and 11.2 – 48-Quintara-24th Street Improvements

Project Variant 2A Mitigation Measure 13: Implement Project Mitigation Measure 12 – 54-Felton Improvements

Project Variant 2A Mitigation Measure 14: Implement Project Mitigation Measure 13.1 and 13.2 – T-Third Improvements

Project Variant 2A Mitigation Measure 15: Implement Project Mitigation Measure 14.1 and 14.2 – 28L-19th Avenue/Geneva Limited Improvements

Bicycle

Project Variant 2A Mitigation Measure 16: Implement Project Mitigation Measure 15 – Bicycle Route #70 and #170 Improvements

Pedestrian

No significant environmental impacts have been identified; no mitigation required.

Parking

No significant environmental impacts have been identified; no mitigation required.

Loading

No significant environmental impacts have been identified; no mitigation required.

Construction

Project Variant 2A Mitigation Measure 17: Implement Project Mitigation Measure 16 – Construction Traffic Management Program

7Stadium

No stadium proposed as part of Project Variant 2A; no mitigation measures required.

Arena

Project Variant 2A Mitigation Measure 18: Implement Project Mitigation Measure 21 – Arena Transportation Management Program

Project Variant 2A Mitigation Measure 19: SFMTA shall increase frequency on regularly scheduled Muni routes serving the stadium area prior to large events at the arena. Routes 29-Sunset and 28L-19th Avenue Limited would already be operating near their maximum frequency. Therefore, this mitigation measure primarily applies to Route CPX. If headways on this route were increased to five-minute frequencies in the one to two-hours prior to an event at the arena, the hourly transit capacity toward the arena would increase by 380 passengers per hour, for a total of 2,658. This would likely be adequate capacity, but may still leave some routes over-capacity and others below-capacity. Therefore, additional shuttle service to key regional transit destinations, such as BART, Caltrain, and the T-Third light rail route shall also be provided by the arena operator.

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[Appendices are available for review at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA.]

Appendix T7 LCW Consulting, CP-HPS Phase II Development Plan Transportation Study—Subalternative 4A, April 8, 2010

Memo

To: Bill Wycko, San Francisco Planning Department, MEA

From: Luba C. Wyznyckyj, LCW Consulting
Chris Mitchell, Eric Womeldorff, Fehr & Peers

Date: April 8, 2010

Re: CP-HPS Phase II Development Plan Transportation Study – Subalternative 4A

This memorandum is a supplement to the *Candlestick Point-Hunters Point Shipyard Phase II Development Plan Transportation Study* (November 2009) that was prepared to address the impacts associated with a new Alternative 4A. Alternative 4 analyzes a reduced-development alternative while preserving the four historic structures on Hunter Point Shipyard. The purpose of Alternative 4A is to analyze the Project's land use program, while preserving the four historic structures.

The development program for Alternative 4A would be the same as the Project, and therefore the travel demand presented for the Project on Draft EIR pages III.D-56 to III.D-63 would be the same for Alternative 4A. In addition, the transportation improvements included as part of the Project, and described on Draft EIR pages III.D-40 to III.D-56 would also apply to Alternative 4A. Based on the same development program and transportation network, the impact assessment presented in Impacts TR-1 through TR-58 for the Project would be the same for Alternative 4A.

In summary, for purposes of the transportation impact analysis, Alternative 4A would the same as the Project, and therefore all impact assessments, conclusions, and mitigation measures would be same as presented in the Draft EIR and Transportation Study (Appendix D of the Draft EIR) for the Project.

Appendix U CBRE Candlestick Point–Hunters Point Shipyard Phase II Development Plan Secondary Land Use Effects, October 2009

CANDLESTICK POINT – HUNTERS POINT SHIPYARD PHASE II DEVELOPMENT PLAN: SECONDARY LAND USE EFFECTS

SAN FRANCISCO, CALIFORNIA

Prepared for:

LENNAR URBAN

OCTOBER 2009

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October 14, 2009

Ms. Therese A. Brekke
CEQA Manager
Lennar Urban
49 Stevenson Street Suite 600
San Francisco, California 94105

Re: Candlestick Point – Hunters Point Shipyard Phase II Development Plan Retail Impacts Analysis

Dear Ms. Brekke:

CBRE Consulting is pleased to submit this report regarding the potential secondary land use impacts of the planned retail at the Candlestick Point – Hunters Point Shipyard Phase II Development Plan in San Francisco, California. The report discusses the anticipated sales of the Project's proposed retail, the likely impact of these sales on existing retailers, the cumulative impacts of other selected planned developments within and near the market areas, and the extent to which the new development may or may not contribute to urban decay.

It has been a pleasure working with your team. Please let us know if you have any questions or additional needs.

Sincerely,

Amy L. Herman, AICP
Senior Managing Director

Gregory G. Keller
Managing Director

Pipi Ray Diamond
Director

Kate M. Barry
Consultant

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LIST OF EXHIBITS
(LOCATED IN APPENDIX A)

I. EXECUTIVE SUMMARY

INTRODUCTION

This analysis evaluates the economic impact of the retail portion of the Candlestick Point – Hunters Point Shipyard Phase II Development Plan (referred to as the "Project") in the City and County of San Francisco, California ("San Francisco"). This mixed use development is planned for an approximately 764-acre area in the Candlestick Point and Hunters Point Shipyard neighborhoods of San Francisco. The many land uses planned for the Project include residential, retail, office, research & development, hotel, artist's studios/artist education center, institutional, parks & open space, the 49ers Stadium, ferry terminal, marina, performance venue, and parking. Two major areas of retail are planned: a 635,000-square-foot regional center at Candlestick Point with an adjacent 125,000-square-foot neighborhood retail and business services area; and a second 125,000-square-foot neighborhood retail area at Hunters Point Shipyard. The neighborhood retail at Hunters Point Shipyard is located in and adjacent to a planned Village Center. The retail space is anticipated to be completed by 2030. No specific retail tenants have been identified at this time.

This study estimates the potential impacts of the Project's retail tenants on existing retailers in the Project's estimated market areas and other potentially affected areas. In addition, the study estimates the extent to which the opening of the Project may or may not contribute to secondary land use effects in the form of urban decay.

SUMMARY OF FINDINGS

Project Sales

CBRE Consulting estimates that sales at the Candlestick Point regional center ("Candlestick Point") will total $190.6 million in 2009 dollars annually with another $26.7 million at the adjacent neighborhood retail area. Sales at the Hunters Point Shipyard Phase II neighborhood retail component ("HPS Phase II") will total $43.5 million. Sales at the Candlestick Point regional center will be concentrated in the other retail stores category, which covers electronics/appliances, sporting goods, books, a cinema, and other specialty retailers, as well as the general merchandise and apparel categories. The neighborhood retail planned adjacent to the regional center will comprise restaurants, other retail stores, a drug store, and some non-retail personal services and businesses. Sales at the HPS Phase II neighborhood retail component will be concentrated in a grocery store, the other retail stores category, restaurants, and the general merchandise category.

Potential Impacts on Existing Market Area Retailers

Market Areas Determination. Retail shopping center market area geographies are dictated in large part by each center's format and market orientation, such that the Candlestick Point regional center and neighborhood retail area and HPS Phase II neighborhood retail component are estimated by CBRE Consulting to have distinct trade areas. Because of the close proximity of the Candlestick Point neighborhood retail to the regional center, it is included in the larger regional center's market area. Although neighborhood retail does not typically have a wide draw, when it is part of or near to a regional center, it can benefit by the broader draw of the larger center. CBRE Consulting believes that shoppers attracted to the regional center will also visit the stores in the adjacent neighborhood retail component because it is convenient. The Candlestick Point retail market area is roughly an area that is within a 15-minute drive of the planned center. The market area defined for the HPS Phase II is for the most part a three-mile radius. This boundary roughly corresponds with a 10-minute drive time. CBRE Consulting conducted analysis to determine the extent to which the Project's retail sales would impact existing retailers within each of the Project market areas.

Potential Impacts of HPS Phase II. The analysis indicates that absent consideration of cumulative projects, the HPS Phase II neighborhood retail is not estimated to divert sales from existing retailers in any of the retail categories analyzed. The demand associated with new household growth is expected to absorb a large component of sales at the planned HPS Phase II neighborhood retail area in 2030. New demand associated with household growth is estimated to account for $13.8 million of the HPS Phase II's $41.3 million in market area sales. The remaining $103.0 million in demand from new households will be distributed among other market area stores, such that any potential impacts to existing stores will be fully offset. While these recaptured sales are likely to occur at the detriment of other retailers outside the market area, there is still other remaining demand available to offset both these impacts and the ones in the market area. Therefore, no substantial impacts are estimated to occur to the detriment of existing retailers due to HPS Phase II.

Potential Impacts of Candlestick Point. The demand associated with new household growth is expected to absorb a large component of sales at the planned Candlestick Point retail areas in 2030. New demand associated with household growth is estimated to account for $11.0 million of the Candlestick Point's $173.2 million in market area sales. The remaining $246.3 million in demand from new households will be distributed among other market area stores, such that potential impacts to existing stores will be at least partially offset. Remaining impacts are estimated in the apparel stores and other retail stores categories. However, as a share of the market area sales, these impacts are only 2.3 percent in apparel and less than 1.0 percent in the other retail stores category. There is also still a large amount of remaining demand in the general merchandise, food stores, restaurants, and building materials categories. If any apparel retailers or other retail stores were to close due to impacts from Candlestick Point, there appears to be sufficient demand for a store in a different retail category to retenant the space. Therefore, no substantial impacts to the detriment of existing retailers are estimated to lead to prolonged vacancies due to the planned Candlestick Point.

Impacts on Stores Outside of the Market Areas

CBRE Consulting analyzed the potential sales impacts to existing stores that are located outside but near the two respective market areas following potential changes in shopping patterns that may occur after the opening of the Project's retail components. Overall, the analysis finds that the introduction of new retail stores at HPS Phase II and Candlestick Point are likely to attract some shoppers away from existing neighborhood-serving shopping districts and regional centers that are outside the Project's market areas. However, demand growth due to the introduction of new households in San Francisco and nearby San Mateo County cities is also projected to be strong enough to counter most, if not all, potential sales impacts on competitive stores. Specifically, for the neighborhood-serving trade areas in the analysis, potential diversions of the competitive sales base ranged from 0.0 percent to 7.7 percent, and projected household growth through 2030 supports the conclusion that there will be no net consumer loss at any of the representative locations analyzed. For the regional retail trade areas, the three centers analyzed had a greater overlap with the Candlestick Point market area, and as a result, the potential diversion of the associated consumer bases ranges from 14.7 percent to 16.1 percent. Demand growth in two of the three representative regional trade areas is projected to be sufficient to fully offset related diversions by 2030, while the Westlake Shopping Center, one of the centers analyzed, may experience a net loss of up to 1.1 percent of its trade area base. In addition, this potential net consumer loss is likely an extreme example based on the study assumption that the planned Candlestick Point retail area will divert a full 50 percent of household demand from the overlapping trade area; this result would be lower if a more moderate assumption of redirected demand had been applied.

Cumulative Impacts

Potential Impacts of HPS Phase II. When taking into consideration all cumulative projects planned in the HPS Phase II market area, sales impacts of up to $0.4 million in 2009 dollars in the other retail stores category are estimated. These impacts are relatively small accounting for only 1.0 percent of the market area sales base. These impacts will likely be spread among many retailers; however, if certain retailers are affected disproportionately, store closures could occur. There is also remaining new household demand of $91.8 million concentrated in the food stores, restaurants, and general merchandise categories in the HPS Phase II neighborhood retail market area. If store closures were to occur in other retail stores category, those vacant spaces could be retenanted by a retailer in a category with remaining new household demand. Because of this remaining demand, CBRE Consulting does not anticipate that any vacancies due to the HPS Phase II in combination with the India Basin project will remain empty for a prolonged period of time. Therefore, existing retail districts in the HPS Phase II market area are unlikely to be substantially negatively impacted by the neighborhood retail planned at HPS Phase II and India Basin. Instead, new household growth in the HPS Phase II market area is likely to benefit the existing retail districts.

Potential Impacts of Candlestick Point. Table 1 summarizes the estimated sales impacts to existing retailers in the Candlestick Point market area due to the Candlestick Point retail components in combination with the cumulative projects.

Table 1
Maximum Cumulative Sales Impacts in Candlestick Point Market Area
2009 Dollars, in millions

Retail Category	Maximum Sales Diverted From Project Market Area Retailers	Maximum Sales Diverted as a Share of Market Base	Final Remaining New Household Demand
Apparel	$23.4	9.1%	$0.0
General Merchandise	$9.9	1.2%	$0.0
Food Stores	$0.0	0.0%	$74.9
Eating and Drinking	$0.0	0.0%	$61.4
Home Furn. & Appliances	$10.8	3.5%	$0.0
Building Materials	$0.0	0.0%	$43.9
"Other Retail Stores"	$81.1	5.1%	$0.0
Total[1]	$125.3	2.4%	$180.2

Source: Exhibit 56.
(1) Figures may not total due to rounding.

As shown, the Candlestick Point market area may experience up to $125.3 million in sales impacts in 2009 dollars concentrated in the other retail stores and apparel categories. Smaller impacts are estimated in the general merchandise and home furnishings & appliances categories. These impacts will likely be spread among many retailers. However, if certain retailers are affected disproportionately, store closures could occur.

Table 1 also shows the final remaining new household demand in the Candlestick Point market area, net of demand that offsets some of the impacts of new retail projects. This $180.2 million in demand is in the Food Stores, Restaurants, and Building Materials categories. If store closures were to occur in Other Retail Stores and Apparel categories, those vacant spaces could be retenanted by a retailer in a category with remaining new household demand. Because of this remaining demand, CBRE Consulting does not believe any vacancies due to Candlestick Point in combination with the cumulative projects will remain empty for a prolonged period of time. The existing retail districts in the Candlestick Point market area also are unlikely to be substantially negatively impacted by planned Candlestick Point retail components in combination with cumulative projects because their main retail categories are estimated to have minimal impacts. The South Bayshore and Third Street retail districts both have retail sales concentrated in the building materials, gas stations, and restaurants categories, which are not estimated to have any impacts. The San Bruno Avenue retail district has most of its sales in the gas stations and restaurants categories and Leland Avenue has retail sales concentrated in the food stores category and the motor vehicles and parts category. Instead, new household growth in the Candlestick Point market area and remaining demand in the restaurants, food stores, and building materials categories are likely to benefit the existing retail districts.

URBAN DECAY DETERMINATION

Study Definition of Urban Decay

For the purpose of this analysis, urban decay is defined as, among other characteristics, multiple visible symptoms of physical deterioration that invite vandalism, loitering, and graffiti that is caused by a downward spiral of business closures and long term vacancies. This physical deterioration to properties or structures is so prevalent, substantial, and lasting for a significant period of time that it impairs the proper utilization of the properties and structures, and the health, safety, and welfare of the surrounding community. The manifestations of urban decay include such visible conditions as plywood-boarded doors and windows, parked trucks and long term unauthorized use of the properties and parking lots, extensive gang and other graffiti and offensive words painted on buildings, dumping of refuse on site, overturned dumpsters, broken parking barriers, broken glass littering the site, dead trees and shrubbery together with weeds, lack of building maintenance, homeless encampments, and unsightly and dilapidated fencing.

Urban Decay Approach

CBRE Consulting's approach to assessing the potential for urban decay is grounded in all of the preceding analysis, focused on determining if the Project and identified cumulative projects will directly or indirectly cause any existing retailers to close, and if the subsequent vacancies will remain vacant for a prolonged period of time such that they develop the symptoms cited above that contribute to and eventually lead to urban decay. As reviewed in the preceding chapters, new household demand by 2030, the assumed operational year of the Project's retail developments, is anticipated to be sufficient to result in minimal anticipated negative sales impacts on existing retailers attributable to each project independently. There is anticipated to be new demand due to household growth in adequate quantities to support the Project's retail components (as well as recaptured leakage relative to HPS Phase II) as well as existing retail developments that may experience some Project-related diverted sales. This is the case for retail developments located in the respective HPS Phase II and Candlestick Point market areas as well as for nearby retail developments with shared market area portions.

The planned Project's retail developments are also not perceived to lead to the closure of existing retailers on a cumulative basis after consideration of demand generated by household growth. Despite identified plans for 3.5 million square feet of cumulative retail development, the Project's retail components are not anticipated to result in retail store impacts leading to prolonged retail store vacancy. While some stores may close as a result of diverted retail sales, sufficient retail demand is anticipated to occur in other retail categories that will enable new or expanded retail enterprises to backfill the resulting vacancies. Therefore, the existing retail commercial base is not anticipated to experience prolonged vacancy or other condition likely to contribute to or lead to urban decay.

Urban Decay Conclusion

Based upon the findings regarding the presence of new retail demand sufficient to support the planned Project, other cumulative retail projects, and/or backfill retail spaces vacated as a result of project impacts, CBRE Consulting concludes that the Project's retail components will not cause or contribute to urban decay. This finding pertains to the Project's retail components on both an individual and a cumulative basis.

II. INTRODUCTION

This analysis evaluates the economic impact of the retail portion of the Candlestick Point – Hunters Point Shipyard Phase II Development Plan ("Project"), a mixed use development planned for an approximately 764-acre area in the Candlestick Point and Hunters Point Shipyard (HPS) neighborhoods of San Francisco. The many land uses planned for the Candlestick Point – Hunters Point Shipyard Phase II Development Plan (referred to throughout this report as the "Project") include residential, retail, office, research & development, hotel, artist's studios/artist education center, institutional, parks & open space, the 49ers Stadium, ferry terminal, marina, performance venue, and parking. Two major areas of retail are planned: a 635,000-square-foot regional center at Candlestick Point with an adjacent 125,000-square-foot neighborhood retail and business services area; and a second 125,000-square-foot neighborhood retail area at Hunters Point Shipyard. The neighborhood retail at Hunters Point Shipyard ("HPS Phase II") is located in and adjacent to a planned Village Center.

STUDY BACKGROUND AND PURPOSE

An Environmental Impact Report (EIR) for the Project is being prepared and coordinated by PBS&J. To support this effort and comply with the California Environmental Quality Act (CEQA), CBRE Consulting was asked to assess the potential for the proposed retail development to cause urban decay. The decision by the Fifth District Court of Appeal in *Bakersfield Citizens for Local Control v. The City of Bakersfield* indicated that CEQA requires a lead agency to consider and analyze the potential for the introduction of planned retailers to result in adverse physical impacts on the environment by causing a chain reaction of store closures and long-term vacancies, otherwise referred to as a condition of "urban decay." This study addresses the concerns voiced in the Bakersfield decision by considering the potential impact of the Project in conjunction with the introduction of other retail developments in San Francisco and the surrounding area. For purposes of this analysis, and to be consistent with the EIR, the Project is expected to be completed such that the retail tenants will have their first full year of operations in 2030.

STUDY TASKS

CBRE Consulting performed numerous tasks during the course of this assignment. In brief, these tasks included the following:

- Estimated the retail sales associated with the two components of retail planned at the Project;
- Defined the market areas for each retail component;
- Estimated the share of the Project's sales to be generated by residents of the Project market areas;
- Conducted retail demand, sales attraction, and spending leakage analyses for the Project market areas;
- Estimated the maximum potential impacts on existing Project market area retailers due to the introduction of the Project;
- Conducted fieldwork to evaluate existing market conditions;
- Assessed the competitiveness of existing Project market area stores and likely impacts on these stores;
- Identified competitive planned retail projects that could contribute to cumulative impacts;

- Assessed the cumulative impacts of planned retail projects;
- Assessed the potential impacts to retail outside of but near the Project market areas; and
- Assessed the extent to which the Project and the opening of other cumulative retail developments may or may not contribute to urban decay.

These tasks were completed in Summer 2009, and the related analysis is based on government data and other research information most currently available during that period.

STUDY RESOURCES

Many resources were relied upon for this study. Information on the Project was obtained from Lennar Urban and PBS&J. An estimate of the retail mix at the two components was developed in coordination with Lennar Urban and the San Francisco's Base Reuse and Real Estate Development Department. A reference material for determining the retail mix at the neighborhood retail component adjacent to the Candlestick Point regional center was the *Retail Market Analysis for Candlestick Point* study done by Irwin Development Group in January 2008.

Data on retail sales per square foot for store types and specific retailers were obtained from specific stores' 10-K reports on file with the United States Securities and Exchange Commission. Other estimates utilize Retail MAXIM, *Alternative Retail Risk Analysis for Alternative Capital 2004, 2006, and 2008* and *Dollars & Cents of Shopping Centers/The Score 2008*. Market area retail sales estimates for 2008 were obtained from Claritas, Inc., a national provider of demographic and economic data and used in conjunction with taxable sales data from the State of California Board of Equalization (BOE) for 2007, the most recent annual data available when this study was completed. Data for recent trends in San Francisco sales tax came from the city's tax consultant, MuniServices. Projections for retail sales by category were based upon Hinderliter de Llamas (HdL) projections.

Data on drugstore sales payer composition were obtained from company's 10-K filings with the United States Securities and Exchange Commission and the September 2008 Kaiser Family Foundation Report, *Prescription Drug Trends*. Business-specific data identifying local retailers were obtained from Claritas and CoStar, a commercial real estate information service, as well as through field research conducted in May 2009.

The San Francisco Urban Water Management Plan provided household estimates and projections for San Francisco. The Association of Bay Area Government's *2007 Projections* provided household estimates and projections for South San Francisco, Daly City, and Brisbane. Resources prepared by Claritas, Inc. were relied upon for average household income trend data as well as some household estimates. Sources for information on cumulative projects include Fehr & Peers as well as the planning departments of the following cities: San Francisco, Brisbane, South San Francisco, Daly City, Colma, Millbrae, Burlingame, Foster City, San Mateo, and San Bruno.

REPORT ORGANIZATION

This report includes eleven chapters, organized as follows:

I. Executive Summary
II. Introduction
III. Project Definition and Sales Projections
IV. Project Market Area Description
V. Retail Market Characterization
VI. Retail Sales Base Characterization
VII. HPS Phase II Retail Sales Impacts
VIII. Candlestick Point Retail Sales Impacts
IX. Impacts on Retailers Outside the Market Area
X. Cumulative Impacts
XI. Urban Decay Determination

This report is subject to the appended Assumptions and General Limiting Conditions. All of the exhibits referenced in the report are included in the Appendices.

III. PROJECT DEFINITION & SALES PROJECTIONS

CBRE Consulting's findings relative to the anticipated retail sales for the proposed retail at the Project are presented below. These include estimates of the total retail sales generated by the two different retail components of the Project: Candlestick Point Regional Center and Neighborhood Retail/Main Street Concept; and HPS Phase II Neighborhood Retail. Sales calculations for the Project and supporting retail space are based on average sales per square foot estimates for retail store types and categories that will be represented. These averages were calculated using Retail MAXIM, *Alternative Retail Risk Analysis for Alternative Capital 2004, 2006, and 2008*. This portion of the analysis classifies the projected sales according to retail categories reported by the California Board of Equalization, which provides a basis for analyzing potential sales impacts related to the Project and to cumulative retail developments, which are described in Chapters VII, VIII, IX, and X.

DEVELOPMENT PROGRAM AND TIMING

The Candlestick Point and HPS Phase II retail components of the Project are planned in the areas of San Francisco congruent with their names in a 764-acre area east of U.S. Highway 101 in the southeast area of the City and County of San Francisco. Candlestick Point is located near the intersection of Harney Way and Jamestown Avenue and HPS Phase II is planned near the intersection of Spear and Fischer avenues in San Francisco. Build-out for the retail portions of the Project is anticipated for 2030. The components analyzed by CBRE Consulting include the following:

Candlestick Point Retail

- ***Regional Center.*** Anchored by a 125,000-square-foot general merchandiser, this 635,000-square-foot outdoor shopping center is planned in Candlestick Point. Other anchors are a 60,000-square-foot grocery store and a cinema. Large stores planned include those selling books, sporting goods, hardware, and electronics. Smaller stores will include 70,000 square feet of apparel, a food court, sit-down restaurants, furniture and home furnishings, gifts, and specialty retail. A small portion of the space is allocated to business and personal services stores such as banks, spas, and salons.
- ***Neighborhood Retail/Main Street Concept.*** Located on two streets adjacent to the regional center, this retail area will have a total of 125,000 square feet. Half of the space is expected to be composed of business and personal services shops such as doctors, lawyers, and insurance offices that do not produce taxable sales.[1] About 20 percent of the space, or 25,000 square feet, is planned for cafes and other restaurants. A drug store is expected as well as some specialty and other retail stores.

[1] This relatively large amount of business and personal services stores is consistent with The Irwin Development Group's January 2008 study *Retail Market Analysis for Candlestick Point, San Francisco, California*. This study examined three Bay Area retail districts with a Main Street concept (Grand Avenue in South San Francisco, Solano Avenue in Albany, and the Broadway downtown area in Redwood City) and found that each had a similarly high level of business and personal services stores.

HPS Phase II Neighborhood Retail

The HPS Phase II neighborhood will be located in a Village Center and along adjacent streets. With a total of 125,000 square feet, the largest component, a small grocery store, will account for 30 percent of the space. General merchandise retailers, restaurants, and specialty retail are anticipated to account for 15 percent of the space each. Other retailers and business and personal services stores are each projected to account for 10 percent of the space. About 5 percent of the space is estimated to be filled by home furnishings and appliances stores.

These retail components in the Project will comprise a total of 885,000 million square feet of space, which is the focus of this analysis. Exhibit 1 presents the details for the planned development.

APPROACH TO ESTIMATING AND ALLOCATING PROJECTED SALES

In order to estimate the impact of the planned retail centers to the existing retail sales base, CBRE Consulting first allocated the retail by component, provided in Exhibit 1, into the retail categories used by the California State Board of Equalization (BOE). This translation facilitates a direct comparison of the projected Project retail sales to the existing sales in the market areas, which will be identified and defined in the following chapters. The cinema (concession sales) as well as electronics/appliances, sporting goods, and books are classified in the Other Retail category. These retail space category allocations are presented in Exhibit 2.

Project Sales Per Square Foot Assumptions

CBRE Consulting estimated the Project's projected retail sales based on the square feet allocated to each retail category and a sales per square foot figure attributed to each category. If a prospective retail tenant had been identified by the developer, or if a reasonable assumption could be made regarding the specific tenant type that is likely to occupy a space, then CBRE Consulting utilized sales per square foot figures for those specific retail stores or store types. In its 2004, 2006, and 2008 publications titled *Alternative Retail Risk Analysis for Alternative Capital,* Retail MAXIM estimates sales per square foot for retail stores and store categories during the years 2003, 2005, and 2007, respectively. CBRE Consulting averaged the sales per square foot figures achieved by representative retail stores during these three years to estimate the sales per square foot potential for similar stores within the Project. By averaging three years of data that span five years in time, the sales per square foot figures are normalized across several years that had varying economic characteristics. This process is detailed in Exhibit 3. First, the 2005 and 2007 sales estimates were deflated to 2003 dollars, then the sales estimates from all three years (2003, 2005, and 2007) were averaged in 2003 dollars. Finally, the average figure was inflated from 2003 to 2009 dollars.[2] A summary of averages from Exhibit 3 is presented in Exhibit 4 by BOE Category in 2009 dollars.

[2] Inflation was calculated based on the Bureau of Labor Statistics *Consumer Price Index for All Urban Consumers in the United States*. The average annual inflation rates used were: 3.03 percent from 2003 to 2005; 3.04 percent from 2005 to 2007; and 1.44 percent from 2007-2009.

Drug Store Sales Adjustment

The General Merchandise Stores category average is weighted based on the share of General Merchandise sales attributable to drug stores. According to MuniServices, the city's tax consultant, drug store sales in San Francisco represented approximately 21.7 percent of total General Merchandise group sales.

This analysis makes a distinction between total drugstore sales and resident-supported drugstore sales. Prescription drug revenues at drugstores are supported both by customers and third-party payers (such as health insurance groups and Medicaid). A review of major drugstore chains' financial statements found that third-party payments comprise a large share of drugstore revenues, as shown in Exhibit 5. The findings suggest that sales from direct customers support, on average, about 50.5 percent of total drugstore revenues; the remainder of store revenues is generated by third-party payers. Therefore, for the purpose of this analysis, it is assumed that household spending comprises 50.5 percent of total drugstore sales.

Sales Timing and Presentation Level

While the first new retail may open as early as 2015, full build-out is expected to be completed in 2029 such that many Project retailers are likely to open and to have a first full year of operations in 2030. New stores typically require two to three years to reach stabilized sales levels, but for purposes of this analysis, CBRE Consulting assumes that stabilized sales levels for all of the Project's retail components will be achieved in 2030.

CBRE Consulting prepared its sales estimates in constant 2009 dollars. This base year allows for an effective comparison of all related data later in the report. In addition, all sales figures in this analysis, unless stated otherwise, are reported in 2009 constant dollars.

ANTICIPATED PROJECT SALES

BOE Retail Sales Categories

As shown in Exhibit 2 and discussed previously, CBRE Consulting allocated the projected sales to categories that match the classifications reported by the BOE, which publishes taxable retail sales figures for cities and counties. To maximize the use of these data, the analysis is benchmarked to the BOE retail categories and the related sales figures reported in its *Taxable Sales in California* publication. These categories, as typically reported for cities, include the following:

- General Merchandise Stores;
- Apparel Stores;
- Food Stores;
- Eating and Drinking Places;
- Home Furnishings and Appliances;
- Building Materials;
- Motor Vehicles and Parts;
- Service Stations; and
- Other Retail Stores.[3]

[3] The Other Retail Stores category includes a wide range of retailers such as pet supplies, office supplies, garden stores, sporting goods, jewelry, books, florists, and gifts.

The BOE records a retailer's sales in only one sales category, even if that store sells a range of consumer goods that would otherwise be categorized into several different categories if they were sold at stores with more specific product offerings.

Non-Retail Tenant Sales

Some space at each of the Project's retail areas is allocated to non-retail tenants, which include bank branches, business services (e.g., tax preparation, real estate offices), and personal services such as hair and nail salons and dentist offices. Since revenues for these types of tenants are not tracked by the BOE, the analysis uses broader retail demand growth (based on projected new households and BOE-based sales estimates) as a proxy for the likely demand for non-retail services. In other words, if future demand from new household growth is high enough such that substantial retail sales impacts are not anticipated, then the related demand from new households should also be sufficient to support services-oriented tenants in the Project's retail areas as well. This approach will be discussed further in Chapters VII and VIII, which address potential sales impacts. However, the sales estimates that follow are for retail tenants only, as defined by the BOE classifications.

Candlestick Point

Regional Center. In estimating the annual retail sales from the 635,000-square-foot Candlestick Point regional center, CBRE Consulting assumed an average vacancy rate of 5.0 percent of the gross leasable area in order to account for normal tenant turnover. Accounting for this vacancy, the total occupied space for the regional center is estimated to be 606,000 square feet.[4] Table 2 summarizes the distribution of retail sales estimated for the Candlestick Point regional shopping center by BOE category. Total sales are $190.6 million; the largest category is "other retail stores" which includes an electronics/appliance store, sporting goods store, book store, cinema, gift stores, and other specialty retailers. The next two largest categories are general merchandise and apparel.

[4] The 29,000 square feet of vacant space are less than 5.0 percent of the total regional center square feet because the 55,000-square-foot cinema space is assumed to be 100 percent occupied. Therefore, the 5.0 percent vacancy allowance is applied to only 580,000 square feet of gross leasable area.

Table 2: Candlestick Point Regional Center
Estimated Sales by Retail Category[1]
In 2009 Dollars

Retail Category	Estimated Occupied Sq. Ft.	Estimated Sales Per Sq. Ft.	Annual Sales Estimate
Apparel	66,500	$429	$28,528,500
General Merchandise	118,750	$282	$33,441,885
Food Stores	57,000	$462	$26,334,000
Eating and Drinking Places	64,125	$433	$27,766,125
Home Furnishings & Appliances	28,500	$278	$7,923,000
Building Materials	47,500	$312	$14,820,000
Other Retail			
Electronics/Appliance Store	47,500	$496	$23,560,000
Sporting Goods Store	38,000	$254	$9,652,000
Books & Stationary Store	23,750	$263	$6,246,250
Gifts and Novelty Store	23,750	$160	$3,800,000
Other Specialty Store	21,375	$270	$5,771,250
Cinema	55,000	$50	$2,750,000
Other Retail Subtotal	209,375	N/A	$51,779,500
Non-Retail	14,250		
Total	606,000		$190,593,010

Sources: Exhibit 6; and CBRE Consulting.
(1) Based on California State Board of Equalization retail categories.

Subsequent analysis examines the extent to which the $190.6 million in estimated Candlestick Point sales may or may not have an impact on existing retailers.

Neighborhood Retail. In estimating the annual retail sales from the 125,000-square-foot neighborhood retail/main street concept planned on two streets adjacent to the regional center, CBRE Consulting again assumed an average vacancy rate of 5.0 percent of the gross leasable area in order to account for normal tenant turnover. Accounting for this vacancy, the total occupied space is estimated to be 118,750 square feet. Table 3 presents the distribution of retail sales estimated for the Candlestick Point neighborhood retail/Main Street concept by BOE category. Total sales are $26.7 million comprised of $10.3 million in restaurants, $9.1 million in other retail stores, and $7.3 million in general merchandise.

Table 3
Candlestick Point Neighborhood Retail/Main Street Concept
Estimated Sales by Retail Category[1]
In 2009 Dollars

Retail Category	Estimated Occupied Square Feet	Estimated Sales Per Sq. Ft.	Annual Sales Estimate
General Merchandise (Drug Store)	11,875	$617	$7,326,875
Eating & Drinking Places	23,750	$433	$10,283,750
Other Retail Stores	23,750	$382	$9,072,500
Non-Retail	59,375	N/A	N/A
Total	118,750		$26,683,125

Sources: Exhibit 7; and CBRE Consulting.
(1) Based on California State Board of Equalization retail categories.

Subsequent analysis examines the extent to which the $26.7 million in estimated sales at Candlestick Point may or may not have an impact on existing retailers.

HPS Phase II Neighborhood Retail

The HPS Phase II neighborhood retail is planned for a total of 125,000 square feet. Utilizing the same methodology for estimating retail sales planned at Candlestick Point, CBRE Consulting again assumed that 5.0 percent of the space would be vacant due to normal tenant turnover. Accounting for this unoccupied space, the estimated total occupied space would be 118,748 square feet.

Table 4 summarizes the distribution of retail sales estimated for the HPS Phase II neighborhood retail by BOE category. The largest component of the total $43.5 million in sales will be the grocery store with $16.5 million in sales. The next largest category is Other Retail Stores with $11.3 million retail sales estimated.

Table 4
HPS Phase II Neighborhood Retail
Estimated Sales by Retail Category[1]
In 2009 Dollars

Retail Category	Estimated Occupied Square Feet	Estimated Sales Per Sq. Ft.	Annual Sales Estimate
General Merchandise	17,812	$354	$6,312,779
Food Stores	35,625	$462	$16,458,750
Eating & Drinking Places	17,812	$433	$7,712,596
Home Furnishings & Appliances	5,937	$278	$1,650,486
Other Retail	29,687	$382	$11,340,434
Non-retail	11,875	N/A	N/A
Total	118,748		$43,475,045

Sources: Exhibit 8; and CBRE Consulting.
(1) Based on California State Board of Equalization retail categories.

Subsequent analysis examines the extent to which the $43.5 million in estimated sales at HPS Phase II may or may not have an impact on existing retailers.

IV. PROJECT MARKET AREA DESCRIPTIONS

This chapter describes the boundaries of the market areas determined for each of the Project retail components – the regional and neighborhood shopping areas at Candlestick Point and the neighborhood retail in HPS Phase II. These market areas are the focal points for further analysis of supply and demand in Chapters VII and VIII, and for the urban decay determination in Chapter XI. In addition, Chapter V, Retail Market Characterization, discusses the broader San Francisco area retail market, including the relevant retail submarkets that are within and near the two defined market areas.

APPROACH TO MARKET AREA DEFINITIONS

For the purpose of analyzing the prospective economic impacts of the retail components of the Project, CBRE Consulting defined a market area for each of the project components: the regional center and neighborhood retail at Candlestick Point and HPS Phase II neighborhood retail. Shopping center trade area definition draws on a range of factors including but not limited to the location of competitive supply, prevailing commute patterns in the region, and physical barriers (both topographical and psychological). The International Council of Shopping Centers (ICSC), widely considered the retail real estate industry's pre-eminent research organization, states:

> "A trade area is the geographic market that you will be offering to potential retailers as a consumer market… Defining a retail trade area is an art and a science. In general, a trade area should reflect the geography from which 75-90 percent of retail sales are generated. Different stores can have different trade areas based on their individual drawing power and the competitive market context."[5]

While geographic considerations and the location of competitive retail centers are a major determinant of a planned center's market area, each shopping center has a unique market draw based on its format and mix of tenants. Literature published by the Urban Land Institute (ULI), a non-profit research and educational organization with the mission of providing leadership in the responsible use of land and in creating and sustaining thriving communities worldwide, supports that a shopping center's format is another major determinant of its market area:[6]

> "The trade area traditionally is the geographic area that provides the majority of the steady customers necessary to support a shopping center. The delineation of trade areas is more complex than in the past as a result of the proliferation in the variety and volume of shopping centers already present in most trade areas. It is further complicated by the existence of multiple consumer markets attracted to a center by their affinity for the type of goods sold and the environment in which they are sold rather than because the center is located within a prescribed distance of home or office."[7]

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[5] International Council of Shopping Centers (ICSC), *Developing Successful Retail in Secondary & Rural Markets*, 2007, p. 7.
[6] ULI mission statement according to the ULI website (http://www.uli.org/LearnAboutULI.aspx), accessed September 2009.
[7] Urban Land Institute, *Shopping Center Development Handbook*, Third Edition, 1999, p. 46.

The two market areas defined for the Project were determined through two distinct processes to account for the fact that the regional center at Candlestick Point and the HPS Phase II neighborhood retail will be oriented towards two distinct consumer markets. Consistent with industry definitions of shopping center market areas, however, they each represent the geographic area in which the estimated majority of the shopping center's repeat customers reside.

CANDLESTICK POINT MARKET AREA

Approach

CBRE Consulting conducted research to estimate the market area for the proposed Candlestick Point regional center and neighborhood retail component. The 635,000-square-foot open-air regional center is planned to be anchored by a 125,000-square-foot general merchandiser, a 60,000-square-foot grocery store, and a cinema. Other large stores are in the categories of electronics, hardware, sporting goods, and books. The neighborhood component is planned as a main street concept located on two streets directly adjacent to the regional center. One street will be dominated by personal and business services while the other street will have a mix of restaurants, cafes, and other retailers. A drug store is planned to anchor the neighborhood component. Because of the close proximity of the neighborhood retail, it is included in the larger regional center's market area. Although neighborhood retail does not typically have a wide draw, when it is part of or near to a regional center it can benefit by the larger draw of the larger center. CBRE Consulting believes that shoppers drawn to the regional center will also visit the stores in the adjacent neighborhood retail component because it is convenient.

Industry sources such as ICSC and ULI were first consulted to determine what factors are most indicative of trade area boundaries for regional shopping centers. The regional shopping center format is defined by ICSC as follows:

> "A regional center provides general merchandise, apparel, furniture, and home furnishings in depth and variety, as well as a range of services and recreational facilities. It is built around one or two full-line department stores of generally not less than 50,000 square feet, although there are exceptions in small communities."[8]

ICSC defines the typical market area for regional shopping centers as being within a 5- to 15-mile radius. San Francisco has a relatively small geography with a dense urban population. Because of this, and the hilly topography of San Francisco, it was determined that a simple radius would be unrealistic and would not reflect the realities of how long it takes to drive from one point to another. Instead, the market area was determined primarily through drive-time analysis. Although up to 15-20 percent of all retail trips to the Project are anticipated to be generated by public transit,[9] the drive-time estimates are viewed as a reasonable approximation of the accessibility of the Project's retail areas.

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[8] ICSC / ULI, *Dollars & Cents of Shopping Centers / The Score 2008*, page 5.

[9] Personal communication from Eric Wolmerdorff, Fehr & Peers, to Wells Lawson, City of San Francisco Office of Economic & Workforce Development, October 2009.

Description and Boundaries

The Candlestick Point retail market area is roughly an area that is within a 15-minute drive of the planned center. Exhibit 10 displays its borders. The two major highways, 101 and 280, and major arterial streets, influence the shape of the market area. Market Street in San Francisco was deemed an appropriate northern boundary for the Candlestick regional center market area because it is approximately a 15-minute drive time from Market Street to the Candlestick Point retail site and it marks a geographic boundary between the north of market and south of market neighborhoods. Guerrero Street in the Mission District is another boundary for the market area as well as Geneva Avenue, which crosses from San Francisco into Brisbane. The market area skirts the edge of San Bruno Mountain State and County Park in San Mateo County, a natural boundary. As the market area follows Highway 101 south it includes most of the small City of Brisbane, a small portion of Daly City around the Cow Palace, and a portion of the City of South San Francisco just north of the San Francisco International Airport. The area around the airport was excluded because it has a limited population base.

CBRE Consulting estimates that residents of the Candlestick Point regional center's market area will generate 80 percent of the sales as shown in Exhibit 6 because Hwy 101 provides an opportunity to capture commuters and out-of-town visitors. Thus, shoppers coming from outside the market area will generate the remaining 20 percent of sales. The 20 percent estimate is also consistent with the passage quoted above from ICSC, which states that in general, residents of shopping center market areas generate 75 to 90 percent of sales at that center.

HPS PHASE II MARKET AREA

Approach

CBRE Consulting conducted research to estimate the market area for the proposed HPS Phase II neighborhood retail shopping area. Industry source ICSC was consulted to determine what factors are most indicative of trade area boundaries for neighborhood shopping areas. According to ICSC, neighborhood shopping centers typically have a three-mile trade area radius and are defined as follows:

> "A neighborhood center provides for the sale of convenience goods (food, drugs, and sundries) and personal services (laundry and drycleaning, barbering, shoe repairing, etc.) for the day-to-day living needs of the immediate neighborhood."[10]

Since neighborhood shopping areas cater to convenience shoppers, the trade area was identified based on the proximity of households as well as the location, size, quality, and other characteristics of existing shopping centers and retail districts deemed to be competitive with the planned HPS Phase II neighborhood retail area.

[10] ICSC / ULI, *Dollars & Cents of Shopping Centers / The Score 2008*, page 5.

Description and Boundaries

The market area defined for the HPS Phase II neighborhood retail area is for the most part a three-mile radius. This boundary roughly corresponds with a 10-minute drive time. The market area's northward reach is abbreviated at Cesar Chavez Street. Within the market area there are very few concentrations of neighborhood retail; however, in the area just north of Cesar Chavez Street there are several grocery-anchored neighborhood shopping centers. Residents in those areas are more likely to go to the center closest to them than to the retail planned at HPS Phase II. Therefore, that area was excluded from the HPS Phase II neighborhood retail market area.

CBRE Consulting estimates that market area residents will generate 95 percent of the HPS Phase II neighborhood retail area's sales as shown in Exhibit 8. Thus, shoppers coming from outside the market area will generate the remaining 5 percent of sales. This distribution is consistent with the guidelines set forth by ICSC and ULI (discussed in the previous section of this chapter), and takes into account that the neighborhood retail area's convenience orientation will draw its customer base more from nearby households than from distant ones.

V. RETAIL MARKET CHARACTERIZATION

Retail demand in San Francisco and northern San Mateo County is substantial, though the extent to which it can absorb the Project's planned retail areas without over-saturating the market and contributing to potential store closures and urban decay is dependent upon many complex factors. These include the size and strength of the area's retail inventory, the characterization of San Francisco as a retail hub, the performance of key retail submarkets, the historic ability of the market to back-fill vacancies, and the demonstrated level of retailer interest in establishing new operations in San Francisco. Assessment of these factors provides a backdrop for analyzing the planned Project retail components, as well as other planned new cumulative retail centers.

BACKGROUND

CBRE Consulting's analysis of the local retail market was based on a range of research and background resources. First, the firm has completed numerous real estate research projects in the San Francisco Bay Area and is generally familiar with the characteristics of the geographic areas covered in this study. Second, CBRE Consulting conducted field research of the major regional and neighborhood shopping nodes in southeastern San Francisco and nearby cities in May 2009 to gain a better understanding of current market conditions including shopper volumes, the level of retail vacancy, and the general condition of local retail properties. Various commercial databases, including Claritas and CoStar, informed this fieldwork by providing background on the larger shopping centers and retail businesses in the area. Moreover, taxable retail sales data from the California Board of Equalization (BOE) and information on sales tax collections from the City of San Francisco complemented the field research by providing a view of the relative performance of retail categories within specific geographic areas. Third, CBRE Consulting contacted local economic development and planning officials to understand their views on shopping patterns and the strengths and weaknesses of individual retail areas. Several prior research studies, including a January 2008 report prepared by Irwin Development Group for the Project and a Seifel Consulting May 2009 Draft report prepared for the San Francisco Redevelopment Agency on the Bayview Hunters Point Redevelopment Area offered additional background for this analysis.[11]

RETAIL MARKET OVERVIEW

San Francisco is a major retail attraction market, drawing consumers from far beyond the city limits. Tourism is a significant factor in retail sales. In 2008, the San Francisco Convention & Visitors Bureau estimates that 16.4 million visitors to San Francisco spent $3.6 billion on restaurants, general merchandise, apparel, gas/auto services, and miscellaneous retail.[12] That comprises a large portion of San Francisco's previous year's total annual taxable sales as reported by BOE as $10.0 billion. Although tourism was up in 2008, the California Travel & Tourism Commission forecasts that tourist spending will decline 8 percent in 2009.[13] In fact, in the first half of 2009, hotel occupancy at San Francisco hotels was down 8.4 percent.[14] This drop in tourism

[11] See "Retail Market Analysis for Candlestick Point, San Francisco, California, January 2008," Irwin Development Group, and "Bayview Hunters Point Redevelopment Plan Amendment, Existing Conditions Report, May 2009 Administrative Draft," prepared for the San Francisco Redevelopment Agency by Seifel Consulting.
[12] "Total Direct Visitor Spending within San Francisco: 2008," San Francisco Convention & Visitors Bureau.
[13] "State expects tourist spending to fall 8%", by George Raine, *San Francisco Chronicle*, February 18, 2009.
[14] PKF Consulting.

may have a big effect on San Francisco's retail sales in 2009; however, the decline in tourism is expected to be temporary. Moody's Economy.com forecasts that San Francisco will start to recover from the current recession in 2010.

As a regional center, San Francisco also draws large numbers of commuting employees from surrounding areas, who also contribute to the City's retail sales attraction. For example, the Metropolitan Transportation Commission, the transportation planning agency for the nine-county Bay Area, estimated that San Francisco's net in-commute (i.e., total employment less employed residents) was 171,544 employees in 2006 and projected that this figure would increase to 314,073 employees by 2035.[15] This net inflow contributes to restaurant sales, purchases at downtown shopping areas, and stops at shopping centers along major traffic routes.

According to Terranomics, market rents for shopping centers in San Francisco as of mid-year 2009 ranged from $27.00 to $100.00/year per square foot with an average asking rate of $47.30. [16] This average is higher than any of the other nine counties in the Bay Area. Total leasable space in San Francisco shopping centers is estimated at approximately 3.8 million square feet. However, San Francisco's retail market is highly decentralized, with much of the retail space located outside of formal centers. Statistics from Terranomics exclude the concentration of non-shopping center retail at Union Square, in the Downtown area, and in neighborhood retail districts. The average vacancy rate in San Francisco shopping centers as of mid-year 2009 was at 7.5 percent, up from 5.3 percent one year ago. [17]

RETAIL SALES MIXES BY GEOGRAPHY

San Francisco, San Mateo County, and Selected Cities

The BOE publishes taxable retail sales information for cities and counties in California, which were available for 2007 on a full-year basis and through the first two quarters of 2008 on a quarterly basis when CBRE Consulting's analysis was prepared. Table 5 below presents the BOE information for San Francisco, for San Mateo County, and selected northern San Mateo County cities that have regionally-oriented shopping centers that tend to attract some San Francisco shoppers.

[15] See "Travel Forecasts Data Summary: Transportation 2035 Plan for the San Francisco Bay Area, December 2008," Metropolitan Transportation Commission; (http://www.mtc.ca.gov/maps_and_data/datamart/forecast/).
[16] Annualized NNN. From "Bay Area Retail Report: Mid Year 2009" by Terranomics, the Retail Division of BT Commercial. The average rent among Bay Area shopping centers is estimated at $27.48/month per square foot.
[17] *Ibid.*

Table 5
2007 Taxable Retail Sales for
San Francisco, San Mateo County, and Selected San Mateo County Cities ($ 000s)

Type of Retail	City and County of San Francisco	San Mateo County	City of Daly City	City of San Bruno
Apparel Stores	$1,028,602	$425,086	$67,421	$52,073
General Merchandise	$1,349,158	$1,363,715	$172,447	$147,933
Food Stores	$480,587	$430,879	$48,684	$14,862
Eating & Drinking Places	$2,589,892	$1,245,105	$131,464	$81,352
Home Furn. & Appliances	$608,766	$535,371	$42,527	$9,782
Building Materials	$459,332	$846,050	# (1)	# (1)
Motor Vehicles and Parts	$502,912	$1,579,609	$148,377	$86,450
Service Stations	$565,749	$1,008,460	$109,317	$71,460
Other Retail Stores (1)	$2,421,574	$1,564,706	$125,141	$132,727
Total	**$10,006,572**	**$8,998,981**	**$845,378**	**$596,639**

Sources: State of California Board of Equalization *Taxable Sales in California* report 2007, which was the most recent full year available at the time of this analysis.
(1) The sales marked with a "#" are omitted from the BOE report for the respective year to prevent the disclosure of confidential information. The sales for the unreported categories are incorporated into the Other Retail Stores classification and are also reported as part of total taxable sales.

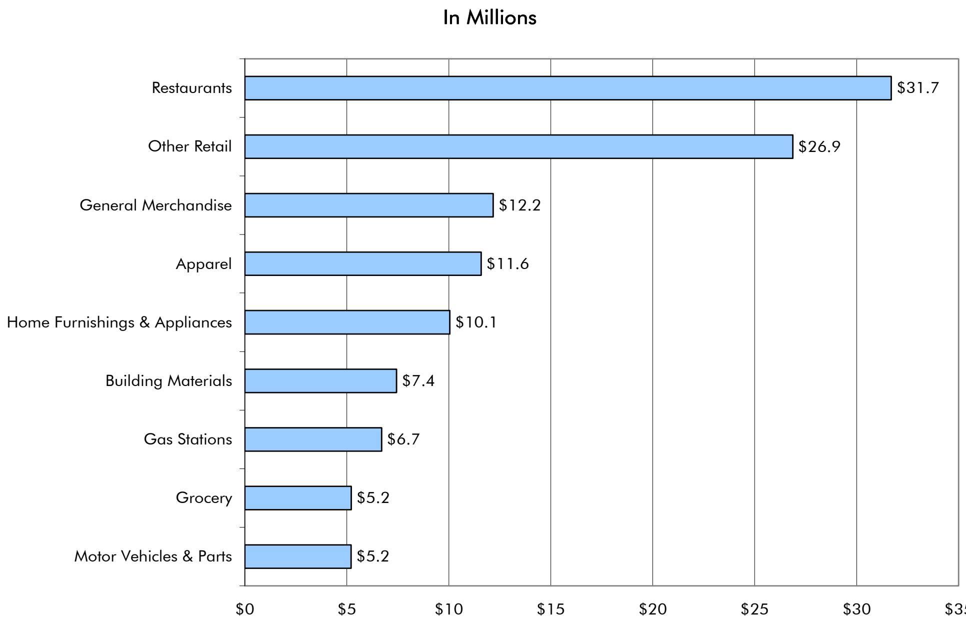
As shown, San Francisco's sales are concentrated in the eating and drinking places category (i.e., restaurants) and among other retail establishments, which include office supplies, computer stores, jewelry, sporting goods, and miscellaneous retail. The sales share for apparel stores (10.3 percent of the total) is also high, especially when compared with the statewide average of 3.7 percent, whereas the shares for motor vehicles and parts, service stations, and building materials are relatively low.[18] San Mateo County, by contrast, offers a much more representative mix of retail when compared with the rest of the state since there are more areas devoted to car dealers and "big box"-type stores. Within San Mateo County, the cities of Daly City and San Bruno host regional-serving retail primarily at Westlake Shopping Center, Serramonte Center, and the Shops at Tanforan, though these two cities still capture a relatively small share of overall purchases among the two counties. Further analysis of the sales mix for the Candlestick Point and HPS Phase II market areas is discussed in Chapter VI, Retail Sales Base Characterization.

San Francisco and Selected Neighborhood Districts

CBRE Consulting also evaluated data provided by the City of San Francisco showing the annual sales tax collections by retail category for 2003-2008, which are prepared by MuniServices, a municipal tax consulting firm. The 2008 sales tax information presents a more current picture of retail activity in San Francisco and reinforces the findings about the mix of retail that were apparent in the BOE figures. Total retail sales tax collected for 2008 was $117.0 million, which reflects San Francisco's percentage share of overall sales tax collections.

[18] See *Taxable Sales In California (Sales & Use Tax) During 2007,* Table 1, California Board of Equalization web site (http://www.boe.ca.gov/news/pdf/ts_a07.pdf).

Chart 1
San Francisco
2008 Retail Sales Tax Collected by Type of Retail



Sources: MuniServices; and CBRE Consulting.

Another advantage of the MuniServices information is that it includes subsets of the data for several neighborhood retail districts within San Francisco, including South Bayshore, which substantially overlaps with the HPS Phase II market area and also accounts for a large section of the Candlestick Point market area. Sales tax data for the Third Street corridor (a subdistrict within South Bayshore), San Bruno Avenue, and Leland Avenue serve as further indicators of the mix and level of the retail activity in the southeastern section of San Francisco. Table 6 presents the sales tax collections for South Bayshore and the other relevant retail districts tracked within the MuniServices data. Since the Third Street corridor appears to be fully within the South Bayshore boundaries, these areas in total provide about 13 percent of the taxable retail purchases in the City.

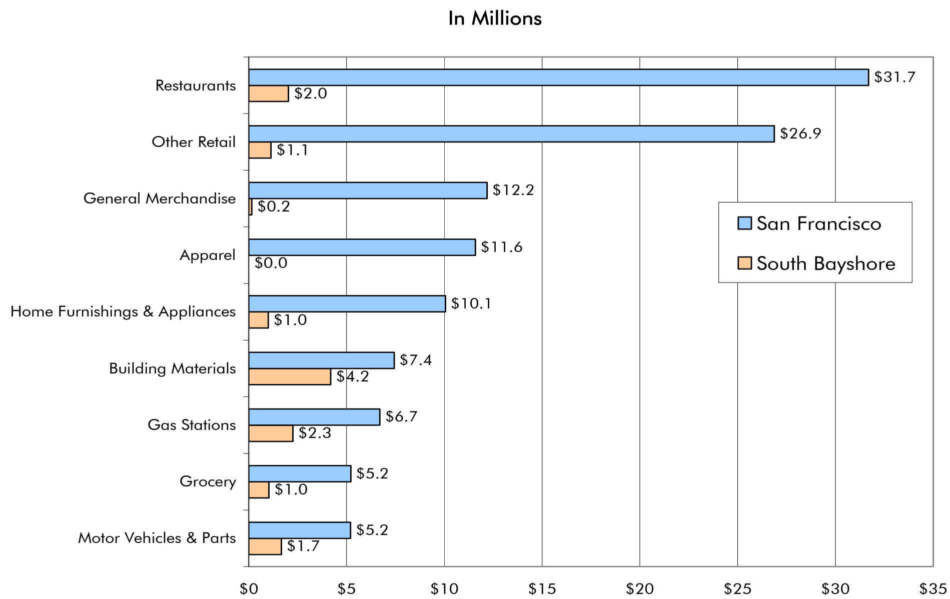
Table 6
Candlestick Point Regional Center Market Area
Retail Districts' Sales Tax Collected for 2008

Retail District/City	2008 Sales Tax	Share of San Francisco
South Bayshore	$13,480,965	11.5%
Third Street (1)	$2,580,886	2.2%
San Bruno Avenue	$1,667,826	1.4%
Leland Avenue	$131,733	0.1%
San Francisco	$116,957,925	100.0%

Source: MuniServices; and CBRE Consulting.
(1) The Third Street Corridor is a subdistrict within the South Bayshore retail district.

The South Bayshore area accounts for the majority of taxable retail activity in these parts of San Francisco. In addition, unlike the City as a whole, the categories of building materials, service stations, and motor vehicles and parts are particularly strong, each comprising at least a third of San Francisco's overall taxable sales in these sectors as shown in Chart 2.

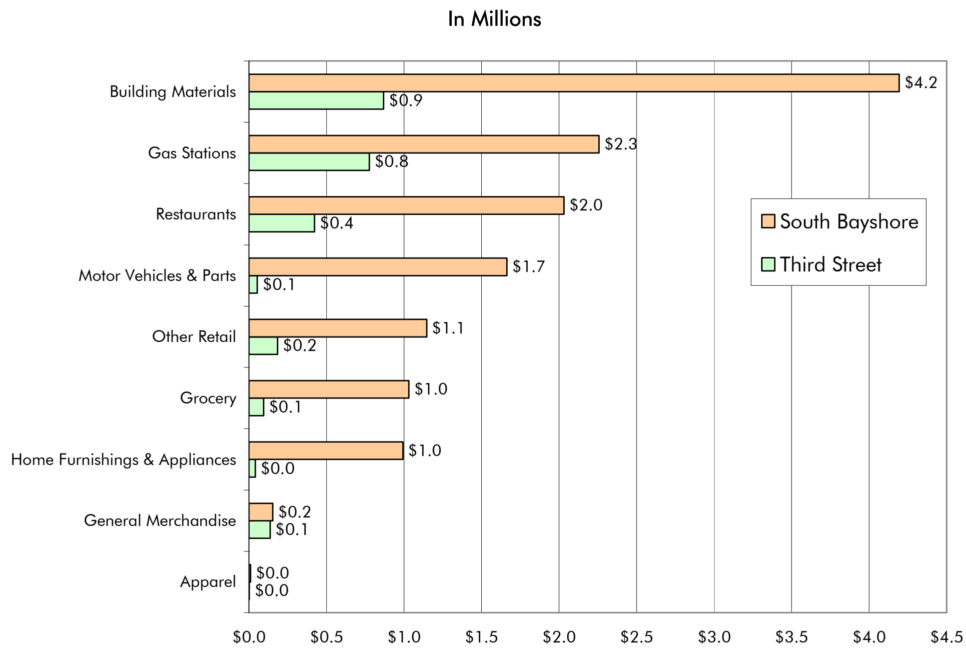
Chart 2
San Francisco vs South Bayshore District
2008 Retail Sales Tax Collected by Type of Retail



Sources: MuniServices; and CBRE Consulting.

The Third Street corridor, a subset of the South Bayshore retail district, is an emerging transit-oriented area following the introduction of a new light rail line along Third Street in 2007. The construction of the Third Street line included a mix of infrastructure improvements such as new sidewalks, lights, and benches. Comprising only 2.2 percent of total San Francisco retail sales tax, with taxable retail sales totaling $258.1 million and sales tax of $2.6 million, the largest taxable retail category in the Third Street corridor is building materials. Gas stations and restaurants are the next two biggest taxable categories. Chart 3 below shows Third Street's retail sales tax in 2008 as compared to tax collected in the much more substantial South Bayshore district.

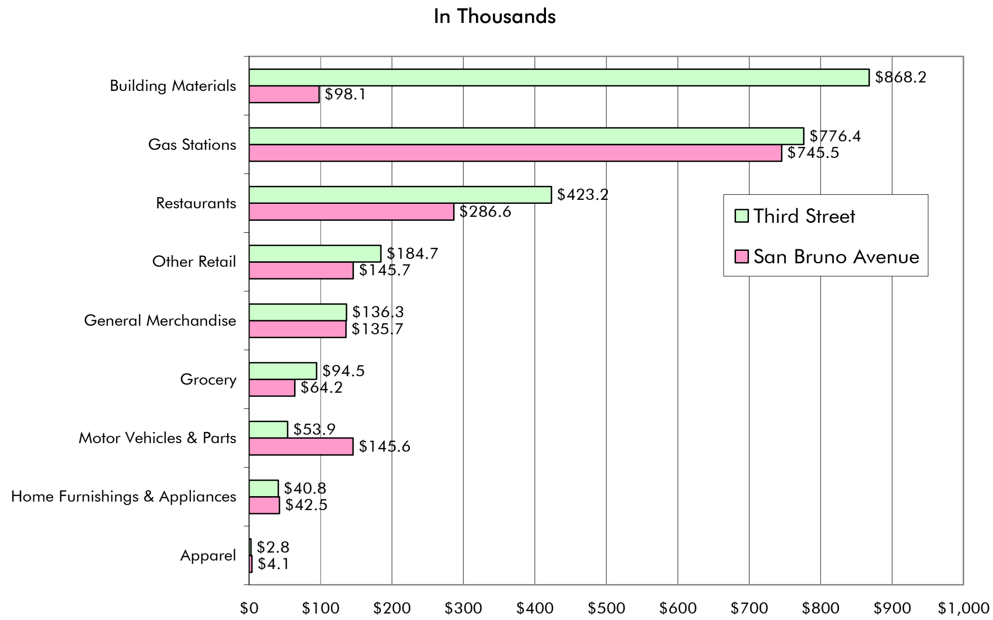
Chart 3
South Bayshore District vs Third Street District
2008 Retail Sales Tax Collected by Type of Retail



Sources: MuniServices; and CBRE Consulting

San Bruno Avenue is a small retail district located just to the southwest of where Highway 101 crosses Interstate 280. The retail sales tax revenues in this corridor account for about 1.4 percent of total sales tax citywide. Gasoline stations contribute the highest share of the district's tax revenues, followed by restaurants, other retail, and motor vehicles and parts (see Chart 4). This neighborhood also appears to have been served by a Cala Foods grocery store (1390 Silver Avenue) that has closed. CBRE Consulting visited this property during its field research in May 2009. At the time, the store was closed with a chain-link fence around the property, and no real estate brokerage signs were visible, which suggests that the property was not yet being marketed to new tenants.

Chart 4
Third Street District vs San Bruno Avenue
2008 Retail Sales Tax Collected by Type of Retail

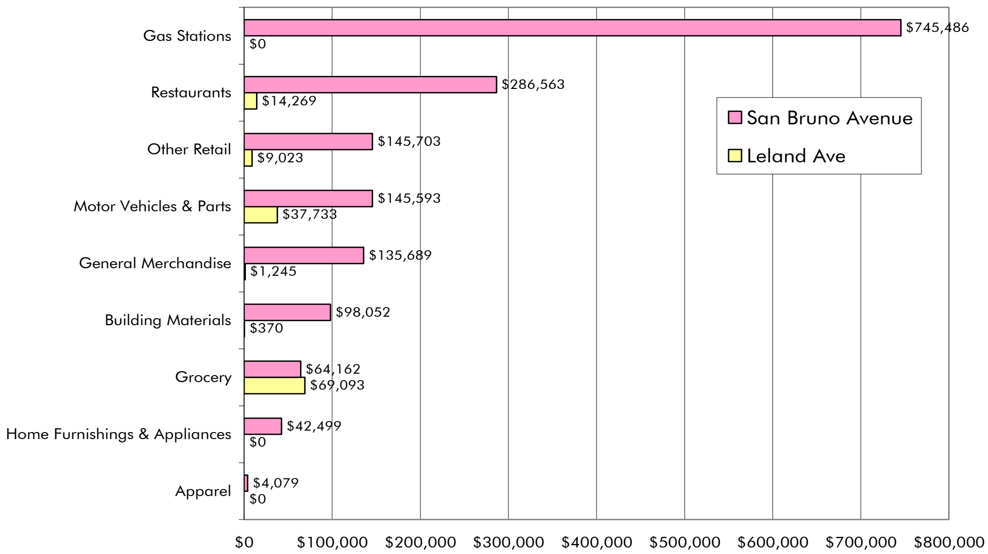


Sources: MuniServices; and CBRE Consulting.

Leland Avenue's retail district is the smallest of the four neighborhood shopping areas in the MuniServices data that CBRE Consulting analyzed, accounting for 0.1 percent of all retail sales tax collected in San Francisco. Taxable retail sales totaled $13.2 million in 2008, with $131,733 collected in sales tax. Chart 5 below shows this district's sales tax by retail type in comparison to San Bruno Avenue.

Chart 5
San Bruno Avenue vs Leland Avenue
2008 Retail Sales Tax Collected by Type of Retail

In Actual Dollars



Sources: MuniServices; and CBRE Consulting.

Sale tax in the Grocery category comprised about half of all retail sales tax in the Leland Avenue district, though it appears that there has also been a recent food store closure in the area.

PROPERTY CONDITIONS AT THE LARGER SHOPPING NODES

CBRE Consulting visited six regional-serving shopping centers in San Francisco and surrounding San Mateo County cities, and numerous neighborhood retail districts that are proximate enough to be considered competitive with the HPS Phase II retail components. Despite the regional and national recession, shopper volume in most areas was moderate during CBRE Consulting's site visits. Moreover, most retail properties were well-maintained, though there were examples of long-term store vacancies in the South Bayshore area that had fallen into some disrepair.

South Bayshore/Third Street Retail Corridor

As mentioned, the South Bayshore area, which is primarily south of Cesar Chavez Avenue and east of Highway 101 in San Francisco, comprises a large part of both the HPS Phase II and the Candlestick Point market areas. While the introduction of the Third Street light rail line has contributed to investment in this neighborhood, this section of the city is largely within the Bayview Hunters Point Redevelopment Project Area. Specifically, Project Area B, as defined by the San Francisco Redevelopment Agency, encompasses most of the Third Street retail corridor.

Seifel Consulting prepared a recent mandated study of the Bayview Hunters Point Redevelopment Area for the San Francisco Redevelopment Agency. While the report highlighted several positive improvements in Project Area B including the planned development of a 15,000-square-foot Fresh & Easy grocery store and the potential opening of a Lowe's Home Improvement store, Seifel Consulting concluded that "Project Area B continues to suffer from unsafe and unhealthy buildings, inadequate circulation, lack of economic development, underutilized retail and commercial corridors, environmental impediments, problem businesses and a high crime rate."[19] These conditions are indicative of economic and physical blight and are "substantial and prevalent"[20] in Project Area B such that further redevelopment was recommended.

With regard to retail properties in particular, the Seifel report indicates that the two retail corridors in the area, Third Street and a section of Bayshore Boulevard, have historically had higher vacancies than other areas of San Francisco due to the perception of crime in the area. One business, a Walgreens located on the corner of Third Street and Williams Avenue reportedly spends $15,000 per month on security measures and loses about $12,000 per month in merchandise theft. There are numerous mid-sized to large retail properties in Project Area B that have experienced long-term vacancies and have fallen into disrepair due to limited demand and existing rent levels that are reportedly too low to justify investments in building improvements. Specifically, the 50,000-square-foot former Goodman's Lumber store on Bayshore Boulevard has been vacant for almost a decade while the adjacent former Whole Earth Access store space has been closed for at least 13 years.[21]

Further analysis by Seifel Consulting indicates that retail lease rates in the Project Area B are much lower than other neighborhood shopping districts in San Francisco due a range of factors:

> Bayview neighborhood commercial establishments struggle to attract desirable tenants due to the poor condition of buildings along Third Street, the high crime rate, and public improvement deficiencies. Moreover, the ability to attract tenants is hampered by the lack of local brokers specializing in the area. Retail brokers tend to specialize in geographic areas with a concentration of retailers. The perception of the brokerage community is that the Bayview retail market is weak or non-existent for neighborhood serving retailers. The area will likely continue to struggle unless this perception is changed through redevelopment assistance.[22]

The Seifel Consulting analysis of retail property conditions is consistent with CBRE Consulting's observations about the South Bayshore shopping districts. While there are some larger retailers such as Walgreens, Smart & Final, and a Foods Co. store, which had moderate shopper volumes, there are also sections of Third Street and Bayshore Boulevard with vacant store space that is not likely to be re-tenanted without substantial investment in improvements.

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[19] "Bayview Hunters Point Redevelopment Plan Amendment, Existing Conditions Report, May 2009 Administrative Draft," prepared for the San Francisco Redevelopment Agency by Seifel Consulting, p. I-3.
[20] *Ibid.*, p. III-65.
[21] *Ibid.*, p. III-47; Note that redevelopment of the Goodman's Lumber store site has been planned for years and that Lowe's Home Improvement is currently evaluating the property as a new store location.
[22] *Ibid.*, p. III-50.

San Bruno Avenue

The San Bruno Avenue neighborhood retail district is just west of Highway 101 near South Bayshore. The retail area is primarily an 8- to 10-block stretch of gas stations, shops, restaurants, and service-oriented businesses between Hale Street on the northern end and Paul Street to the south. A few of the intersecting streets are major thoroughfares that pass under elevated sections of the freeway, and there is a highway exit and on-ramp from San Bruno Avenue at Stillman Street. The retail properties in the area tend to be older and are in fair to moderate condition. The larger stores include Walgreens, a Kragen Auto Parts, and a few ethnic specialty food markets. Fast food chains and other convenience restaurants (pizza, taquerias, Asian take-out) are also common. While there were a few retail vacancies in the area, these were being marketed by landlords, and there were signs that older properties had been re-tenanted with new uses, (e.g., a former movie theatre that is now occupied by a church).

Leland Avenue

This shopping district, which is located within the Visitacion Valley neighborhood, has lower traffic volumes and a smaller mix of retail options than either the Third Street or the San Bruno Avenue corridors. The four-block section of Leland Avenue between Bayshore Boulevard and Cora Street has a Bank of America branch, a few small restaurants and produce stores, and some neighborhood services. This district also previously included a small grocery store, the Super Fair market, which was listed in a Claritas database of neighborhood businesses. However, during CBRE Consulting's field research in May 2009, this store building had been razed.

Regional-Serving Shopping Areas

CBRE Consulting also identified seven regionally-oriented shopping centers in San Francisco, Daly City, San Bruno, and San Mateo, which are potentially competitive with the planned regional center at Candlestick Point. Six of these centers were analyzed through field research, and background on these properties is presented below. The seventh center, Hillsdale Shopping Center in San Mateo, was considered too distant to merit a field visit, though this shopping area is included in later analysis presented in Chapter IX, Sales Impacts Beyond the Project Market Areas.

San Francisco Shopping Centre. This upscale center, located on Market Street in downtown San Francisco near Union Square, expanded substantially in 2006 with the opening of a 338,000-square-foot Bloomingdale's store, a 53,000-square-foot cinema, and new space for specialty retail and restaurants. The mixed-use property is 1.5 million square feet in total, including 245,000 square feet of office space, and is reportedly the largest urban shopping center west of the Mississippi River. The retail space is in excellent condition with only a few smaller vacancies. Shopper volume was moderate when CBRE Consulting visited the property as part of its research for this study.

Stonestown Galleria. This center is an enclosed two-story mall located in the western part of San Francisco along 19th Avenue. The property maintains an upscale format, with Macy's and Nordstrom serving as its department store anchors. A Borders bookstore and Trader Joe's are also among the larger tenants. Stonestown Galleria had several inline store vacancies in May 2009. Nevertheless, the property has historically attracted new tenants despite some store turnover and is generally well-maintained.

Westlake Shopping Center. Kimco, the center's owner, has invested in reconfiguring and expanding this older, mid-range shopping center in Daly City. As part of this process, a Home Depot was added as an anchor, complementing an existing Safeway, Burlington Coat Factory, and a Ross Dress for Less. An existing Trader Joe's store was also moved to a new space, and most of the storefronts and walkways have been upgraded. With the expansion of the center, several newer shop and office spaces were vacant in May 2009, and Kimco was actively seeking tenants to fill these sections the property.

Serramonte Center. This 847,000-square-foot regional mall is located just off of Interstate 280 on Serramonte Boulevard in Daly City, and is proximate to other "big box" stores and auto dealerships that have clustered in this area. Serramonte Center is anchored by a Macy's and a Target store, which is described as one of the top 20-performing stores by sales volume among 1,500 Target outlets nationwide.[23] In addition, the interior of the center has been renovated and an expanded food court opened in late 2007.[24] The recent closure of the Mervyns chain created a 75,000-square-foot anchor vacancy in 2008 that has not been filled, and there are also some inline store vacancies. Costar also reports that another 30,000-square-foot store space is available within the mall. Nearby, a Circuit City store on Serramonte Boulevard remains vacant following that chain's bankruptcy.

The Shops at Tanforan. To the southeast of Serramonte Center on El Camino Real in San Bruno, the Shops at Tanforan is a 672,000-square-foot mall anchored by a Target, a Sears, a JC Penney, and a large Barnes and Noble bookstore. This shopping center was renovated in 2005 and benefits from traffic access on Interstate 280 and transit access from the San Bruno BART station and local bus lines. Moreover, adjacent "big box" retail, grocery stores, and restaurants along El Camino Real help support this retail area. The interior and exterior of the Shops at Tanforan were in good condition, and no store vacancies were identified.

Bridgepointe Shopping Center. This power center in eastern San Mateo features a Target, Sports Authority, Marshalls, and Staples, as well as mid-sized chain restaurants and smaller stores. The property is located near a concentration of mid-rise office buildings and hotels, and benefits from a location near the intersection of Highway 92 and Highway 101, each of which are major commuting routes. This center was in good condition with no major vacancies, and shopper volume was moderate during a weekend site visit. Given that many of Bridgepointe's larger tenants are located in and around other regional malls that are closer to the Candlestick Point market area, Bridgepointe Shopping Center may not be highly competitive with the proposed Candlestick Point regional center.

SUMMARY

San Francisco and northern San Mateo County offer a diverse set of retail options, which serve local residents, daily commuters, out-of-town business travelers, and tourists. Despite recent declines in local retail sales, most of the regional- and neighborhood-shopping areas that CBRE Consulting visited had limited vacancies due to store closures, and with the exception of the South Bayshore area, retail properties were typically well-maintained. In addition, the San Francisco metro area is viewed as a vibrant market, where many national retailers are continuing to expand.

[23] According to a property fact sheet available at www.serramontecenter.com.
[24] *Ibid.*

VI. RETAIL SALES BASE CHARACTERIZATION

This section analyzes the retail sales leakage and attraction profile of the market areas, meaning the extent to which market area stores capture retail spending from market area households as well as from households located outside of the market area. It provides a quantitative measure of the market area's sales performance. CBRE Consulting conducts this analysis as a building block towards determining the extent to which the Project's development may or may not divert sales from existing retailers.

METHODOLOGY

CBRE Consulting has developed a statistical regression-based model that estimates retail spending potential for a market area based upon household counts, income, and consumer spending patterns. Generally referred to as a "Retail Demand, Sales Attraction, and Spending Leakage Analysis," or similar nomenclature by real estate-based economic consulting firms comparable to CBRE Consulting, the model determines the extent to which a designated market area is or is not capturing its sales potential based upon reported taxable sales data. In California, these data are generally published by the BOE or provided by municipal tax consultants. Retail categories in which spending is not fully captured are called "leakage" categories, while categories in which more sales are captured than are generated by market area residents are called "attraction" categories. Generally, attraction categories signal particular strengths of a retail market, while leakage categories signal particular weaknesses.

Several data points are presented in the findings of CBRE Consulting's Retail Demand, Sales Attraction, and Spending Leakage Analysis. These include per-household figures and aggregate figures. Per-household figures are presented for the sales achieved by retail category for a control area and the market area under study, as well as an estimate of spending by retail category generated from within the defined market area. The per-household ***spending*** figures (as a proxy for all area spending) in the Retail Sales Leakage Analysis are the result of extensive calculations. On the other hand, the per-household ***sales*** figures simply reflect actual area sales divided by the estimated household count, with some disclosed adjustments for taxable versus non-taxable sales. Additional background about the model's approach to estimating retail demand is presented in Appendix B of this report.

DEMOGRAPHICS

CBRE Consulting's Retail Demand, Sales Attraction, and Spending Leakage Analysis relies on household counts and average household income inputs for its control area benchmarks and for the designated market areas for the analysis. The HPS Phase II neighborhood retail market area is located largely in San Francisco, but one small portion is located in Daly City. The Candlestick Point market area is located in portions of San Francisco as well as portions of South San Francisco, Daly City, and Brisbane. In order to be consistent with the EIR, the household estimate and forecast for the San Francisco portions of the market area were derived from the San

Francisco Urban Water Management Plan's (SFUWMP) estimates and forecast.[25] Claritas, Inc., a national vendor of demographic and employment data, which produces household estimates and forecasts for specific geographic areas, was used to benchmark the share of households within the market area to the larger city. Exhibit 11 and Appendices C and D show the calculations for the number of households in the Candlestick Point and HPS Phase II market areas.

In Appendix C-1 the Claritas estimates and forecasts for households in San Francisco are shown as well as the estimates and forecasts for households within San Francisco's portion of the Candlestick Point market area. In 2009, Claritas data imply that the San Francisco portion of the Candlestick Point market area contains 25.1 percent of all households living in San Francisco. Appendix C-1 also shows the SFUWMP's 2005 estimate that 341,478 households reside in San Francisco. For 2030 the SFUWMP forecasts 403,300 households for San Francisco. This forecast includes extraordinary growth planned at Treasure Island, Park Merced, and the Project. This growth is taken out of the forecast in Appendix C-1 so that the average growth rate in San Francisco can be deductively calculated. The overall annual SFUWMP growth rate including extraordinary growth from 2005 to 2030 is 0.67 percent. However, subtracting out the extraordinary growth (28,400 households), the average annual growth rate for San Francisco is 0.37 percent.

This study's 2009 estimate for households in San Francisco is determined by interpolating between the 2005 estimate and the 2030 forecast without the extraordinary growth. To determine households in the San Francisco portion of the market area, the estimates using SFUWMP are multiplied by the share of the population living in the market area as determined by Claritas resulting in 82,767 households in 2005 in the San Francisco portion of the Candlestick Point market area. In Exhibit 11 the extraordinary growth planned for the Project (10,500 units) and growth planned at the Schlage Lock site in San Francisco (1,600 units) is added back in to the 2030 forecast to determine total growth in the San Francisco portions of the market areas resulting in 109,624 households projected in the San Francisco portion of the Candlestick Point market area by 2030.

Appendices C-2, C-3, and C-4 use the same process to determine households in the portions of the Candlestick Point market area within the cities of Daly City, South San Francisco, and Brisbane. Here the Association of Bay Area Government's *2007 Projections* are used for the household estimates and projections for each entire city. Appendices D-1 and D-2 determine the households in the portions of the HPS Phase II market area within San Francisco and the City of Daly City.

Due to the irregular shapes of the market areas, government-sponsored data sources cannot provide average household income estimates for the HPS Phase II or Candlestick Point Project market areas. The analysis therefore utilized data from Claritas for estimates and projections of average household income, since Claritas is capable of pulling demographic data for user-generated polygons.

[25] The 2005 Urban Water Management Plan for the City and County of San Francisco was prepared by The San Francisco Public Utilities Commission.

Table 7
Average Household Income Estimates
Project Market Areas

Market Area	2000 Estimated	2009 Estimated	Compound Average Annual Growth Rate 2000-2009	2007 Implied Income
Candlestick Point	$70,475	$89,678	2.7%	$85,002
HPS Phase II	$61,941	$82,319	3.2%	$77,277

Sources: Exhibit 13; Claritas; and CBRE Consulting.

At the time this report was prepared, Claritas provided data from years 2000, 2009, and 2014. In order to estimate the average household income for 2007, which is an input to the Retail Demand, Sales Attraction, and Spending Leakage Analyses, CBRE Consulting inflated the 2000 estimate to 2007 using the compound average annual growth rate between 2000 and 2009, as shown in Exhibit 13 and Table 7.

CALCULATION OF THE 2007 MARKET AREA RETAIL SALES BASE

As a necessary input to the Retail Demand, Sales Attraction, and Spending Leakage Analysis, CBRE Consulting estimated sales for the Project market areas utilizing BOE taxable sales data in concert with Claritas data. The BOE publishes taxable sales figures for counties and major cities on a quarterly basis, and the most recent full year for which data were published at the time this study was conducted was 2007. In addition, the first two quarters of 2008 are available. CBRE Consulting used BOE's data for the cities of San Francisco, South San Francisco, Daly City, and Brisbane as presented in Table 3 of the *Taxable Sales in California* publication. In order to use the most recent data available, a year's worth of sales was summed from the last two quarters of 2007 and the first two quarters of 2008. CBRE Consulting also relied on geographic mapping information and data from Claritas to estimate the proportion of taxable sales reported by the BOE that occurred within each market area's boundary. The calculations behind these estimates for the Candlestick Point market area are shown in Exhibits 14 through 18, and in Appendices E and F. The calculations behind these estimates for the HPS Phase II market area are shown in Exhibits 20 through 22, and in Appendices E, F, and G.

Table 8 summarizes the results from these exhibits. The total retail sales column reflects an adjustment for non-taxable retail sales at drug stores and at food stores.[26] CBRE Consulting estimates that 70 percent of food store sales and 67 percent of drug store sales are non-taxable based on discussions with the BOE and research into other industry sources, including U.S. Census publications. In addition, sales of grocery items at non-drug store general merchandise stores are non-taxable and are estimated to equal 10 percent of sales for this sub-set of the retail category based on analysis of the U.S Economic Census for General Merchandise Stores.[27] Consequently, the BOE taxable sales figures for the General Merchandise and Food Stores categories are

[26] Drug stores are a subset of the BOE General Merchandise category.

[27] Per the U.S. Economic Census data, General Merchandise stores encompass a mix of department stores, discount department stores, warehouse clubs, and Supercenters, variety stores, and other general miscellaneous stores. The 10 percent estimate is based on the existing mix of stores in the market areas.

adjusted upward to reflect non-taxable transactions that are not accounted for in the BOE's taxable retail sales estimates.

Table 8
Market Areas' Retail Sales Estimates
2007 Dollars, in Millions

BOE Retail Category	Estimated Total Retail Sales incl. Non-Taxable[1]	
	Candlestick Point Market Area[2]	HPS Phase II Market Area[2]
Apparel Stores	$262.8	$6.9
General Merchandise	$863.0	$65.8
Food Stores	$541.5	$115.2
Eating and Drinking Places	$844.3	$67.4
Home Furnishings & Appliances	$334.5	$62.6
Building Materials	$336.6	$130.9
Motor Vehicles and Parts	$294.4	$39.8
Service Stations	$324.8	$22.3
Other Retail Stores	$1,537.9	$43.3
Total[2]	**$5,339.9**	**$554.1**

Sources: Exhibits 18 and 22.
(1) Estimates include taxable and non-taxable sales, the latter of which consists of drug store sales in the General Merchandise category and grocery store sales in the Food Stores category.
(2) Due to rounding, total may not equal the sum of components shown.

Retail sales in the Candlestick Point market area are generally concentrated in the Other Retail Stores, General Merchandise, Restaurants, and Food Stores categories. By contrast, the HPS Phase II market area, which is a subset of the Candlestick Point market area, has almost a quarter of its sales in Building Materials. The lowest volume of sales in both market areas is estimated to occur in the Apparel category.

DISCUSSION OF CHANGES TO THE RETAIL SALES BASE

Changes to Retail Sales Base

For the purpose of this analysis, the retail sales base is calculated so that the magnitude of each retail component of the Project's impact on the market area may be measured against the existing base. While the analysis assumes the Project will not be fully operational until 2030, the sales base relevant to the analysis for CEQA purposes is the existing sales base, reflective of existing conditions. For analytic purposes, CBRE Consulting developed an estimate of the existing sales base, starting with actual annual sales data from 2007. This base is then adjusted to a 2009 estimate, with further adjustments reflecting expectations regarding the characteristics of the existing base by 2030. Sales base adjustment factors may include:

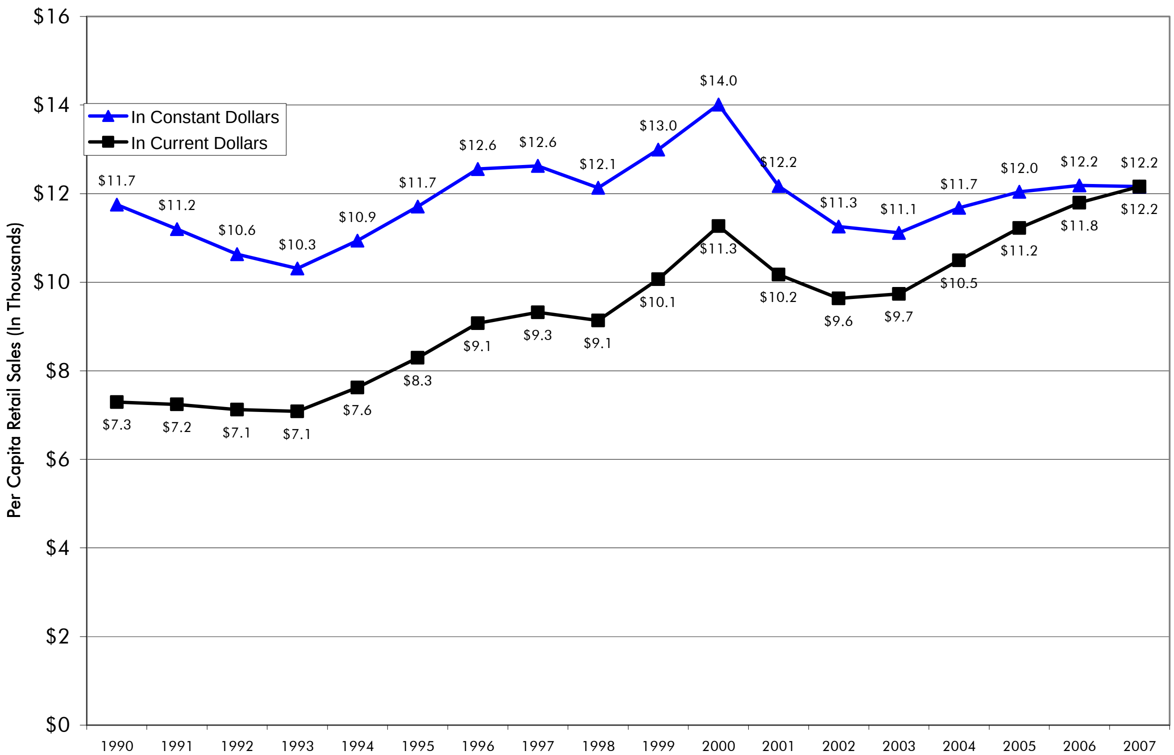
- The opening of new shopping centers and stores;
- The closures of retail stores that contributed to the 2007 sales base;
- Changes in consumer preferences towards retail spending; and
- Residential growth in the area, which drives additional demand for retail goods.

Although there have been some changes to the sales base in the market area from 2007 to 2009, no one store is large enough to make a substantial difference. Given the recessionary conditions it is likely that the store closures have been greater than store openings. As mentioned earlier in the previous chapter, actual sales data for all of San Francisco and the major retail corridors in the Candlestick Point market area were obtained from MuniServices, the tax consultant for San Francisco. In Exhibits 19 and 23 the sales base for each market area is projected from 2007 to 2009. The sales base adjustment figures for 2007-2008 are the actual change in sales taxes in all of San Francisco from 2007 to 2008 based on data from MuniServices and The HdL Companies, the latter comprising another California-based tax consultant firm. CBRE Consulting estimated the trend for 2008 to 2009, assuming one-half the prior year rate of change, with the exception of Service Stations, which are assumed to decline 5.0 percent because of the lower gas prices relative to 2008, and Food Stores, which have been projected by HdL to be flat through 2010. The assumption for using one-half the prior year rate of change is because the recession is expected to lift before the end of 2009; therefore, half the negative growth of the previous year is assumed. This adjustment should cover the impacts of store openings, store closures, changes in consumer preferences towards retail spending and any residential growth in the area. The Candlestick Point market area sales base is $5.34 billion in 2007, but is adjusted to $5.30 billion in 2009. The HPS Phase II market area sales base is $554.1 million in 2009, adjusted to $534.8 million in 2009.

Historical Trends in the Retail Sales Base

Recognizing that stores will continue to open and close between the publication of this analysis and the opening of the Project, it would not be possible to thoroughly estimate the resulting additions to, and subtractions from, the retail sales base. Moreover, for CEQA purposes, the existing base is most relevant as it reflects existing conditions. Therefore, CBRE Consulting assessed the suitability of 2007 as a proxy year for the existing base given historical trends in retail sales in San Francisco. Figure 1 illustrates the results of that analysis. The black trend line shows that retail sales per capita peaked at approximately $11,300 in 2000 before dropping to approximately $9,600 in 2002 with steady increases in each year since. The blue trend line represents taxable sales per capita adjusted to eliminate the effects of inflation. This adjustment was made in order to focus on other economic forces including consumer spending preferences. The trend shows that from 1990 to 1993, real sales per capita retreated from $11,750 to $10,300 in San Francisco, then steadily increased until 1996 and 1997, when they reached $12,600. After a brief drop in 1998, real sales per capita increased to a peak of $14,000 in 2000 during the technology boom. After dropping to $11,100 in 2003 after the dot.com bust real per capita sales has regained some ground. In 2007 real per capita sales was at $12,200, about 2.5 percent higher than the overall 18-year average of $11,900.

Figure 1
San Francisco Taxable Sales Per Capita
1990 – 2007
In Thousands



Considering how close the real per capita sales figure is to the long-term average, the 2007 sales base is an accurate proxy for the 2030 equivalent of the existing retail sales base in San Francisco. It is not believed to overestimate sales occurring in the market area, as would the 2000 sales base, nor is it believed to underestimate them. In 2030, the first full year of sales for the Project's retail components, CBRE Consulting anticipates that the sales base is more likely to be in line with the historical average than with the historic lows experienced in the current recession.

RETAIL DEMAND, SALES ATTRACTION, AND SPENDING LEAKAGE ANALYSES FINDINGS

CBRE Consulting prepared a Retail Demand, Sales Attraction, and Spending Leakage Analysis for each market area to examine its retail sales performance relative to its household base and to assess the degree to which the related stores are serving the retail needs of the resident households. The results for each market area, based upon the annual 2007 data[28], are presented in Exhibits 24 and 26.

[28] Although more recent data from the first and second quarters of 2008 were available from BOE, they were not used. Instead, trends from actual full year 2008 data from MuniServices for San Francisco were used to adjust the 2007 figures from 2007 to 2008.

Candlestick Point Market Area

Based on 2007 retail sales data, the Candlestick Point market area had attraction in all retail categories, except Motor Vehicles and Parts. Overall, the market area attracted 49.6 percent of spending from non-residents. However, the performance across categories was varied, ranging from $77.3 million of attraction in Service Stations to $1.2 billion of attraction in the Other Retail Stores category. The other categories that demonstrated attraction are as follows, listed in descending order based on their percentage of attraction:

- Home Furnishings and Appliances with 72.7 percent sales attraction;
- Eating and Drinking Places with 62.5 percent attraction;
- General Merchandise with 58.5 percent sales attraction;
- Apparel Stores with 49.9 percent sales attraction;
- Building Materials with 39.9 percent sales attraction; and
- Food Stores with 27.2 percent sales attraction.

These findings indicate that in 2007, the defined market area had a strong retail sales draw, to which sales were attracted in almost every retail category. The market area can be characterized as fully meeting the retail needs of its resident population, as well as partially supporting the retail needs for households beyond the market area boundaries. These sales attraction and leakage findings suggest that the market area is a retail destination supporting numerous shopping centers and retailers that draw from a consumer base far exceeding the market area's resident population.

HPS Phase II Neighborhood Retail Market Area

Based on 2007 retail sales data, the HPS Phase II neighborhood retail market area had retail sales leakage, with 10.9 percent of residents' spending ($68.1 million) estimated to occur outside the geographic area. Despite overall retail sales leakage, three categories had attraction: Food Stores with 19.2 percent attraction, Home Furnishings and Appliances with 67.7 percent attraction, and Building Materials with 65.3 percent attraction. The categories that demonstrated leakage are as follows, listed in descending order based on their percentage of leakage:

- Apparel, with 77.3 percent sales leakage;
- Motor Vehicles and Parts, with 72.9 percent sales leakage;
- Service Stations with 61.9 percent sales leakage;
- Other Retail Stores with 39.8 percent sales leakage;
- General Merchandise, with 20.8 percent sales leakage; and
- Eating and Drinking Places with 7.7 percent sales leakage.

These findings indicate that in 2007, the defined market area for HPS Phase II had a net loss of retail sales. Although three retail categories did attract substantial retail sales from non-residents, overall the market area can be characterized as not fully meeting the retail needs of its resident population. These sales attraction and leakage findings suggest that the market area is underserved by retail in most categories except for groceries, home furnishings and appliances, and building materials.

VII. HPS PHASE II RETAIL SALES IMPACTS

The following analysis examines the extent to which the HPS Phase II neighborhood retail is likely to attract new sales to the market area and/or divert sales from existing retailers. For sales that may be diverted, the maximum level of impact on existing HPS Phase II market area retailers is identified. To determine potential sales impacts to existing stores within the HPS Phase II market area, the analysis evaluates existing supply and demand for retail sales within each BOE category. Projected household growth and the recapture of existing leakage are also considered as sources of potential demand that may offset the potential sales impacts associated with the HPS Phase II retail development. For this analysis, the approach assumes that if the retail planned will add sales to a retail category in an amount greater than the combination of estimated recaptured leakage in the category and the expected demand from new households, *then at worst*, the remaining amount of sales will be diverted away from existing market area retailers.

ESTIMATED NEW DEMAND

HPS Phase II market area household growth represents a major source of new demand for the planned retail and other area retailers. CBRE Consulting prepared projections for this component of demand, as follows.

New Household Growth

As shown in Exhibit 11, CBRE Consulting used projections from the San Francisco Urban Water Management Plan and Claritas to estimate that a total of 13,892 new households will be added to the HPS Phase II market area between 2009 and 2030. This estimate includes the 10,500 units planned for the Project and the 1,600 units planned at Schlage Lock.

New Household Demand Captured by the HPS Phase II Retail Development

In order to help estimate the demand from net new households presented in Exhibit 27, CBRE Consulting calculated the assumed percentage of new demand that may be captured by the HPS Phase II neighborhood retail within the market area. These capture rates were developed based on comparing the share of the new development's projected sales to the total retail sales in the market area. It is likely that not all of the HPS Phase II neighborhood retail sales will be new to the market area; however, this analytic convention comprises a conservative approach to provide minimum capture rate assumptions for the planned retail, assuming that all sales are diverted from existing retailers. These capture rates are calculated in Exhibit 28 and range from 2.7 percent in the home furnishings and appliances category to 24.0 percent in the other retail stores category.

New household spending demand is calculated based on the average household income. Because of the affordable housing requirements at the Project, there will be a relatively large number of households with below-average incomes. Appendix H and Exhibit 29 parse out the new household spending demand based on the type of housing unit (affordable rental, affordable for-sale, and market rate). Appendix H-1 shows the breakdown of affordable housing units by unit type. Assuming that each unit will house an average of one person more than the number of bedrooms, the weighted average of persons per unit in affordable housing is approximately 3.5 (see Appendix H-1 for details). The affordable units at the Project will have income limits of approximately 50 percent of the area median income for rental units and 80 percent of the area median income for for-sale units. The most recent Federal Department of Housing and Urban Development guidelines show that maximum 2009 income at 50 percent of the area median income in San Francisco is $43,550 for a three-person household and $48,400 for a four-person household.[29] Since the average household size in affordable housing planned at the Project is 3.5 persons, the average of those two figures was taken to determine the average household income of households living in affordable rental units. The same process was used to determine the average income for household living in affordable for-sale units and is also presented in Appendix H-1, which shows that the maximum 2009 income at 80 percent of the area median income in San Francisco is $69,700 for a three-person household and $77,450 for a four-person household.[30] The average of those two figures, or $73,575, was used as the average household income of those living in affordable for-sale units at the Project.

Exhibit 29 shows the imputed retail spending demand for households that would qualify for affordable housing at the Project. This retail spending demand is derived from the Retail Demand, Sales Attraction, and Spending Leakage Analysis using the average household income (see Appendix H-2). The retail spending demand for households in market rate units comes from the analysis done in Exhibit 26 after projecting the figures from 2007 to 2009 in Exhibit 27.[31] Using the total household spending for each relevant BOE retail sales category, CBRE Consulting calculated the aggregate new demand by retail sales category that will be generated by the addition of these households to the HPS Phase II market area. As shown in Exhibit 30, the 13,892 households added by 2030 are projected to generate $386.2 million in new retail demand spread across the BOE retail categories.

New Demand Captured by Other Retailers in the HPS Phase II Market Area

CBRE Consulting assumes that all retailers (i.e., existing and planned) within the HPS Phase II market area could reasonably expect to capture between 20 and 90 percent of the new household demand depending on the retail category, as shown in Exhibit 30. These capture rates were estimated based on consumer spending patterns as well as the amount of existing retail offerings in the HPS Phase II market area as opposed to offerings outside the market area. For example, for apparel stores a capture rate of 20 percent was assumed. Given the large amount of apparel offerings outside the market area, this category is not likely to capture a high share of new demand. In contrast, the Food Stores category was assumed to be able to capture 90 percent of new demand because most consumers will do the bulk of their grocery shopping at the store closest to where they live. Pursuant to this capture rate analysis, HPS Phase II market area retailers are assumed to capture up to $116.9 million in sales generated by the new market area residents.

Further applying the capture rates derived for just HPS Phase II, the analysis concludes that $13.8 million in new household demand is likely to be captured by the planned HPS Phase II neighborhood retail stores. This comprises approximately 12 percent of all available market area captured sales. This leaves an additional $103.0 million in new household demand captured by other retailers within the market area, which is available to offset any potential sales impacts. By

[29] *Maximum Income by Household Size: derived from the Unadjusted Area median Income for HUD Metro Fair Market Rent Area that contains San Francisco*, San Francisco Mayor's Office, March 31, 2009.
[30] *Maximum Income by Household Size: derived from the Unadjusted Area median Income for HUD Metro Fair Market Rent Area that contains San Francisco*, San Francisco Mayor's Office, March 31, 2009.
[31] Spending is projected from 2007 to 2009 using the same methods used to project the sales base from 2007 to 2009.

this is meant that $103.0 million in remaining demand is available to offset sales diverted from existing retailers as a result of HPS Phase II achieving its projected level of sales.

RECAPTURED LEAKAGE

Another source of potential retail demand for new retail projects can be recaptured sales leakage from resident spending that is occurring outside the HPS Phase II market area. Exhibit 31 shows that there is leakage in the relevant categories of General Merchandise, Eating and Drinking Places, and Other Retail Stores. It is assumed that only one-third of leakage in the market area in the relevant categories will be absorbed by new retail offerings at HPS Phase II. This is a conservative assumption because consumers often choose to make these types of purchases based on convenience, and the addition of high quality retailers to the market area will reduce the need to travel outside of the market area for neighborhood-oriented shopping.[32] Given this assumption it is estimated that there will be $5.4 million of retail sales leakage in General Merchandise, $1.9 million in Eating and Drinking Places, and $9.8 million in Other Retail Stores available to HPS Phase II retailers.

POTENTIAL SALES IMPACTS

The demand associated with new household growth is expected to absorb a large component of sales at the planned HPS Phase II neighborhood retail area in 2030, which comprises the first full year of operations. Exhibit 31 summarizes the projected sales and the estimates of demand related to household growth, some of which will benefit the existing HPS Phase II market area stores. New demand associated with household growth is estimated to account for $13.8 million of the Project's $41.3 million in market area sales. The remaining $103.0 million in demand from new households will be distributed among other market area stores, such that any potential impacts to existing stores will be fully offset. While these recaptured sales will occur to the detriment of other retailers outside the market area, there is still other remaining demand available to offset both these impacts and the ones in the market area. The calculations leading to these conclusions are detailed in Exhibit 31. Therefore, no substantial impacts are estimated to occur to the detriment of existing retailers due to the planned HPS Phase II neighborhood retail.

Moreover, as shown in Exhibit 8 and Table 4, about 10 percent of the tenant space (11,875 square feet) in the HPS Phase II neighborhood retail area is allocated to non-retail services businesses such as a bank branch or a dry cleaner. Since new household growth is estimated to create demand that is sufficient to offset potential retail sales impacts, it is likely that this incremental demand will also support the anticipated mix of neighborhood-oriented non-retail tenants without generating sales diversions from comparable businesses.

[32] Leakage recapture rates will vary depending on the strength of competitive area retail and the range of new stores within a planned development. CBRE Consulting has typically estimated recapture rates of 50 percent to 75 percent of leakage for underserved retail categories in other retail market areas that the firm has analyzed. The estimate that one-third of existing leakage will be recaptured by the HPS Phase II retailers is based on CBRE Consulting's professional judgment.

VIII. CANDLESTICK POINT RETAIL SALES IMPACTS

The following analysis examines the extent to which the Candlestick Point regional center and neighborhood retail is likely to attract new sales to the market area and/or divert sales from existing retailers. For sales that may be diverted, the maximum level of impact on existing Candlestick Point market area retailers is identified. To determine potential sales impacts to existing stores within the Candlestick Point market area, the analysis evaluates existing supply and demand for retail sales within each BOE category. Projected household growth and the recapture of existing leakage are also considered as sources of potential demand that may offset the potential sales impacts associated with the retail development at Candlestick Point. For this analysis, the approach assumes that if the retail planned will add sales to a retail category in an amount greater than the combination of estimated recaptured leakage in the category and the expected demand from new households, ***then at worst***, the remaining amount of sales will be diverted away from existing market area retailers.

ESTIMATED NEW DEMAND

Candlestick Point market area household growth represents a major source of new demand for the planned retail and other area retailers. CBRE Consulting prepared projections for this component of demand using an approach similar to the HPS Phase II analysis. Accordingly, the same population figures and projections are relevant to the Candlestick Point analysis as documented in Exhibit 11.

New Household Retail Demand

In order to help estimate the demand from net new households, CBRE Consulting calculated the assumed percentage of this new demand within the market area that may be captured by the Candlestick Point regional center and neighborhood retail. These capture rates were developed based on comparing the share of the new development's projected sales to the total retail sales in the market area, similarly to the methods used in the previous chapter. These capture rates are calculated in Exhibit 32 and range from 2.0 percent in the home furnishings and appliances category to 8.9 percent in the apparel category.

Exhibit 33 shows the imputed retail spending demand for households that would qualify for affordable housing at Candlestick Point.[33] This retail spending demand is derived from the Retail Demand, Sales Attraction, and Spending Leakage Analysis using the average household income (see Appendix H-2). The retail spending demand for households in market rate units comes from the analysis done in Exhibit 24 after projecting the figures from 2007 to 2009 in Exhibit 25.[34] As shown in Exhibit 34, the 24,395 households added by 2030 are projected to generate $694.0 million in new retail demand spread across the BOE retail categories.

New Demand Captured

[33] A full explanation of the calculations are in the previous chapter.
[34] Spending is projected from 2007 to 2009 using the same methods used to project the sales base from 2007 to 2009.

CBRE Consulting assumes that Candlestick Point market area retailers could reasonably expect to capture between 50 and 85 percent of the new household demand depending on the retail category, as shown in Exhibit 34. These capture rates were estimated based on consumer spending patterns as well as the amount of existing retail offerings in the Candlestick Point market area as opposed to offerings outside the market area. These rates are higher than the capture rates for the HPS Phase II market area because of the many additional retail offerings in the Candlestick Point market area. A rate of 50 percent was used for apparel, general merchandise, restaurants, home furnishings and appliances, and other retail stores. A higher rate of 80 percent was used for building materials since much of the building materials retailers in San Francisco are located in the Candlestick Point market area. A rate of 85 percent was used for the Food Stores category since most consumers will do the bulk of their grocery shopping at the store closest to where they live. This rate is slightly lower than the capture rate for grocery stores in the HPS Phase II market area because there are more grocery options just outside the Candlestick Point market area. Pursuant to this capture rate analysis, Candlestick Point market area retailers are assumed to capture up to $284.6 million in sales generated by the new market area residents.

Further applying the capture rates derived for just the Candlestick Point project, the analysis concludes that $11.0 million in new household demand is likely to be captured by the planned Candlestick Point regional center and neighborhood retail stores. This comprises approximately 4.0 percent of all available market area captured sales. This means that remaining demand is available to offset sales diverted from existing retailers as a result of the Candlestick Point project achieving its projected level of sales. The $246.3 million in new household demand captured within the market area is available to offset any potential impacts.

RECAPTURED LEAKAGE

Another source of potential retail demand for new retail projects can be recaptured sales leakage from resident spending that is occurring outside the Candlestick Point market area. However, the Candlestick Point market area has retail sales leakage in only one category, motor vehicles and parts. This category is not relevant to the analysis since no motor vehicles and parts retailers are planned for the regional center or neighborhood retail area. Exhibit 35 shows that no potential leakage is available to absorb sales at the new retail planned for Candlestick Point.

POTENTIAL SALES IMPACTS

The demand associated with new household growth is expected to absorb a large component of sales at the planned Candlestick Point neighborhood retail area in 2030, which comprises the first full year of operations. Exhibit 35 summarizes the projected sales and the estimates of demand related to household growth, some of which will benefit the existing Candlestick Point market area stores. New demand associated with household growth is estimated to account for $11.0 million of the Project's $173.2 million in market area sales. The remaining $246.3 million in demand from new households will be distributed among other market area stores, such that potential impacts to existing stores will be at least partially offset. The calculations leading to these conclusions are detailed in Exhibit 35.

Remaining impacts are estimated in the apparel stores and other retail stores categories. However, as a share of the market area sales, these impacts are only 2.3 percent in apparel and less than 1.0 percent in the other retail stores category. There is also still a large amount of remaining demand in the general merchandise, food stores, restaurants, and building materials categories. If any apparel retailers or other retail stores were to close due to impacts from the Candlestick Point regional center and neighborhood retail, there appears to be sufficient demand for a store in a different retail category to retenant the space. Therefore, no substantial impacts to the detriment of existing retailers are estimated to lead to prolonged vacancies due to the planned Candlestick Point planned retail.

Similarly, new household demand growth is anticipated to be ample enough to support the non-retail tenant space within the regional center and neighborhood retail component without creating substantial sales diversions from competitive businesses in the market area. If, however, a comparable business does close due to the opening of the new non-retail tenants at Candlestick Point, demand for other non-retail services or across retail categories is expected to be sufficient such that any vacant spaces can be re-tenanted.

IX. SALES IMPACTS BEYOND THE PROJECT MARKET AREAS

This chapter discusses potential sales impacts to existing stores that are located outside but near the two respective market areas following potential changes in shopping patterns that may occur after the opening of the Project's retail components. Specifically, some consumers who currently rely on nearby neighborhood shopping areas may be enticed to shift their purchases to HPS Phase II. Similarly, local households that have historically been attracted to regional shopping centers in San Francisco and northern parts of San Mateo County may redirect some of their spending to the Candlestick Point regional retail center.

As described in earlier chapters, two separate market areas – the HPS Phase II neighborhood retail market area and the Candlestick Point regional market area – have been defined based on the mix of planned retail and the types of customers that each shopping area is likely to attract. For each of the two market areas, this analysis identifies the competitive retail locations that are proximate enough such that there may be trade area overlap with the proposed new retail stores that are part of the Project. For simplicity, the level of overlap is estimated in terms of the number of households. This overlap is then compared against projected household growth in individual trade areas, which serves as a proxy for new demand that can partially or fully offset the potential impacts of some trade area shoppers shifting their purchases to the Project's retail components.

APPROACH TO THE ANALYSIS

This analysis is presented in two parts. The first section identifies and compares Food Stores that are near the boundary of the HPS Phase II neighborhood retail market area since grocery stores typically anchor the neighborhood-oriented retail nodes that are likely to be most affected by the introduction of new stores in the HPS Phase II retail area. The second section focuses on competitive regional shopping centers beyond the Candlestick Point market area and the related impacts that could be caused by the opening of the proposed Candlestick Point retail stores. Each of these two analyses focus on sample locations to the north, west, and south of the respective market areas, which are indicative of the potential impacts and future demand growth within estimated trade areas. Given the eastern waterfront locations of both the HPS Phase II neighborhood retail area and the Candlestick Point regional retail area, there are not relevant competitive retail locations other than to the north, west, and south.

NEIGHBORHOOD-ORIENTED RETAIL NEAR THE HPS PHASE II MARKET AREA

Identification of Neighborhood-Oriented Retail Areas

As part of the field research for this report, CBRE Consulting identified and visited neighborhood-oriented shopping nodes within San Francisco and in cities to the south. In most but not all cases, these nodes featured some type of grocery store that catered to local residents and helped draw shoppers to a mix of restaurants, shops, and other service-oriented businesses. Therefore, the analysis of neighborhood retail impacts uses the locations of mid-sized to larger Food Stores as an indicator of the distribution of local shopping areas that are near the HPS Phase II market area.

Although it is possible that this approach will exclude an individual shopping node,[35] the number and concentration of mid-sized to larger Food Stores within a few miles of the market area boundary are substantial enough to estimate the potential impacts on neighborhood-oriented shopping areas.

Exhibit 36 presents a map of 44 grocery stores that are located in San Francisco, Daly City, and South San Francisco. Three of the stores – a Foods Co. supermarket, a Good Life Grocery, and a Smart & Final outlet – are within the HPS Phase II neighborhood market area, which is analyzed in Chapter VII. The remaining 41 stores, including multiple Safeway, Trader Joe's, and Whole Foods Market locations, are viewed as potentially competitive with the Food Stores component of the proposed HPS Phase retail development. The distribution of the grocery stores is largely a reflection of the local residential densities and area geography, with most being located north of Cesar Chavez Street. To the west of the market area boundary, the hills and uninhabited park areas (e.g., McLaren Park, Bernal Heights Park, Holly Park, etc.) comprise barriers to more concentrated shopping nodes. Similarly, San Bruno Mountain to the southwest is primarily a County park, such that larger grocery stores are further away along Highway 82 (El Camino Real).

Industry research from the International Council of Shopping Centers (ICSC)[36] and other sources indicate that supermarkets and neighborhood retail centers typically draw customers from 3- to 5-mile trade areas. Within the San Francisco area, the topography, the smaller size of grocery stores, and residents' propensities to walk or use public transit for neighborhood shopping suggest that this range may be overstated for some areas, particularly those north of Cesar Chavez Avenue. Still, for this analysis, a 3-mile radius trade area is relevant for illustrative purposes.[37] From the grocery stores shown in Exhibit 36, CBRE Consulting selected the following seven to analyze at a more detailed level:

- Whole Foods Market (399 4th Street, San Francisco)
- Foods Co. (1800 Folsom Street, San Francisco)
- Good Life Grocery (1524 20th Street, San Francisco)
- Delano IGA Market (1245 South Van Ness Avenue, San Francisco)
- Safeway (5290 Diamond Heights Boulevard, San Francisco)
- Safeway (4950 Mission Street, San Francisco)
- Safeway (30 Chestnut Avenue, South San Francisco)

These supermarkets were selected based on a combination of their store formats, the mix of neighborhoods they represent, their relative proximity to the HPS Phase II neighborhood market area, and the fact that two of the chains (Foods Co. and Good Life Grocery) operate stores within the HPS Phase II neighborhood retail market area. The Exhibit 36 map also depicts 3-mile radius trade areas for these seven stores.

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[35] For example, the San Bruno Avenue shopping district, which is within the Hunters Point neighborhood market area, has a broad mix of retail yet its Food Stores are smaller and more specialty-oriented, like many within San Francisco.

[36] *ICSC's Dictionary of Shopping Center Terms,* International Council of Shopping Centers, New York, 2005, page 101.

[37] The concentration of 12 Safeway stores in Exhibit 36 suggests that the trade area for these supermarkets is smaller than a 3-mile radius. By contrast, specialty-oriented stores, such as Trader Joe's, Whole Foods Market, and certain ethnic-oriented markets would be more likely to draw customers from a 3-mile radius based on their more unique selections of items and more limited penetration of San Francisco and other nearby cities.

Trade Area Household Estimates

Exhibit 37 presents household estimates for each representative trade area based on demographic data obtained from Claritas. These trade area estimates range from 50,648 households for the Safeway in South San Francisco to 247,754 for the Foods Co. supermarket on Folsom Street. These household estimates are indicative of the level of available demand within a store's trade area. In addition, the existing level of competition helps determine how well each store is capturing available demand.

Exhibit 37 also shows the degree to which each store's trade area households overlap with the demand base in the HPS Phase II neighborhood retail market area. For example, the trade area for the Safeway in South San Francisco does not include any overlapping households based on its distance from the market area, while the Safeway at 4950 Mission Street shares 15.4 percent of its trade area households with the HPS Phase II retail market area. It is notable that a few of the other stores (e.g., Foods Co., Good Life Grocery, and Delano IGA Market) are closer to the HPS Phase II retail market area boundary, yet the next highest level of trade area overlap is 9.8 percent. These lower levels of overlap appear to be due to the higher residential concentrations north of Cesar Chavez Avenue, (i.e., the northern sections of the respective trade areas are likely more densely populated than the sections that overlap with the HPS Phase II market area).

Exhibit 38 translates the household overlap figures into estimates of the potential consumer base diversion for a given store. This analysis assumes that as many as half of the households located within the intersection of a store's trade area and the HPS Phase II retail market area may shift their related purchases to the neighborhood retail component of the Project. This assumption is based on the premise that residents living in between an existing store/neighborhood shopping area and the proposed HPS Phase II retail area would be equally likely to shop at either location based on convenience.[38] Consequently, for the Safeway at 4950 Mission Street, up to an estimated 7.7 percent of its 2009 trade area demand (i.e., equivalent to an estimated 9,861 households) may be redirected to the HPS Phase II neighborhood retail stores. Similarly, since this analysis uses the grocery store location as representative of a neighborhood shopping area, up to 7.7 percent of other neighborhood sales near this Safeway store may also be diverted to the HPS Phase II neighborhood retail area. For the other five representative stores with potential impacts, the consumer base diversion is anticipated to range from 0.8 percent to 4.9 percent, assuming a 50 percent shift in existing overlapping household demand,.

Projected Demand Growth, 2009-2030

As mentioned above, the existing trade area household estimates serve as a proxy for available demand for a given store/shopping area. Moreover, forecasting population and household growth is an industry-standard approach to gauging future demand. As stated in *Shopping Centers and Other Retail Properties*:

[38] Another explanation of this approach is that as the assumption all households within the overlapping trade area will shift 50 percent of their convenience-oriented purchases from existing stores to the HPS Phase II neighborhood retail area. This assumption most likely overstates the level sales diversion since shoppers within a given store's trade area often have access to more than one competitive neighborhood shopping area. Therefore, it is not likely that stores in the Hunters Point neighborhood retail area would capture 50 percent of household demand that is currently distributed among other competitive stores.

> "For most retailers, demand is generated by individuals or by households, so these are the most common measures of a market's depth and adequacy, while anticipated household or population growth is indicative of future opportunity."[39]

Within San Francisco, substantial household growth is projected through 2030. According to the San Francisco Urban Water Management Plan, citywide household growth will average 0.67 percent per year from 2005-2030, (see Appendix C-1 for details). Since some of this growth is driven by larger development projects that may not be part of individual trade areas, CBRE Consulting adjusted the forecast downward to exclude 28,400 households planned for Park Merced, Treasure Island, and the Project such that the revised annual growth rate is 0.37 percent per year.

Exhibit 38 projects 2030 trade area households for five of the seven selected grocery stores based on this rate of growth. The analysis does not include a household projection for the South Francisco Safeway store since this location did not have an overlapping trade area. Household demand growth for the remaining store in the exhibit, the Safeway at 4950 Mission Street, is calculated based on a 0.42 percent annual growth rate for 2009-2030, which is the weighted average of the San Francisco projection and forecasts for neighboring cities available from the Association of Bay Area Governments, (see Appendix J for details).[40] Based on this analysis, each of the representative store trade areas is likely to experience sufficient levels of new demand to offset any projected sales diversions prior to 2030. Consequently, none of the seven representative grocery stores or their surrounding local shopping nodes is projected to experience a net loss in demand due to the opening of the planned HPS Phase II neighborhood retail component.

Even though detailed analysis was only performed for representative stores (i.e., seven of the 41 non-market area grocery stores listed in Exhibit 36), a comparable result is anticipated for any of the other supermarkets, as well as for non-market area shopping nodes that may have been excluded based on the Food Stores orientation of the approach. In general, the level of trade area overlap – even for the most proximate grocery stores or neighborhoods – is not substantial compared with the levels of household growth that are projected from 2009-2030.

REGIONAL SHOPPING CENTERS NEAR THE CANDLESTICK POINT MARKET AREA

Identification of Regional Shopping Areas

CBRE Consulting conducted a similar analysis based on the regional shopping areas that are located in San Francisco and other nearby cities, which are relevant to the Candlestick Point regional retail area. In addition to its analysis of neighborhood shopping nodes, CBRE Consulting identified and visited the following seven regional shopping centers that are viewed as potentially competitive with the planned Candlestick Point retail components:

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[39] *Shopping Centers and Other Retail Properties*, Edited by John R. White and Kevin D. Gray in association with the Urban Land Institute, 1996, page 129.

[40] Five of the seven stores analyzed have trade areas that are fully within San Francisco. The Safeway at 4950 Mission Street has a trade area that partially includes other cities, including South San Francisco, Brisbane, and Daly City.

- Westfield San Francisco Centre (San Francisco)
- Stonestown Galleria (San Francisco)
- Westlake Shopping Center (Daly City)
- Serramonte Center (Daly City)
- The Shops At Tanforan (San Bruno)
- Bridgepointe Shopping Center (San Mateo)
- Hillsdale Shopping Center (San Mateo)

Regional shopping centers generally have much larger trade areas than neighborhood-serving retail. According to industry research from ICSC, regional shopping centers typically have 400,000-800,000 square feet of retail space and attract the majority of their customers from trade areas of 5-15 miles. Larger centers, which ICSC refers to as superregionals, have more than 800,000 square feet of retail space and trade areas of 5-25 miles. The seven centers listed above range in size from 569,049 square feet (Bridgepointe Shopping Center) to 1,250,000 square feet (Westfield San Francisco Centre), with an average size of about 850,000 square feet according to estimates from CoStar. In addition, a few of the centers (e.g., the Shops at Tanforan, Serramonte Center) are part of larger shopping nodes that also have a regional draw. However, the geography of San Francisco and San Mateo County tends to limit access from several directions, which supports using a drive-time approach as opposed to a large radius (e.g., 5-25 miles) to estimate representative trade areas. Therefore, CBRE Consulting estimated the regional trade areas for each center according to 15-minute drive-time estimates, which tend to fall within the ICSC's mileage ranges and area consistent with the approach used to estimate the trade area for the regional retail proposed for Candlestick Point.

Exhibits 39-41 map the locations of each of these shopping centers in comparison with the Candlestick Point regional market area. In addition, estimated trade areas and trade area overlaps with the Candlestick Point market area are shown for three representative centers: Westfield San Francisco Centre, the Shops at Tanforan, and Westlake Shopping Center. The Westfield San Francisco Centre (see Exhibit 39) is located on the edge of the Candlestick Point market area but has a trade area that extends through most of northern San Francisco.[41] This center's trade area is also representative of Union Square and other downtown retail, which are not presented as regional "centers" yet have some potentially competitive stores.[42] The Shops at Tanforan (see Exhibit 40) is the nearest regional center to the south of the Candlestick Point market area and benefits from its location near each of the major highways serving the Peninsula. Finally, three regional centers are located to the west of the Candlestick Point regional market area, and Westlake Shopping Center serves as the representative center for this area in the analysis.

Trade Area Household Estimates

CBRE Consulting used geographic mapping software and demographic figures available from Claritas to calculate the number of households within each of the three regional shopping center's respective trade areas and the degree of overlap with the Candlestick Point market area. As presented in Exhibit 42, the trade area estimates range from 167,447 to 303,645 households for

[41] The 15-minute drive-time approach also extended the Westfield San Francisco Centre's trade area to parts of Oakland, though these geographic area was excluded from the analysis since the Bay is likely to serve as a geographic boundary for potential shoppers despite the drive-time.
[42] For example, any sales diversions for the Westfield San Francisco Centre are likely to be indicative of similar effects on nearby mainstream retailers such as Macy's, Crate & Barrel, and Old Navy.

each of the three centers. Westlake Shopping Center has the largest percentage of households that overlap with the Candlestick Point regional market area (32.3 percent), followed by the Westfield San Francisco Centre (29.3 percent), and the Shops at Tanforan (24.2 percent).

Exhibit 43 replicates the estimates of potential diversion of the existing consumer base as described earlier in this chapter based on the assumption that up to one-half of the trade area households in the overlapping geographies may redirect their purchasing to the planned Candlestick Point retail stores. Consequently, the representative centers and surrounding regional retail could experience potential sales impacts of as much as 16.1 percent of their 2009 retail base following the opening of the Candlestick Point retail area.

Projected Demand Growth, 2009-2030

Exhibit 43 also presents estimates of the household growth that is projected to occur in each of the representative regional shopping center trade areas. These increases are based on the weighted averages of San Francisco citywide forecasts and projections from the Association of Bay Area Governments for cities in San Mateo County as summarized in Appendix L. For the San Francisco component of these trade areas, a household growth rate of 0.67 percent annually was used in the calculations, which is consistent with the citywide forecast for 2005-2030 in the San Francisco Urban Water Management Plan.[43]

The related projections show that long-term household growth will exceed the estimates of potential consumer sales base diversions for two of the three representative trade areas – Westfield San Francisco Centre and the Shops at Tanforan. In other words, the level of new household demand for the two regional centers is likely to be higher than the baseline 2009 levels such that no net customer loss will occur. The trade area for the third representative regional center, Westlake Shopping Center, is also calculated to have substantial household growth, but could experience a net loss of demand equivalent to as many as 2,021 households in 2030. For reference, this level of demand translates to 1.1 percent of Westlake Shopping Center's 2009 estimated trade area household base. This result is likely a high-end estimate of potential demand impacts and would be lower if a more moderate estimate of redirected demand (e.g., a one-third shift of overlapping trade area demand versus the 50 percent level in the analysis) had been applied. Moreover, if household growth for the trade area continues at a comparable rate beyond 2030, this net consumer loss will be offset within a few years, (e.g., by 2032 or 2033).

While this analysis focused on three regional centers, the locations to the north, west, and south of the proposed Candlestick Point retail area are representative enough that similar results are anticipated for the other regionally-oriented shopping nodes. For example, Bridgepointe shopping center and Hillsdale shopping center are both further south than the Shops at Tanforan and would have lower levels of trade area overlap with the Candlestick Point regional market area. Serramonte Center and Stonestown Galleria are more proximate to the planned retail development, yet their respective trade area overlaps are likely to be comparable to the range found for the other centers analyzed. Consequently, local household growth from 2009-2030 will

[43] The analysis uses the citywide household growth estimate of 0.67 percent annually through 2030 for the San Francisco component of each representative regional center's trade area since these trade areas cover large portions of the city, including one or more of the planned major residential development projects. In the preceding analysis of neighborhood serving retail, a lower projection (0.37 percent per year) was used for household growth since many of the relevant trade areas excluded major planned development sites.

likely generate sufficient new demand to offset most, if not all, of any estimated diversions of their respective consumer sales bases.

SUMMARY OF FINDINGS

Ultimately, many factors will determine whether a competitive shopping area located near the Project's two market areas will be susceptible to potential sales diversions or store closures. These factors include, but are not limited to, store/center management and quality, market strength, levels of service, ability to respond to changing market conditions, and store locations relative to other competitors. Overall, CBRE Consulting finds that the introduction of new retail stores at the Project are likely to attract some shoppers away from existing neighborhood-serving shopping districts and regional centers that are outside the Project's market areas. However, demand growth due to the introduction of new households in San Francisco and surrounding San Mateo County cities is also projected to be strong enough to counter most, if not all, potential sales impacts on competitive stores.

For the neighborhood-serving trade areas in the analysis, potential diversions of the competitive sales base ranged from 0.0 percent to 7.7 percent, and projected household growth through 2030 supports a finding that there will be no net consumer loss at any of the seven representative locations analyzed. For the regional retail trade areas, the three centers analyzed had a greater overlap with the Candlestick Point market area, and as a result, the potential diversion of the associated consumer bases ranges from 14.7 percent to 16.1 percent. Demand growth in two of the three representative regional trade areas is projected to be sufficient to fully offset related diversions by 2030, while the Westlake Shopping Center may experience a net loss of up to 1.1 percent of its trade area base. In addition, this potential net consumer loss is likely an extreme example based on the assumption that the planned Candlestick Point retail area will divert a full 50 percent of household demand from the overlapping trade area and would be lower if a more moderate assumption of redirected demand had been applied.

X. CUMULATIVE IMPACTS

This analysis seeks to quantify the impact of the proposed retail planned at the Project taking into consideration other planned competitive retail developments. The cumulative projects that have been assessed for impacts are those that are reasonably foreseeable to be open and have a first full year of retail operations by 2030. The approach for this analysis is similar to what was used in the assessment of Project sales impacts in that the supply of planned retail and related new sales by BOE category are estimated and compared against the expected new demand associated with household growth and recaptured leakage. If the cumulative retail developments, including the planned retail, add sales to a retail category in an amount greater than the combination of estimated recaptured leakage in the category and the expected demand from new households, *then at worst,* the remaining amount of sales are estimated to be diverted from existing market area retailers.

PROJECTS INCLUDED IN THE ANALYSIS

The information on planned retail projects came primarily from city planning offices and select environmental documents. The projects were selected because of their location either in the HPS Phase II and Candlestick Point market areas or nearby the Candlestick Point market area. Through this process, CBRE Consulting identified three cumulative retail projects within the HPS Phase II market area: Lowe's, Brisbane Baylands, and India Basin. However, two of those projects, Lowe's and Brisbane Baylands, are not competitive with the neighborhood retail planned at HPS Phase II. Those two projects likely have much larger draws for residents from a broader area than just the HPS Phase II market area. Therefore, only one project, India Basin, was considered in the cumulative impacts to the HPS Phase II market area. For the Candlestick Point market area, ten projects, including Lowe's and Brisbane Baylands, were identified within the Candlestick Point market area, and another 17 planned retail projects were identified outside of but near the Candlestick Point market area. These projects, along with a description and estimated square footage and opening dates, are presented in Exhibit 44 and mapped in Exhibit 46.

Including all projects located both within and near the Candlestick Point market area boundaries, there are a total of 3.5 million square feet of retail space in planning. Of these 3.5 million square feet, approximately 2.2 million square feet are within the Candlestick Point market area, while the remaining 1.3 million square feet are in locations outside of, but proximate to, the Candlestick Point market area boundary.

Methodology and Calculation of Planned Square Feet

The uncertain nature of the cumulative projects list, which endeavors to inventory all projects that might open over the next two decades, means that the estimated opening timeframes for each of the remaining projects are unknown. These projects are analyzed collectively. Rather than engaging in the highly uncertain task of estimating specific build-out square feet and year for each project, which cannot be accurately estimated at this time, CBRE Consulting utilized a methodology in which all planned retail square feet across the 26 retail projects was aggregated. An attrition rate of 20 percent was applied to each project's planned square feet, which accounts for the anticipation that most projects will not be developed to the density currently envisioned or some projects may not be realized.

The location of each cumulative retail project is mapped in Exhibit 46, which shows that planned projects are widely spread out except for one concentration in the South of Market neighborhood of San Francisco. Only four projects are planned within the central and southern portions of the Candlestick Point market area.

Cumulative Projects Trade Overlap with the Project

The cumulative projects are considered competitive with the Project only insomuch as their trade area overlaps with the HPS Phase II market area or the Candlestick Point market area. To this end, each cumulative project was considered in an attempt to approximate its trade area overlap with the HPS Phase II and Candlestick Point market areas. Cumulative projects were assigned a market area based on whether they draw customers mainly from the surrounding neighborhood or whether they draw residents from beyond just the surrounding neighborhood.

The market area definitions were informed by shopping center definitions published by the ICSC. Smaller projects with a neighborhood draw were assumed to have a market area of a 3-mile radius. Larger projects with a regional draw were assumed to have a market area equivalent to a 15-minute drive time, comparable to the Candlestick Point market area.[44] These are market generalizations given the available project information and deemed sufficient for this level of analysis. These determinations are shown in Exhibit 48. Seven of the 26 projects, when given this trade area definition, were found to be located far enough away from the Project to have no overlap with the HPS Phase II or Candlestick Point market areas. These projects were therefore excluded from the analysis starting in Exhibit 48.

The number of households shared by the market areas are considered to be an indicator of the trade area overlap. Using mapping software and Claritas data, Exhibit 48 calculates the share of households located both within the cumulative projects' market areas and in the HPS Phase II and/or Candlestick Point market area. Applying the resulting percentage to each planned center's estimated sales potential approximates the dollar amount of sales introduced to the HPS Phase II or Candlestick Point market area by that cumulative project, net of sales already accounted for by the Project. For example, if "Planned Project X" is projected to generate $50 million in annual sales, and 20 percent of the households in its market area are also located within the Candlestick Point market area, then it is assumed that $10 million (or 20 percent of $50 million) of additional sales are introduced to the Candlestick Point market area, above and beyond those introduced by the Project's planned retail.

Cumulative Project Sales Estimates and Sales Impacts

Exhibit 47 presents calculations of the estimated retail sales generated by each new development project. Exhibit 49 then applies the percentage estimates derived in Exhibit 48 to these sales in order to arrive at the total sales from each cumulative project that will draw from HPS Phase II or Candlestick Point market area residents. The first percentage applied is the project's market area overlap with the Project's retail component market area, approximated using households as discussed in the previous section of this chapter (and calculated in Exhibit 48). The second percentage applied to the sales estimates is the percentage of sales estimated to originate from

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[44] ICSC, *U.S. Shopping Center Definitions,* April 2009 (https://www.icsc.org/srch/lib/2009_S-C_CLASSIFICATION_May09.pdf), accessed September 2009.

each project's market area. This adjustment takes into consideration that shopping center trade areas account for the majority, but not all, of a center's sales. The percentage of sales estimated to originate from outside of each project's market area was based on the available information pertaining to each project's prospective format and size. This percentage ranges from 85 percent for Brisbane Baylands and Lowe's, which are likely to have a strong regional draw, to 95 percent for India Basin, which is likely to draw only from neighborhood residents.

Based on the preceding methodology and the calculations shown in Exhibit 49, cumulative projects located within the HPS Phase II market area will contribute $12.7 million. Cumulative projects located within and near the Candlestick Point market area will contribute $277.7 million in estimated retail sales to the Candlestick Point market area by 2030.[45] Exhibit 50 presents the allocation of cumulative project sales generated by market area residents to the BOE retail categories for purposes of comparing the sales figures with sources of new demand.[46] Exhibit 50 also accounts for normal vacancy in the market area by adjusting the $277.7 million downward by a factor of 5.0 percent to $263.8 million.

HPS PHASE II MARKET AREA IMPACTS

Exhibits 51, 52, and 53 estimate the impacts to the HPS Phase II market area from the planned Project retail component as well as the cumulative India Basin retail project. The process matches the one used to estimate impacts to the HPS Phase II market area in Chapter VII. Exhibit 51 calculates a new household demand capture rate for the HPS Phase II neighborhood retail planned combined with the India Basin retail project. Overall, these two projects will capture 9.1 percent of new household demand, but this varies by relevant category, from 0.5 percent in Building Materials to 23.5 percent in the Other Retail Stores category. Exhibit 52 applies these capture rates and the market area capture rates to determine the capture of household demand within the HPS Phase II market area. The market area capture rates are estimated based on the retail offerings within the market area as compared to options outside the market area. These market area capture rates range from 20 percent in Building Materials to 90 percent in Food Store sales. The result finds that $14.8 million of new household demand for retail is estimated to be captured by the HPS Phase II neighborhood retail area in combination with the India Basin cumulative retail project. The remaining new household demand is $102.1 million.

Table 9 summarizes the estimated sales impacts to existing retailers in the HPS Phase II market area due to the HPS Phase II neighborhood retail project in combination with the India Basin retail project.

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[45] Approximately $206.6 million in sales will be generated by projects in the Candlestick Point market area and $71.1 million will come from projects outside of but near the Candlestick Point market area. See Exhibit 49.

[46] Planned retail space with unknown orientation or product type was allocated into BOE categories by CBRE Consulting based on the estimated size of the project and analysis of various existing shopping centers in the Bay Area. See footnote 2 in Exhibit 50 for these distributional assumptions.

Table 9
Maximum Cumulative Sales Impacts in HPS Phase II Market Area
2009 Dollars, in millions

Retail Category	Maximum Sales Diverted From Project Market Area Retailers	Maximum Sales Diverted as a Share of Market Base	Final Remaining New Household Demand
Apparel	$0.0	0.0%	$3.0
General Merchandise	$0.0	0.0%	$13.3
Food Stores	$0.0	0.0%	$45.8
Eating and Drinking	$0.0	0.0%	$20.4
Home Furn. & Appliances	$0.0	0.0%	$3.8
Building Materials	$0.0	0.0%	$5.7
"Other Retail Stores"	$0.4	1.0%	$0.0
Total[1]	**$0.4**	**0.1%**	**$91.8**

Source: Exhibit 53.
(1) Figures may not total due to rounding.

As shown, the HPS Phase II market area may experience up to $0.4 million in sales impacts in 2009 dollars in the Other Retail Stores category. These impacts are relatively small, accounting for only 1.0 percent of the market area sales base in this retail category, or 0.1 percent overall. These impacts will likely be spread among many retailers; however, if certain retailers are affected disproportionately, store closures could occur.

Table 9 also shows the final remaining new household demand in the HPS Phase II market area. This demand is new household demand remaining after potential sales impacts are accounted for. In this case the potential sales impacts in the Other Retail Stores category total $10.7 million, but new household demand reduces those impacts to only $437,000 as shown in Exhibit 53. There is, therefore, no remaining demand in the Other Retail Stores category. Instead, the $91.8 million in remaining demand is most heavily concentrated in the Food Stores, Restaurants, and General Merchandise categories with yet other demand but not in the other retail sales category. If store closures were to occur in Other Retail Stores category, those vacant spaces could be retenanted by a retailer in a category with remaining new household demand. Because of this remaining demand, CBRE Consulting does not believe any vacancies due to the HPS Phase II neighborhood retail area in combination with the India Basin project will remain empty for a prolonged period of time. Therefore, existing retail districts in the HPS Phase II market area, and discussed in Chapter V, Leland Avenue, San Bruno Avenue, Third Street, and South Bayshore, are unlikely to be negatively impacted by the neighborhood retail planned at HPS Phase II and India Basin. Instead, new household growth in the HPS Phase II market area is likely to benefit the existing retail districts.

CANDLESTICK POINT MARKET AREA IMPACTS

Exhibits 54, 55, and 56 estimate the impacts to the Candlestick Point market area from the planned Project retail component as well as the cumulative projects. The process matches the one used to estimate impacts to the Candlestick Point market area in Chapter VIII. Exhibit 54 calculates a new household demand capture rate for the Candlestick Point regional center and neighborhood retail planned combined with the cumulative projects. Overall, these projects will capture 7.6 percent of new household demand, but this varies by relevant category, from 5.5 percent in

Building Materials to 17.3 percent in Apparel. Exhibit 55 applies these capture rates and the market area capture rates to determine the capture of household demand within the Candlestick Point market area.

The market area capture rates are estimated based on the retail offerings within the market area as compared to options outside the market area. Since the Candlestick Point market area is so large and since the cumulative projects' market areas extend to most of San Francisco, these market area capture rates are high. It is estimated that 95 percent of Food Store sales will be captured in the market area. The other categories are set at 90 percent.

The estimated new household demand for retail estimated to be captured by the Candlestick Point regional center and neighborhood retail area in combination with the cumulative projects totals $35.5 million. The remaining new household demand, $389.2 million, is then reduced by the estimated HPS Phase II neighborhood retail sales, since the previous analysis found that all HPS Phase II sales will be offset by new household demand. The net remaining demand that will help offset impacts to other existing retailers is $347.9 million as shown in Exhibit 55.

Table 10 summarizes the estimated sales impacts to existing retailers in the Candlestick Point market area due to the Candlestick Point regional center and neighborhood retail project in combination with the cumulative projects.

Table 10
Maximum Cumulative Sales Impacts in Candlestick Point Market Area
2009 Dollars, in millions

Retail Category	Maximum Sales Diverted From Project Market Area Retailers	Maximum Sales Diverted as a Share of Market Base	Final Remaining New Household Demand
Apparel	$23.4	9.1%	$0.0
General Merchandise	$9.9	1.2%	$0.0
Food Stores	$0.0	0.0%	$74.9
Eating and Drinking	$0.0	0.0%	$61.4
Home Furn. & Appliances	$10.8	3.5%	$0.0
Building Materials	$0.0	0.0%	$43.9
"Other Retail Stores"	$81.1	5.1%	$0.0
Total[1]	**$125.3**	**2.4%**	**$180.2**

Source: Exhibit 56.
(2) Figures may not total due to rounding.

As shown, the Candlestick Point market area may experience up to $125.3 million in sales impacts in 2009 dollars concentrated in the Other Retail Stores and Apparel categories. Smaller impacts are estimated in the General Merchandise and Home Furnishings & Appliances categories. These impacts will likely be spread among many retailers. However, if certain retailers are affected disproportionately, store closures could occur.

Table 10 also shows the final remaining new household demand in the Candlestick Point market area, net of demand that offsets some of the impacts of new retail projects. This $180.2 million in demand is in the Food Stores, Restaurants, and Building Materials categories. If store closures were to occur in Other Retail Stores and Apparel categories, those vacant spaces could be retenanted by a retailer in a category with remaining new household demand. Because of this remaining demand, CBRE Consulting does not believe any vacancies due to the Candlestick Point regional center and neighborhood retail area in combination with the cumulative projects will remain empty for a prolonged period of time. The existing retail districts in the Candlestick Point market area, Leland Avenue, San Bruno Avenue, Third Street, and South Bayshore, also are unlikely to be negatively impacted by the Candlestick Point regional center and neighborhood retail area in combination with cumulative projects because their main retail categories are estimated to have minimal impacts. South Bayshore and Third Street both have retail sales concentrated in the building materials, gas stations, and restaurants categories, which are not estimated to have any impacts. The San Bruno Avenue retail district has most of its sales in the gas stations and restaurants categories and Leland Avenue has retail sales concentrated in the food stores category and the motor vehicles and parts category. Instead, new household growth in the Candlestick Point market area and remaining demand in the Restaurants, Food Stores, and Building Materials categories are likely to benefit the existing retail districts.

XI. URBAN DECAY DETERMINATION

The purpose of this chapter is to assess the degree to which development of the Project's retail components will or will not contribute to urban decay. This includes impacts associated with the cumulative impacts of the planned HPS Phase II and Candlestick Point retail components and other identified planned retail developments. Urban decay could theoretically result from development of the Project's planned retail and other known planned retail developments due to closure of other stores resulting from negative economic impacts. This chapter discusses the definition of urban decay, approach to assessing the potential for urban decay, and CBRE Consulting's urban decay conclusion.

STUDY DEFINITION OF URBAN DECAY

For the purpose of this analysis, urban decay is defined as, among other characteristics, multiple visible symptoms of physical deterioration that invite vandalism, loitering, and graffiti that is caused by a downward spiral of business closures and long term vacancies. This physical deterioration to properties or structures is so prevalent, substantial, and lasting for a significant period of time that it impairs the proper utilization of the properties and structures, and the health, safety, and welfare of the surrounding community. The manifestations of urban decay include such visible conditions as plywood-boarded doors and windows, parked trucks and long term unauthorized use of the properties and parking lots, extensive gang and other graffiti and offensive words painted on buildings, dumping of refuse on site, overturned dumpsters, broken parking barriers, broken glass littering the site, dead trees and shrubbery together with weeds, lack of building maintenance, homeless encampments, and unsightly and dilapidated fencing.

URBAN DECAY APPROACH

CBRE Consulting's approach to assessing the potential for urban decay is grounded in all of the preceding analysis, focused on determining if the Project's retail development(s) and identified cumulative projects will directly or indirectly cause any existing retailers to close, and if the subsequent vacancies will remain vacant for a prolonged period of time such that they develop the symptoms cited above that contribute to and eventually lead to urban decay. As reviewed in the preceding chapters, new household demand by 2030, the assumed operational year of the Project retail developments, is anticipated to be sufficient to result in minimal anticipated negative sales impacts on existing retailers attributable to each project independently. There is anticipated to be new demand due to household growth in adequate quantities to support the Project's retail projects (as well as recaptured leakage relative to HPS Phase II) as well as existing retail developments that may experience some Project-related diverted sales. This is the case for retail developments located in the respective Project retail market areas as well as for nearby retail developments with shared market area portions.

The planned Project retail developments are also not perceived to lead to the closure of existing retailers on a cumulative basis after consideration of demand generated by household growth. Despite identified plans for 3.5 million square feet of cumulative retail development, the Project retail projects are not anticipated to result in retail store impacts leading to prolonged retail store vacancy. While some stores may close as a result of diverted retail sales, sufficient retail demand is anticipated to occur in other retail categories that will enable new or expanded retail enterprises to backfill the resulting vacancies. Therefore, the existing retail commercial base is not anticipated to experience prolonged vacancy or other condition likely to contribute to or lead to urban decay.

URBAN DECAY CONCLUSION

Based upon the findings regarding the presence of new retail demand sufficient to support the Project's planned retail components, other cumulative retail projects, and/or backfill retail spaces vacated as a result of project impacts, CBRE Consulting concludes that the Project's retail components will not cause or contribute to urban decay. This findings pertains to the Project's retail components on both an individual and a cumulative basis.

ASSUMPTIONS AND GENERAL LIMITING CONDITIONS

Fieldwork for this study was completed in May 2009. Accordingly, CBRE Consulting assumes no responsibility for market events pertinent to the market area occurring after that time.

CBRE Consulting has made extensive efforts to confirm the accuracy and timeliness of the information contained in this study. Such information was compiled from a variety of sources, including interviews with government officials, review of City and County documents, and other third parties deemed to be reliable. Although CBRE Consulting believes all information in this study is correct, it does not warrant the accuracy of such information and assumes no responsibility for inaccuracies in the information by third parties. We have no responsibility to update this report for events and circumstances occurring after the date of this report. Further, no guarantee is made as to the possible effect on development of present or future federal, state or local legislation, including any regarding environmental or ecological matters.

The accompanying projections and analyses are based on estimates and assumptions developed in connection with the study. In turn, these assumptions, and their relation to the projections, were developed using currently available economic data and other relevant information. It is the nature of forecasting, however, that some assumptions may not materialize, and unanticipated events and circumstances may occur. Therefore, actual results achieved during the projection period will likely vary from the projections, and some of the variations may be material to the conclusions of the analysis.

Contractual obligations do not include access to or ownership transfer of any electronic data processing files, programs or models completed directly for or as by-products of this research effort, unless explicitly so agreed as part of the contract.

This report may not be used for any purpose other than that for which it is prepared. Neither all nor any part of the contents of this study shall be disseminated to the public through publication advertising media, public relations, news media, sales media, or any other public means of communication without prior written consent and approval of CBRE Consulting.

APPENDIX A: EXHIBITS

Exhibit 1
Candlestick Point - Hunters Point Shipyard Phase II Development Plan Allocation
Retail Space by Project and Retail Tenant Type

Type of Retail	BOE Category	Share of Total	Square Feet
Candlestick Point			
Regional Center			
Anchors/Large Stores			
Anchor	General Merchandise	20%	125,000
Grocery Store	Food Stores	9%	60,000
Cinema	Specialty/Other Retail Stores	9%	55,000
Electronics/Appliances Store	Specialty/Other Retail Stores	8%	50,000
Hardware/Garden Store	Building Materials	8%	50,000
Sporting Goods Store	Specialty/Other Retail Stores	6%	40,000
Books and Stationery Store	Specialty/Other Retail Stores	4%	25,000
Smaller Stores			
Clothing Stores	Apparel	11%	70,000
Fast Food/Food Court/Misc. Food Stores	Eating and Drinking Places	7%	43,500
Furniture and Home Furnishings Stores	Home Furnishings and Appliances	5%	30,000
Gifts and Novelty Stores	Specialty/Other Retail Stores	4%	25,000
Sit-Down Restaurants	Eating and Drinking Places	4%	24,000
Other Specialty Stores	Specialty/Other Retail Stores	4%	22,500
Business and Personal Services	Not Applicable	2%	15,000
Subtotal - Regional Shopping Center		100%	635,000
Neighborhood Retail/Main Street Concept			
Business and Personal Services	Not Applicable	50%	62,500
Restaurants	Eating and Drinking Places	20%	25,000
Specialty Retail	Specialty/Other Retail Stores	12%	15,000
Drug Store	General Merchandise	10%	12,500
Other Retail Stores	Other Retail Stores	8%	10,000
Subtotal - Neighborhood Retail/Main Street Concept		100%	125,000
Total for Candlestick Point			760,000
Hunters Point Shipyard Phase II Neighborhood Retail			
Grocery	Food Stores	30%	37,500
General Merchandise	General Merchandise	15%	18,750
Restaurants	Eating and Drinking Places	15%	18,750
Specialty Retail	Specialty/Other Retail Stores	15%	18,750
Other Retail Stores	Other Retail Stores	10%	12,500
Business and Personal Services	Not Applicable	10%	12,500
Home Furnishings and Appliances	Home Furnishings and Appliances	5%	6,250
Total for Hunters Point Shipyard Phase II Neighborhood Retail		100%	125,000

Sources: Lennar Urban; and CBRE Consulting.

Exhibit 2
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
Retail Space Allocation by California State Board of Equalization (BOE) Category

Proposed Use	Square Feet (2)	BOE Sales Categories (1): Apparel	General Merchandise (3)	Food Stores	Eating & Drinking Places	Home Furnishings & Appliances	Building Materials	Other Retail	Non-Retail
Candlestick Point									
Regional Shopping Center Tenant Mix									
Anchors/Large Stores									
Anchor	125,000	0	125,000	0	0	0	0	0	0
Grocery Store	60,000	0	0	60,000	0	0	0	0	0
Cinema	55,000	0	0	0	0	0	0	55,000	0
Electronics/Appliances Store	50,000	0	0	0	0	0	0	50,000	0
Hardware/Garden Store	50,000	0	0	0	0	0	50,000	0	0
Sporting Goods Store	40,000	0	0	0	0	0	0	40,000	0
Books and Stationery Store	25,000	0	0	0	0	0	0	25,000	0
Smaller Stores									
Clothing Stores	70,000	70,000	0	0	0	0	0	0	0
Fast Food/Food Court/Misc. Food Stores	43,500	0	0	0	43,500	0	0	0	0
Furniture and Home Furnishings Stores	30,000	0	0	0	0	30,000	0	0	0
Gifts and Novelty Stores	25,000	0	0	0	0	0	0	25,000	0
Sit-Down Restaurants	24,000	0	0	0	24,000	0	0	0	0
Other Specialty Stores	22,500	0	0	0	0	0	0	22,500	0
Business and Personal Services	15,000	0	0	0	0	0	0	0	15,000
Neighborhood Retail/Main Street Concept									
Business and Personal Services	62,500	0	0	0	0	0	0	0	62,500
Restaurants	25,000	0	0	0	25,000	0	0	0	0
Specialty Retail	15,000	0	0	0	0	0	0	15,000	0
Drug Store (3)	12,500	0	12,500	0	0	0	0	0	0
Other Retail Stores	10,000	0	0	0	0	0	0	10,000	0
Total for Candlestick Point	760,000	70,000	137,500	60,000	92,500	30,000	50,000	242,500	77,500
Hunters Point Shipyard Phase II Neighborhood Retail									
Grocery	37,500	0	0	37,500	0	0	0	0	0
General Merchandise	18,750	0	18,750	0	0	0	0	0	0
Restaurants	18,750	0	0	0	18,750	0	0	0	0
Specialty Retail	18,750	0	0	0	0	0	0	18,750	0
Other Retail Stores	12,500	0	0	0	0	0	0	12,500	0
Business and Personal Services	12,500	0	0	0	0	0	0	0	12,500
Home Furnishings and Appliances	6,250	0	0	0	0	6,250	0	0	0
Total for Hunters Point Shipyard Phase II	125,000	0	18,750	37,500	18,750	6,250	0	31,250	12,500

Sources: Exhibit 1; and CBRE Consulting.

(1) Sales categories reported by the California State Board of Equalization (BOE). CBRE Consulting matched the expected retail sales categories with the BOE categories. Sales categories irrelevant to this analysis (Motor Vehicles and Supplies and Service Stations) are not shown.

(2) See Exhibit 1.

(3) Drug store sales are reported by the BOE in the General Merchandise category.

Exhibit 3
Calculation of Sales Per Square Foot Estimates (1)
Retail Store Types and Specific Retail Stores
National Averages
In 2009 Dollars

	Sales Per Square Foot						
	2003	2005		2007		Average	Average
	In 2003$'s	In 2005$'s	In 2003$'s	In 2007$'s	In 2003$'s	In 2003$'s	In 2009$'s
Store or Category (2)	[A]	[B]	[C]	[D]	[E]	[F = (A+C+E) / 3]	[G]
	(CPI = 184.00)	*(CPI = 195.30)*		*(CPI = 207.34)*			*(CPI = 213.24)*
Apparel - Specialty	$371	$392	$369	$416	$369	$370	$429
Department Stores Category	$239	$234	$220	$304	$270	$243	$282
Domestics Category	$287	$322	$303	$302	$268	$286	$331
Furniture Category	$176	$188	$177	$255	$226	$193	$224
Average of Domestics & Furniture	$232	$255	$240	$279	$247	$240	$278
Neighborhood Center Category	$322	$340	$320	$392	$348	$330	$382
Supermarkets	$348	$450	$424	$480	$426	$399	$462
Drug Stores	$534	$507	$478	$657	$583	$532	$617
Restaurants Category	$389	$372	$350	$430	$382	$374	$433
Home Improvement	$274	$279	$263	$304	$270	$269	$312
Other Retail Categories							
Electronics	$426	$490	$462	$447	$397	$428	$496
Office Supplies	$283	$304	$286	$341	$303	$291	$337
Sports	$209	$243	$229	$246	$218	$219	$254
Pet Supplies	$184	$192	$181	$189	$168	$178	$206
Book Superstores	$244	$237	$223	$242	$215	$227	$263
Video Stores	$106	$106	$100	$117	$104	$103	$119
Toys	$231	$227	$214	$367	$326	$257	$298
Music Superstores	$247	$242	$228	$340	$302	$259	$300
Gifts, Hobbies & Fabrics	$158	$141	$133	$139	$123	$138	$160
Average of Other Retail Categories	$232	$242	$228	$270	$239	$233	$270

Sources: Retail MAXIM, "Alternative Retail Risk Analysis for Alternative Capital" 2004, 2006, and 2008; United States Bureau of Labor Statistics; and CBRE Consulting.

(1) Estimates in columns A, B, and D were obtained from Retail MAXIM. Columns C and E were calculated using the Consumer Price Index for All Urban Consumers in the United States.
(2) Only categories and stores used in this urban decay analysis are shown in this exhibit.

Exhibit 4
Estimate of Average Sales Per Square Foot by BOE Category
National Averages
In 2009 Dollars

Retail Category	Average Sales Per Sq. Ft. 2009$'s (1)	
Apparel Stores		
Apparel - Specialty	$429	
General Merchandise Stores		
Drug Stores	$617	
Department Stores	$282	
Weighted Average	$354	(2)
Food Stores		
Supermarkets	$462	
Eating & Drinking Places		
Restaurants	$433	
Home Furnishings & Appliances		
Domestics	$331	
Furniture	$224	
Average	$278	
Building Materials		
Home Improvement	$312	
Other Retail Stores		
Electronics	$496	
Office Supplies	$337	
Sports	$254	
Pet Supplies	$206	
Book Superstores	$263	
Music Superstores	$300	
Toys	$298	
Gifts, Hobbies & Fabrics	$160	
Video Stores	$119	
Average	$270	

Sources: Exhibit 3; MuniServices, "Sales Tax Review, 4th Quarter 2008"; and CBRE Consulting.

(1) See Exhibit 3.

(2) Represents the weighted average based on the share of General Merchandise sales attributable to drug stores. According to MuniServices data, in the City of San Francisco, drug store sales represented approximately 21.7 percent of total General Merchandise group sales in 2008.

Exhibit 5
Drugstore Sales Payer Composition
2007 Dollars in Millions (1)

Item	Drug Store Operator: Walgreens	Rite Aid	CVS	Average
Total Revenues (2)	$59,034	$26,289	$48,990	
Front-end Sales as a % of Sales (3)	*35.1%*	*32.8%*	*32.5%*	
Front-end Sales (4)	$20,721	$8,623	$15,922	
Prescription Drug Sales as a % of Sales (2)	*64.9%*	*67.2%*	*67.5%*	
Prescription Drug Sales (5)	$38,313	$17,666	$33,068	
Third-Party % of Pharmacy Revenue (2)	*95.3%*	*96.3%*	*96.1%*	
Third-Party Plans (6)	$36,512	$17,013	$31,779	
Co-payments (7)	$8,033	$3,743	$6,991	
Direct Payments (8)	$1,801	$654	$1,290	
Direct Revenues from Customers (9)	$30,554	$13,019	$24,203	
Share of Store Revenues from Direct Customers (10)	51.8%	49.5%	49.4%	*50.2%*

Sources: Walgreens 10-K, period ending August 31, 2008; Rite Aid Corporation 10-K, period ending February 28, 2009; CVS Caremark Corp. 10-K, period ending December 31, 2008; Kaiser Family Foundation; and CBRE Consulting.

(1) Data are based on companies' fiscal year ended between December 31, 2008 and February 28, 2009.
(2) Data provided by each company's 10-K report.
(3) Portion of sales that are not prescription drug sales.
(4) Total Revenues multiplied by Front-end Sales as a percent of Sales. Front-end Sales include all store revenues excluding revenues generated from prescription drug sales.
(5) Total Revenues multiplied by Prescription Drug Sales as a percent of Sales.
(6) Prescription Drug Sales multiplied by Third-Party percent of Pharmacy Revenue.
(7) Assumes 22 percent co-payment for drug prescriptions covered by third-party plans. According to a September 2008 Kaiser Family Foundation Report, "Prescription Drug Trends," the share of prescription drug expenses paid out-of-pocket by consumers was an average of 22 percent nationally in 2006.
(8) Prescription Drug Sales minus Third-Party Plans.
(9) Direct Revenues from customers equals Front-end Sales plus Prescription Drug Co-payments plus Prescription Drug Direct Payments.
(10) Ratio of Direct Revenues from Customers to Total Revenues.

Exhibit 6
Candlestick Point - Hunters Point Shipyard Phase II Development Plan Retail Sales Estimates
Candlestick Point Regional Shopping Center Market Area
In 2009 Dollars

Proposed Use By BOE Category (1)	Estimated Square Feet (2)	National Average Estimated Sales Per Sq. Ft.		Annual Sales Estimate	Sales Originating From Market Area Residents (3)
Apparel					
Gross Leasable Area	70,000				
Vacant Space	3,500				
Occupied Space	66,500	$429	(4)	$28,528,500	$22,822,800
General Merchandise					
Gross Leasable Area	125,000				
Vacant Space	6,250				
Occupied Space	118,750	$282	(5)	$33,441,885	$26,753,508
Food Stores					
Gross Leasable Area	60,000				
Vacant Space	3,000				
Occupied Space	57,000	$462	(6)	$26,334,000	$21,067,200
Eating and Drinking Places					
Gross Leasable Area	67,500				
Vacant Space	3,375				
Occupied Space	64,125	$433	(7)	$27,766,125	$22,212,900
Home Furnishings & Appliances					
Gross Leasable Area	30,000				
Vacant Space	1,500				
Occupied Space	28,500	$278	(8)	$7,923,000	$6,338,400
Building Materials					
Gross Leasable Area	50,000				
Vacant Space	2,500				
Occupied Space	47,500	$312	(9)	$14,820,000	$11,856,000
Other Retail					
Gross Leasable Area					
Electronics/Appliance Store	50,000				
Vacant Space	2,500				
Occupied Space	47,500	$496	(10)	$23,560,000	$18,848,000
Sporting Goods Store	40,000				
Vacant Space	2,000				
Occupied Space	38,000	$254	(11)	$9,652,000	$7,721,600
Books & Stationary Store	25,000				
Vacant Space	1,250				
Occupied Space	23,750	$263	(12)	$6,246,250	$4,997,000
Gifts and Novelty Stores	25,000				
Vacant Space	1,250				
Occupied Space	23,750	$160	(13)	$3,800,000	$3,040,000
Other Specialty Stores	22,500				
Vacant Space	1,125				
Occupied Space	21,375	$270	(14)	$5,771,250	$4,617,000
Cinema Space	55,000	$50	(15)	$2,750,000	$2,200,000
Subtotal Other Retail Occupied Space	*209,375*			*$51,779,500*	*$41,423,600*
Non-Retail					
Gross Leasable Area	15,000				
Vacant Space	750				
Occupied Space	14,250	N/A		N/A	N/A
Occupied Space Total	**606,000 (16)**	--		**$190,593,010**	**$152,474,408**

Sources: Exhibits 1, 2, 3, and 4; and CBRE Consulting.

Exhibit 6
Candlestick Point - Hunters Point Shipyard Phase II Development Plan Retail Sales Estimates
Candlestick Point Regional Shopping Center Market Area
In 2009 Dollars

(1) Allocations of retail space by BOE sales categories are shown in Exhibit 2. Categories irrelevant to this analysis are excluded.
(2) Unless otherwise noted, see Exhibit 2 for square footage allocations (gross leasable area). For the purposes of estimating Candlestick Point Regional Center retail sales, CBRE Consulting assumed an average vacancy rate of 5.0 percent of gross leasable area.
(3) CBRE Consulting estimates that 80 percent of the regional shopping center sales will originate from market area residents.
(4) Represents the average sales per square foot figures from Retail MAXIM for the Apparel - Specialty category. See Exhibit 4.
(5) Represents the weighted average sales per square foot figures from Retail MAXIM for Department Stores. See Exhibit 4.
(6) Sales per square foot for Food Stores represents the Retail MAXIM figure for Supermarkets. See Exhibit 4.
(7) Sales per square foot for Eating and Drinking Places represents the Retail MAXIM figure for Restaurants. See Exhibit 4.
(8) Sales per square foot for Home Furnishings and Appliances represents the Retail MAXIM average of the Domestics and Furniture categories. See Exhibit 4.
(9) Sales per square foot for Building Materials represents the Retail MAXIM average sales per square foot for the Home Improvement category. See Exhibit 4.
(10) Sales per square foot for the Electronics/Appliance Store represents the Retail MAXIM figure for Electronics. See Exhibit 4.
(11) Sales per square foot for the Sporting Goods Store represents the Retail MAXIM figure for Sports. See Exhibit 4.
(12) Sales per square foot for the Books & Stationary Store represents the Retail MAXIM figure for Book Superstores. See Exhibit 4.
(13) Sales per square foot for the Gifts and Novelty Stores represents the Retail MAXIM figure for Gifts, Hobbies & Fabrics. See Exhibit 4.
(14) Represents the average sales per square foot figures from Retail MAXIM for the following categories: Electronics; Office Supplies; Sports; Toys; Pet Supplies; Book Superstores; Music Superstores; Gifts, Hobbies & Fabrics; and Video Stores. See Exhibit 4.
(15) CBRE Consulting estimate of the portion of cinema sales classified among BOE retail categories for snacks and beverages.
(16) Represents the total square feet to which retail sales are allocated, i.e., the total gross leasable area for Candlestick Point Regional Center of 635,000 square feet shown in Exhibit 1, less 5.0 percent of the non-cinema space to allow for vacancy and space turnover.

Exhibit 7
Candlestick Point - Hunters Point Shipyard Phase II Development Plan Retail Sales Estimates
Candlestick Point Neighborhood Retail/Main Street Concept Market Area
In 2009 Dollars

Proposed Use By BOE Category (1)	Estimated Square Feet (2)		National Average Estimated Sales Per Sq. Ft.		Annual Sales Estimate	Sales Originating From Market Area Residents (3)	
General Merchandise (Drug Store)							
Gross Leasable Area	12,500						
Vacant Space	625						
Occupied Space	11,875		$617	(4)	$7,326,875	$3,312,128	(5)
Eating and Drinking Places							
Gross Leasable Area	25,000						
Vacant Space	1,250						
Occupied Space	23,750		$433	(6)	$10,283,750	$9,255,375	
Other Retail							
Gross Leasable Area	25,000						
Vacant Space	1,250						
Occupied Space	23,750		$382	(7)	$9,072,500	$8,165,250	
Non-Retail							
Gross Leasable Area	62,500						
Vacant Space	3,125						
Occupied Space	59,375		N/A		N/A	N/A	
Occupied Space Total	**118,750**	(8)	--		**$26,683,125**	**$20,732,753**	

Sources: Exhibits 1, 2, 3, 4, and 5; Retail MAXIM, "Alternative Retail Risk Analysis for Alternative Capital," July 2008; and CBRE Consulting.

(1) Allocation of retail space by BOE sales categories are shown in Exhibit 2. Categories irrelevant to this analysis are excluded.
(2) See Exhibit 2 for the square footage of the Candlestick Point Neighborhood Retail/Main Street Concept. For the purposes of estimating sales at the Candlestick Point - Hunters Point Shipyard Phase II Development Plan, CBRE Consulting assumed an average vacancy rate of 5.0 percent of gross leasable area.
(3) CBRE Consulting estimates that 90 percent of the Candlestick Point Neighborhood Retail/Main Street Concept sales will originate from market area residents.
(4) The sales per square foot figure of $617 represents the Retail MAXIM estimate for drug stores. See Exhibit 4.
(5) Total sales for the planned drug store retailer has been reduced to reflect the 50.2 percent average share of drug store revenues from direct customers determined in Exhibit 5.
(6) Represents the average sales per square foot figures from Retail MAXIM for Restaurants. See Exhibit 4.
(7) Represents the average sales per square foot figures from Retail MAXIM for Neighborhood Centers. See Exhibit 3.
(8) Represents the total square feet to which retail sales are allocated, i.e., the total gross leasable area for the Candlestick Point Neighborhood Retail/Main Street Concept 125,000 square feet shown in Exhibit 1 less 5.0 percent to allow for vacancy and space turnover.

Exhibit 8
Candlestick Point - Hunters Point Shipyard Phase II Development Plan Retail Sales Estimates
Hunters Point Shipyard Phase II Neighborhood Retail Market Area
In 2009 Dollars

Proposed Use By BOE Category (1)	Estimated Square Feet (2)		National Average Estimated Sales Per Sq. Ft.		Annual Sales Estimate	Sales Originating From Market Area Residents (3)
General Merchandise						
Gross Leasable Area	18,750					
Vacant Space	938					
Occupied Space	17,812		$354	(4)	$6,312,779	$5,997,140
Food Stores						
Gross Leasable Area	37,500					
Vacant Space	1,875					
Occupied Space	35,625		$462	(5)	$16,458,750	$15,635,813
Eating and Drinking Places						
Gross Leasable Area	18,750					
Vacant Space	938					
Occupied Space	17,812		$433	(6)	$7,712,596	$7,326,966
Home Furnishings & Appliances						
Gross Leasable Area	6,250					
Vacant Space	313					
Occupied Space	5,937		$278	(7)	$1,650,486	$1,567,962
Other Retail						
Gross Leasable Area	31,250					
Vacant Space	1,563					
Occupied Space	29,687		$382	(8)	$11,340,434	$10,773,412
Non-Retail						
Gross Leasable Area	12,500					
Vacant Space	625					
Occupied Space	11,875		N/A		N/A	N/A
Occupied Space Total	**118,748**	(9)	--		**$43,475,045**	**$41,301,293**

Sources: Exhibits 1, 2, and 4; Retail MAXIM, "Alternative Retail Risk Analysis for Alternative Capital," July 2008; and CBRE Consulting.

(1) Allocation of retail space by BOE sales categories are shown in Exhibit 2. Categories irrelevant to this analysis are excluded.

(2) See Exhibit 2 for the square footage of the Hunters Point Shipyard Phase II Neighborhood Retail. For the purpose of estimating sales at the Candlestick Point - Hunters Point Shipyard Phase II Development Plan, CBRE Consulting assumed an average vacancy rate of 5.0 percent of gross leasable area.
(3) CBRE Consulting estimates that 95 percent of the Hunters Point Shipyard Phase II Neighborhood Retail sales will originate from market area residents.
(4) Represents the weighted average based on the share of General Merchandise sales attributable to drug stores. In the City of San Francisco, drug stores sales represented approximately 21.7 percent of total General Merchandise group sales during 2008.
(5) Sales per square foot for Food Stores represents the Retail MAXIM figure for Supermarkets. See Exhibit 4.
(6) Represents the average sales per square foot figures from Retail MAXIM for Restaurants. See Exhibit 4.
(7) Sales per square foot for Home Furnishings and Appliances represent the Retail MAXIM average of the "Domestics" and "Furniture" categories. See Exhibit 4.
(8) Represents the average sales per square foot figures from Retail MAXIM for Neighborhood Centers. See Exhibit 3.
(9) Represents the total square feet to which retail sales are allocated, i.e., the total gross leasable area for the Hunters Point Neighborhood Shipyard Phase II Retail 125,000 square feet shown in Exhibit 1 less 5.0 percent to allow for vacancy and space turnover.

Exhibit 9
Candlestick Point - Hunters Point Shipyard Phase II Development Plan Retail Sales Estimates Summary
In 2009 Dollars

Proposed Use	Estimated Occupied Retail Square Feet	Annual Sales Estimate	Sales Originating From Market Area Residents
Candlestick Point Regional Center (1)	606,000	$190,593,010	$152,474,408
Candlestick Point Neighborhood Retail / Main Street Concept (2)	118,750	$26,683,125	$20,732,753
Candlestick Point Subtotal	**724,750**	**$217,276,135**	**$173,207,161**
Hunters Point Shipyard Phase II Neighborhood Retail (3)	118,748	$43,475,045	$41,301,293
Project Total	**843,498**	**$260,751,180**	**$214,508,454**

Sources: Exhibits 6, 7, and 8; and CBRE Consulting.

(1) See Exhibit 6.
(2) See Exhibit 7.
(3) See Exhibit 8.

Exhibit 10: Candlestick Point and Hunters Point Shipyard Phase II Market Areas

San Francisco, CA

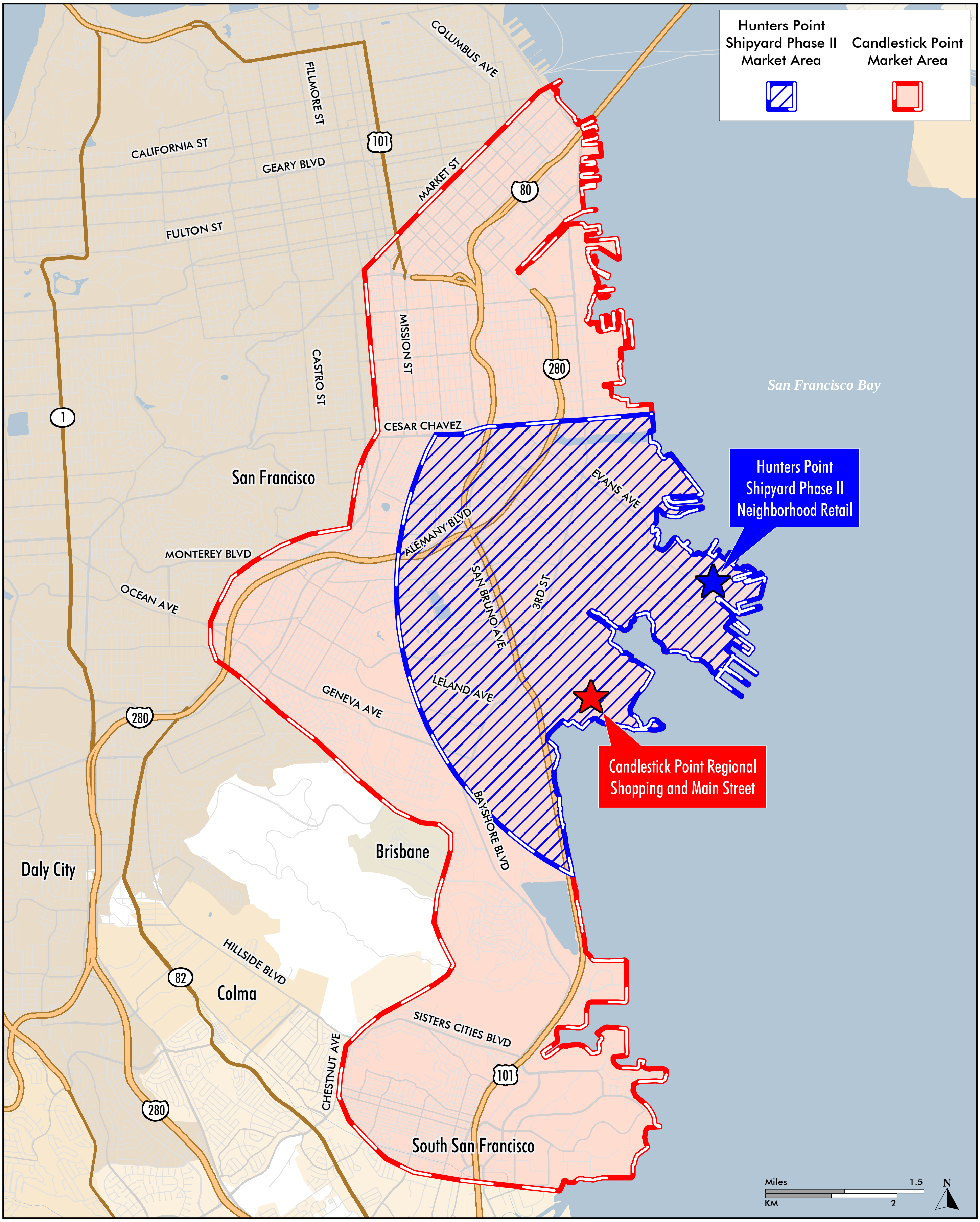

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Exhibit 11
Household Estimates and Projections
Candlestick Point and Hunters Point Shipyard Phase II Retail Market Areas

Geography	2000 (1)	2005	2007	2009 (1)	2014 (1)	2030 (2)		Compound Average Annual Growth Rates 2000-2009	2009-2014	2014-2030
Candlestick Point										
San Francisco Portion (3)	--	82,767	84,894	87,076	91,867	109,624	(4)	--	1.1%	1.1%
South San Francisco Portion (5)	6,141	6,131	6,162	6,470	6,708	7,555		0.6%	0.7%	0.7%
Daly City Portion (6)	1,501	1,537	1,560	1,635	1,702	1,866		1.0%	0.8%	0.6%
Brisbane Portion (7)	1,456	1,479	1,507	1,536	1,632	2,065		0.6%	1.2%	1.5%
Total Candlestick Point Market Area:	--	91,913	94,123	96,716	101,909	121,111		--	1.1%	1.1%
Hunters Point										
San Francisco Portion (8)	--	22,701	22,809	22,917	23,259	36,791	(4)	--	0.3%	2.9%
Daly City Portion (9)	147	154	157	161	168	184		1.0%	0.8%	0.6%
Total Hunters Point Shipyard Phase II Market Area:	--	22,855	22,966	23,078	23,426	36,975		--	0.3%	2.9%

Sources: Claritas; Association of Bay Area Governments, "Projections 2007"; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting.

(1) Claritas data interpolated from 2000 data, 2009 estimates, and 2014 projections, excluding San Francisco.
(2) Comprises the analysis year.
(3) See Appendix C-1.
(4) The total from Appendix C-1 has been increased by 10,500 and 1,600 to account for households planned at Hunters Point and Schlage Lock, respectively.
(5) See Appendix C-2.
(6) See Appendix C-3.
(7) See Appendix C-4.
(8) See Appendix D-1.
(9) See Appendix D-2.

Exhibit 12
Average Household Income Estimates, 2000 and 2009
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
In 2000 and 2009 Year Dollars

Year / Market Area	Average Household Income
2000	
Candlestick Point	
San Francisco Portion	$70,201
South San Francisco Portion	$71,589
Daly City Portion	$75,732
Brisbane Portion	$74,721
Candlestick Point Market Area (1)	$70,475
Hunters Point Shipyard Phase II	
San Francisco Portion	$61,921
Daly City Portion	$64,947
Hunters Point Shipyard Phase II Market Area (1)	$61,941
2009	
Candlestick Point	
San Francisco Portion	$89,210
South San Francisco Portion	$89,268
Daly City Portion	$102,953
Brisbane Portion	$104,672
Candlestick Point Market Area (1)	$89,678
Hunters Point Shipyard Phase II	
San Francisco Portion	$82,246
Daly City Portion	$93,091
Hunters Point Shipyard Phase II Market Area (1)	$82,319

Sources: Claritas; and CBRE Consulting.

(1) Represents the weighted average household income based on the distribution of households across the different Market Areas.

Exhibit 13
Calculation of 2007 Average Household Income Estimates (1)
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
In 2000, 2007, and 2009 Dollars

Market Area / Item	Amount
<u>Candlestick Point Market Area</u>	
Average Household Income 2000 (2)	$70,475
Average Household Income 2009 (2)	$89,678
Compound Average Annual Growth Rate, 2000-2009	2.7%
Implied Average Household Income, 2007	$85,002
<u>Hunters Point Shipyard Phase II Market Area</u>	
Average Household Income 2000 (2)	$61,941
Average Household Income 2009 (2)	$82,319
Compound Average Annual Growth Rate, 2000-2009	3.2%
Implied Average Household Income, 2007	$77,277

Sources: Exhibit 12; and CBRE Consulting.

(1) Average household income estimate is calculated for 2007 in order to conduct the Retail Demand, Sales Attraction, and Spending Leakage Analysis.
(2) See Exhibit 12.

Exhibit 14
Calculation of 2007 Market Area Retail Sales
Candlestick Point Regional Shopping Center and Neighborhood/Main Street Concept Retail Market Area
San Francisco's Portion of the Market Area
In 2007 and 2008 Dollars

	Claritas Retail Sales in 2008 (1)			BOE Sales in 2007			
Type of Retailer	Total Retail Sales in San Francisco County [A]	Total Retail Sales in San Francisco's Portion of Candlestick Point Market Area [B]	Ratio of San Francisco's Portion of the Market Area to County [C = B / A]	Taxable Sales in San Francisco County [D]	Total Retail Sales in San Francisco County [E]		2007 San Francisco's Portion of Candlestick Point Market Area Retail Sales [F = E * C]
Apparel Stores	$1,452,000,000	$368,000,000	25.3%	$1,028,602,000	$1,028,602,000		$260,692,518
General Merchandise Stores	$1,456,700,000	$543,300,000	37.3%	$1,349,158,000	$2,190,901,034	(2)	$817,132,239
Food Stores	$2,033,100,000	$651,600,000	32.0%	$480,587,000	$1,601,956,667	(2)	$513,420,375
Eating and Drinking Places	$3,028,800,000	$914,400,000	30.2%	$2,589,892,000	$2,589,892,000		$781,892,910
Home Furnishings & Appliances	$851,400,000	$434,100,000	51.0%	$608,766,000	$608,766,000		$310,389,148
Building Materials	$431,800,000	$288,600,000	66.8%	$459,332,000	$459,332,000		$307,001,425
Motor Vehicles & Parts	$570,100,000	$301,700,000	52.9%	$502,912,000	$502,912,000		$266,143,747
Service Stations	$477,300,000	$239,000,000	50.1%	$565,749,000	$565,749,000		$283,289,359
Other Retail Stores	$5,041,000,000	$2,927,900,000	58.1%	$2,421,574,000	$2,421,574,000		$1,406,492,068
Total	**$15,342,200,000**	**$6,668,600,000**	**43.5%**	**$10,006,572,000**	**$11,969,684,701**		**$4,946,453,789**

Sources: Appendices E, F-1, and F-2, Claritas Inc. 2008; California State Board of Equalization, "Taxable Sales in California 2007"; and CBRE Consulting.

(1) Claritas data are in 2008 dollars. See Appendices F-1 and F-2 for a translation of Claritas data into BOE retail categories.

(3) Column E represents all retail sales (taxable and non-taxable) based on upward adjustments to the General Merchandise and Food Store amounts in Column D to reflect the non-taxable sales in those categories. CBRE Consulting estimates that 30 percent of food store sales and 33 percent of drug store sales are taxable, based on discussions with the California BOE, examination of U.S. Census data, and the drug store sales information in Exhibit 5. In San Francisco County, drug store sales in 2008 represented approximately 21.7 percent of all general merchandise store sales, and CBRE Consulting applied that percentage to the market area calculation in Column D and then adjusted upward for non-taxable sales. In addition, CBRE Consulting estimates that a minimum of 10.0 percent of the remaining non-drug store General Merchandise sales are for grocery items which are also non-taxable. This estimate is based on the analyses of the 2002 U.S. Economic Census (see Appendix E which attributes 19 percent of General Merchandise Stores sales to food. This 19 percent of food sales was then adjusted downward to account for the portion that is taxable.

Exhibit 15
Calculation of 2007 Market Area Retail Sales
Candlestick Point Regional Shopping Center and Neighborhood Retail/Main Street Concept Market Area
City of South San Francisco's Portion of the Market Area
In 2007 and 2008 Dollars

	Claritas Retail Sales in 2008 (1)			BOE Sales in 2007			
Type of Retailer	Total Retail Sales in San Mateo County [A]	Total Retail Sales in the City of S. San Francisco's Portion of Candlestick Point Market Area [B]	Ratio of S. San Francisco's Portion of the Market Area to County [C = B / A]	Taxable Sales in San Mateo County [D]	Total Retail Sales in San Mateo County [E]		2007 S. San Francisco's Portion of Candlestick Point Market Area Retail Sales [F = E * C]
Apparel Stores	$499,000,000	$1,800,000	0.4%	$425,086,000	$425,086,000		$1,533,376
General Merchandise Stores	$1,818,400,000	$27,600,000	1.5%	$1,363,715,000	$2,013,544,127	(2)	$30,561,932
Food Stores	$1,814,300,000	$29,200,000	1.6%	$430,879,000	$1,436,263,333	(2)	$23,115,741
Eating and Drinking Places	$1,502,900,000	$50,400,000	3.4%	$1,245,105,000	$1,245,105,000		$41,754,802
Home Furnishings & Appliances	$472,800,000	$19,500,000	4.1%	$535,371,000	$535,371,000		$22,080,657
Building Materials	$1,221,700,000	$18,900,000	1.5%	$846,050,000	$846,050,000		$13,088,602
Motor Vehicles & Parts	$2,639,800,000	$44,400,000	1.7%	$1,579,609,000	$1,579,609,000		$26,568,164
Service Stations	$624,700,000	$21,800,000	3.5%	$1,008,460,000	$1,008,460,000		$35,191,977
Other Retail Stores	$1,507,400,000	$59,800,000	4.0%	$1,564,706,000	$1,564,706,000		$62,073,384
Total	**$12,101,000,000**	**$273,400,000**	**2.3%**	**$8,998,981,000**	**$10,654,194,461**		**$255,968,635**

Sources: Appendices E, F-3, and F-4; Claritas Inc. 2008; California State Board of Equalization, "Taxable Sales in California 2007"; and CBRE Consulting.

(1) Claritas data are in 2008 dollars. See Appendices F-3 and F-4 for a translation of Claritas data into BOE retail categories.

(2) Column E represents all retail sales (taxable and non-taxable) based on upward adjustments to the General Merchandise and Food Store amounts in Column D to reflect the non-taxable sales in those categories. CBRE Consulting estimates that 30 percent of food store sales and 33 percent of drug store sales are taxable, based on discussions with the California BOE, examination of U.S. Census data, and the drug store sales information in Exhibit 5. In San Mateo County, drug store sales in 2008 represented approximately 13.5 percent of all general merchandise store sales, and CBRE Consulting applied that percentage to the market area calculation in Column D and then adjusted upward for non-taxable sales. In addition, CBRE Consulting estimates that a minimum of 10.0 percent of the remaining non-drug store General Merchandise sales are for grocery items which are also non-taxable. This estimate is based on the analyses of the 2002 U.S. Economic Census (see Appendix E which attributes 19 percent of General Merchandise Stores sales to food. This 19 percent of food sales was then adjusted downward to account for the portion that is taxable.

Exhibit 16
Calculation of 2007 Market Area Retail Sales
Candlestick Point Regional Shopping Center and Neighborhood Retail/Main Street Concept Market Area
City of Daly City's Portion of the Market Area
In 2007 and 2008 Dollars

	Claritas Retail Sales in 2008 (1)			BOE Sales in 2007		
Type of Retailer	Total Retail Sales in San Mateo County [A]	Total Retail Sales in the City of Daly City's Portion of Candlestick Point Market Area [B]	Ratio of Daly City's Portion of the Market Area to County [C = B / A]	Taxable Sales in San Mateo County [D]	Total Retail Sales in San Mateo County [E]	2007 Daly City's Portion of Candlestick Point Market Area Retail Sales [F = E * C]
Apparel Stores	$499,000,000	$0	0.0%	$425,086,000	$425,086,000	$0
General Merchandise Stores	$1,818,400,000	$10,800,000	0.6%	$1,363,715,000	$2,013,544,127 (2)	$11,959,017
Food Stores	$1,814,300,000	$1,400,000	0.1%	$430,879,000	$1,436,263,333 (2)	$1,108,289
Eating and Drinking Places	$1,502,900,000	$21,500,000	1.4%	$1,245,105,000	$1,245,105,000	$17,812,068
Home Furnishings & Appliances	$472,800,000	$500,000	0.1%	$535,371,000	$535,371,000	$566,171
Building Materials	$1,221,700,000	$2,800,000	0.2%	$846,050,000	$846,050,000	$1,939,052
Motor Vehicles & Parts	$2,639,800,000	$500,000	0.0%	$1,579,609,000	$1,579,609,000	$299,191
Service Stations	$624,700,000	$3,900,000	0.6%	$1,008,460,000	$1,008,460,000	$6,295,812
Other Retail Stores	$1,507,400,000	$6,200,000	0.4%	$1,564,706,000	$1,564,706,000	$6,435,702
Total	**$12,101,000,000**	**$47,600,000**	**0.4%**	**$8,998,981,000**	**$10,654,194,461**	**$46,415,302**

Sources: Appendices E, F-3, and F-5; Claritas Inc. 2008; California State Board of Equalization, "Taxable Sales in California 2007"; and CBRE Consulting.

(1) Claritas data are in 2008 dollars. See Appendices F-3 and F-5 for a translation of Claritas data into BOE retail categories.

(2) Column E represents all retail sales (taxable and non-taxable) based on upward adjustments to the General Merchandise and Food Store amounts in Column D to reflect the non-taxable sales in those categories. CBRE Consulting estimates that 30 percent of food store sales and 33 percent of drug store sales are taxable, based on discussions with the California BOE, examination of U.S. Census data, and the drug store sales information in Exhibit 5. In San Mateo County, drug store sales in 2008 represented approximately 13.5 percent of all general merchandise store sales, and CBRE Consulting applied that percentage to the market area calculation in Column D and then adjusted upward for non-taxable sales. In addition, CBRE Consulting estimates that a minimum of 10.0 percent of the remaining non-drug store General Merchandise sales are for grocery items which are also non-taxable. This estimate is based on the analyses of the 2002 U.S. Economic Census (see Appendix E which attributes 19 percent of General Merchandise Stores sales to food. This 19 percent of food sales was then adjusted downward to account for the portion that is taxable.

Exhibit 17
Calculation of 2007 Market Area Retail Sales
Candlestick Point Regional Shopping Center and Neighborhood Retail/Main Street Concept Market Area
City of Brisbane's Portion of the Market Area
In 2007 and 2008 Dollars

	Claritas Retail Sales in 2008 (1)			BOE Sales in 2007			
Type of Retailer	Total Retail Sales in San Mateo County [A]	Total Retail Sales in the City of Daly City's Portion of Candlestick Point Market Area [B]	Ratio of Daly City's Portion of the Market Area to County [C = B / A]	Taxable Sales in San Mateo County [D]	Total Retail Sales in San Mateo County [E]		2007 Daly City's Portion of Candlestick Point Market Area Retail Sales [F = E * C]
Apparel Stores	$499,000,000	$700,000	0.1%	$425,086,000	$425,086,000		$596,313
General Merchandise Stores	$1,818,400,000	$3,000,000	0.2%	$1,363,715,000	$2,013,544,127	(2)	$3,321,949
Food Stores	$1,814,300,000	$4,900,000	0.3%	$430,879,000	$1,436,263,333	(2)	$3,879,011
Eating and Drinking Places	$1,502,900,000	$3,400,000	0.2%	$1,245,105,000	$1,245,105,000		$2,816,792
Home Furnishings & Appliances	$472,800,000	$1,300,000	0.3%	$535,371,000	$535,371,000		$1,472,044
Building Materials	$1,221,700,000	$21,100,000	1.7%	$846,050,000	$846,050,000		$14,612,143
Motor Vehicles & Parts	$2,639,800,000	$2,400,000	0.1%	$1,579,609,000	$1,579,609,000		$1,436,117
Service Stations	$624,700,000	$0	0.0%	$1,008,460,000	$1,008,460,000		$0
Other Retail Stores	$1,507,400,000	$60,600,000	4.0%	$1,564,706,000	$1,564,706,000		$62,903,797
Total	$12,101,000,000	$97,400,000	0.8%	$8,998,981,000	$10,654,194,461		$91,038,166

Sources: Appendices E, F-3, and F-6; Claritas Inc. 2008; California State Board of Equalization, "Taxable Sales in California 2007"; and CBRE Consulting.

(1) Claritas data are in 2008 dollars. See Appendices F-3 and F-6 for a translation of Claritas data into BOE retail categories.

(2) Column E represents all retail sales (taxable and non-taxable) based on upward adjustments to the General Merchandise and Food Store amounts in Column D to reflect the non-taxable sales in those categories. CBRE Consulting estimates that 30 percent of food store sales and 33 percent of drug store sales are taxable, based on discussions with the California BOE, examination of U.S. Census data, and the drug store sales information in Exhibit 5. In San Mateo County, drug store sales in 2008 represented approximately 13.5 percent of all general merchandise store sales, and CBRE Consulting applied that percentage to the market area calculation in Column D and then adjusted upward for non-taxable sales. In addition, CBRE Consulting estimates that a minimum of 10.0 percent of the remaining non-drug store General Merchandise sales are for grocery items which are also non-taxable. This estimate is based on the analyses of the 2002 U.S. Economic Census (see Appendix E which attributes 19 percent of General Merchandise Stores sales to food. This 19 percent of food sales was then adjusted downward to account for the portion that is taxable.

Exhibit 18
Candlestick Point Regional Shopping Center and Neighborhood Retail/Main Street Concept Market Area
Total Project Market Area Sales Estimates
In 2007 and 2008 Dollars

Type of Retailer	Candlestick Point Market Area Section of San Francisco (1) [A]	Candlestick Point Market Area Section of S. San Francisco (2) [B]	Candlestick Point Market Area Section of Daly City (3) [C]	Candlestick Point Market Area Section of Brisbane (4) [D]	2007 Total Estimated Candlestick Point Market Area Retail Sales [E = A + B + C + D]
Apparel Stores	$260,692,518	$1,533,376	$0	$596,313	$262,822,207
General Merchandise Stores	$817,132,239	$30,561,932	$11,959,017	$3,321,949	$862,975,137
Food Stores	$513,420,375	$23,115,741	$1,108,289	$3,879,011	$541,523,416
Eating and Drinking Places	$781,892,910	$41,754,802	$17,812,068	$2,816,792	$844,276,572
Home Furnishings & Appliances	$310,389,148	$22,080,657	$566,171	$1,472,044	$334,508,020
Building Materials	$307,001,425	$13,088,602	$1,939,052	$14,612,143	$336,641,222
Motor Vehicles and Parts	$266,143,747	$26,568,164	$299,191	$1,436,117	$294,447,219
Service Stations	$283,289,359	$35,191,977	$6,295,812	$0	$324,777,148
Other Retail Stores	$1,406,492,068	$62,073,384	$6,435,702	$62,903,797	$1,537,904,951
Total	**$4,946,453,789**	**$255,968,635**	**$46,415,302**	**$91,038,166**	**$5,339,875,892**

Sources: Exhibits 14, 15, 16, and 17; and CBRE Consulting.

(1) See Exhibit 14.
(2) See Exhibit 15.
(3) See Exhibit 16.
(4) See Exhibit 17.

Exhibit 19
Candlestick Point Market Area 2009 Sales Base
Inflated to 2009 Dollars
In 2007 and 2009 Dollars

Retail Category	Candlestick Point Market Area Sales Base 2007$'s (1)	Sales Base Adjustment (2) 2007-2008	Sales Base Adjustment (2) 2008-2009	Candlestick Point Market Area Sales Base 2009$'s
Apparel Stores	$262,822,207	-1.5%	-0.8%	$256,938,275
General Merchandise Stores	$862,975,137	-3.6%	-1.8%	$816,933,687
Food Stores	$541,523,416	5.6%	0.0%	$571,848,727
Eating & Drinking Places	$844,276,572	2.9%	1.5%	$881,357,621
Home Furnishings & Appliances	$334,508,020	-4.6%	-2.3%	$311,780,876
Building Materials	$336,641,222	-6.8%	-3.4%	$303,082,132
Motor Vehicles & Parts	$294,447,219	-19.3%	-9.7%	$214,688,681
Service Stations	$324,777,148	11.8%	-5.0%	$344,945,809
Other Retail Stores	$1,537,904,951	2.5%	1.3%	$1,596,056,982
Total / Weighted Average	**$5,339,875,892**			**$5,297,632,791**

Sources: Exhibit 24; MuniServices; The HdL Companies; and CBRE Consulting.

(1) See Exhibit 24.
(2) The sales base adjustment figures for 2007-2008 are the actual change in sales taxes in the entire City of San Francisco from 2007 to 2008 based on data from MuniServices and The HdL Companies. CBRE Consulting estimated the trend for 2008 to 2009, assuming one-half the prior year rate of change, with the exception of Service Stations, which are assumed to decline 5.0 percent because of the relatively lower gas prices, and Food Stores, which have been projected by HdL to be flat through 2010.

Exhibit 20
Calculation of 2007 Market Area Retail Sales
Hunters Point Shipyard Phase II Neighborhood Retail
San Francisco's Portion of the Market Area
In 2007 and 2008 Dollars

	Claritas Retail Sales in 2008 (1)			BOE Sales in 2007		
Type of Retailer	Total Retail Sales in San Francisco County [A]	Total Retail Sales in San Francisco's Portion of Hunters Point Shipyard Phase II Market Area [B]	Ratio of San Francisco's Portion of the Market Area to County [C = B / A]	Taxable Sales in San Francisco County [D]	Total Retail Sales in San Francisco County [E]	2007 San Francisco's Portion of Hunters Point Shipyard Phase II Market Area Retail Sales [F = E * C]
Apparel Stores	$1,452,000,000	$9,700,000	0.7%	$1,028,602,000	$1,028,602,000	$6,871,515
General Merchandise Stores	$1,456,700,000	$43,600,000	3.0%	$1,349,158,000	$2,190,901,034 (2)	$65,575,125
Food Stores	$2,033,100,000	$146,000,000	7.2%	$480,587,000	$1,601,956,667 (2)	$115,038,942
Eating and Drinking Places	$3,028,800,000	$78,600,000	2.6%	$2,589,892,000	$2,589,892,000	$67,209,955
Home Furnishings & Appliances	$851,400,000	$87,500,000	10.3%	$608,766,000	$608,766,000	$62,564,042
Building Materials	$431,800,000	$122,900,000	28.5%	$459,332,000	$459,332,000	$130,736,227
Motor Vehicles & Parts	$570,100,000	$45,100,000	7.9%	$502,912,000	$502,912,000	$39,784,829
Service Stations	$477,300,000	$17,300,000	3.6%	$565,749,000	$565,749,000	$20,505,882
Other Retail Stores	$5,041,000,000	$87,300,000	1.7%	$2,421,574,000	$2,421,574,000	$41,936,800
Total	$15,342,200,000	$638,000,000	4.2%	$10,006,572,000	$11,969,684,701	$550,223,317

Sources: Appendices E, F-1, and G-1; Claritas Inc. 2008; California State Board of Equalization, "Taxable Sales in California 2007"; and CBRE Consulting.

(1) Claritas data are in 2008 dollars. See Appendices F-1 and G-1 for a translation of Claritas data into BOE retail categories.

(2) Column E represents all retail sales (taxable and non-taxable) based on upward adjustments to the General Merchandise and Food Store amounts in Column D to reflect the non-taxable sales in those categories. CBRE Consulting estimates that 30 percent of food store sales and 33 percent of drug store sales are taxable, based on discussions with the California BOE, examination of U.S. Census data, and the drug store sales information in Exhibit 5. In San Francisco County, drug store sales in 2008 represented approximately 21.7 percent of all general merchandise store sales, and CBRE Consulting applied that percentage to the market area calculation in Column D and then adjusted upward for non-taxable sales. In addition, CBRE Consulting estimates that a minimum of 10.0 percent of the remaining non-drug store General Merchandise sales are for grocery items which are also non-taxable. This estimate is based on the analyses of the 2002 U.S. Economic Census (see Appendix E which attributes 19 percent of General Merchandise Stores sales to food. This 19 percent of food sales was then adjusted downward to account for the portion that is taxable.

Exhibit 21
Calculation of 2007 Market Area Retail Sales
Hunters Point Shipyard Phase II Neighborhood Retail
City of Daly City's Portion of the Market Area
In 2007 and 2008 Dollars

Type of Retailer	Claritas Retail Sales in 2008 (1) Total Retail Sales in San Mateo County [A]	Claritas Retail Sales in 2008 (1) Total Retail Sales in the City of Daly City's Portion of Hunters Point Shipyard Phase II Market Area [B]	Claritas Retail Sales in 2008 (1) Ratio of Daly City's Portion of the Market Area to County [C = B / A]	BOE Sales in 2007 Taxable Sales in San Mateo County [D]	BOE Sales in 2007 Total Retail Sales in San Mateo County [E]	2007 Daly City's Portion of Hunters Point Shipyard Phase II Market Area Retail Sales [F = E * C]
Apparel Stores	$499,000,000	$0	0.00%	$425,086,000	$425,086,000	$0
General Merchandise Stores	$1,818,400,000	$200,000	0.01%	$1,363,715,000	$2,013,544,127 (2)	$221,463
Food Stores	$1,814,300,000	$200,000	0.01%	$430,879,000	$1,436,263,333 (2)	$158,327
Eating and Drinking Places	$1,502,900,000	$200,000	0.01%	$1,245,105,000	$1,245,105,000	$165,694
Home Furnishings & Appliances	$472,800,000	$0	0.00%	$535,371,000	$535,371,000	$0
Building Materials	$1,221,700,000	$300,000	0.02%	$846,050,000	$846,050,000	$207,756
Motor Vehicles & Parts	$2,639,800,000	$0	0.00%	$1,579,609,000	$1,579,609,000	$0
Service Stations	$624,700,000	$1,100,000	0.18%	$1,008,460,000	$1,008,460,000	$1,775,742
Other Retail Stores	$1,507,400,000	$1,300,000	0.09%	$1,564,706,000	$1,564,706,000	$1,349,421
Total	**$12,101,000,000**	**$3,300,000**	**0.03%**	**$8,998,981,000**	**$10,654,194,461**	**$3,878,403**

Sources: Appendices E, F-3, and G-2; Claritas Inc. 2008; California State Board of Equalization, "Taxable Sales in California 2007"; and CBRE Consulting.

(1) Claritas data are in 2008 dollars. See Appendices F-3 and G-2 for a translation of Claritas data into BOE retail categories.

(2) Column E represents all retail sales (taxable and non-taxable) based on upward adjustments to the General Merchandise and Food Store amounts in Column D to reflect the non-taxable sales in those categories. CBRE Consulting estimates that 30 percent of food store sales and 33 percent of drug store sales are taxable, based on discussions with the California BOE, examination of U.S. Census data, and the drug store sales information in Exhibit 5. In San Mateo County, drug store sales in 2008 represented approximately 13.5 percent of all general merchandise store sales, and CBRE Consulting applied that percentage to the market area calculation in Column D and then adjusted upward for non-taxable sales. In addition, CBRE Consulting estimates that a minimum of 10.0 percent of the remaining non-drug store General Merchandise sales are for grocery items which are also non-taxable. This estimate is based on the analyses of the 2002 U.S. Economic Census (see Appendix E which attributes 19 percent of General Merchandise Stores sales to food. This 19 percent of food sales was then adjusted downward to account for the portion that is taxable.

Exhibit 22
Hunters Point Shipyard Phase II Neighborhood Retail
Total Project Market Area Sales Estimates
In 2007 and 2008 Dollars

Type of Retailer	Hunters Point Shipyard Phase II Market Area Section of San Francisco (1) [A]	Hunters Point Shipyard Phase II Market Area Section of Daly City (2) [B]	2007 Total Estimated Hunters Point Shipyard Phase II Market Area Retail Sales [C = A + B]
Apparel Stores	$6,871,515	$0	$6,871,515
General Merchandise Stores	$65,575,125	$221,463	$65,796,588
Food Stores	$115,038,942	$158,327	$115,197,269
Eating and Drinking Places	$67,209,955	$165,694	$67,375,649
Home Furnishings & Appliances	$62,564,042	$0	$62,564,042
Building Materials	$130,736,227	$207,756	$130,943,983
Motor Vehicles and Parts	$39,784,829	$0	$39,784,829
Service Stations	$20,505,882	$1,775,742	$22,281,624
Other Retail Stores	$41,936,800	$1,349,421	$43,286,221
Total	**$550,223,317**	**$3,878,403**	**$554,101,720**

Sources: Exhibits 20, and 21; and CBRE Consulting.

(1) See Exhibit 20.
(2) See Exhibit 21.

Exhibit 23
Hunters Point Shipyard Phase II Market Area 2009 Sales Base
Inflated to 2009 Dollars
In 2007 and 2009 Dollars

Retail Category	Hunters Point Shipyard Phase II Market Area Sales Base 2007$'s (1)	Sales Base Adjustment (2) 2007-2008	2008-2009	Hunters Point Shipyard Phase II Market Area Sales Base 2009$'s
Apparel Stores	$6,871,515	-1.5%	-0.8%	$6,717,679
General Merchandise Stores	$65,796,588	-3.6%	-1.8%	$62,286,208
Food Stores	$115,197,269	5.6%	0.0%	$121,648,316
Eating & Drinking Places	$67,375,649	2.9%	1.5%	$70,334,821
Home Furnishings & Appliances	$62,564,042	-4.6%	-2.3%	$58,313,316
Building Materials	$130,943,983	-6.8%	-3.4%	$117,890,439
Motor Vehicles & Parts	$39,784,829	-19.3%	-9.7%	$29,008,094
Service Stations	$22,281,624	11.8%	-5.0%	$23,665,313
Other Retail Stores	$43,286,221	2.5%	1.3%	$44,922,981
Total / Weighted Average	**$554,101,720**			**$534,787,167**

Sources: Exhibit 22; MuniServices; The HdL Companies; and CBRE Consulting.

(1) See Exhibit 22.

(2) The sales base adjustment figures for 2007-2008 are the actual change in sales taxes in the entire City of San Francisco from 2007 to 2008 based on data from MuniServices and The HdL Companies. CBRE Consulting estimated the trend for 2008 to 2009, assuming one-half the prior year rate of change, with the exception of Service Stations, which are assumed to decline 5.0 percent because of the relatively lower gas prices, and Food Stores, which have been projected by HdL to be flat through 2010.

Exhibit 24
Retail Demand, Sales Attraction, and Spending Leakage Analysis (1)
Candlestick Point Market Area
2007

	Candlestick Point Mkt. Area Per Household (2)		Candlestick Point Market Area Total (In $ 000's)			
Type of Retailer	Spending	Sales	Spending	Sales	Attraction/ (Leakage)	Percent
Apparel Stores	$1,399	$2,792	$131,666	$262,822	$131,156	49.9%
General Merchandise Stores (3)	$3,807	$9,169	$358,339	$862,975	$504,636	58.5%
Food Stores (4)	$4,187	$5,753	$394,094	$541,523	$147,429	27.2%
Eating and Drinking Places	$3,364	$8,970	$316,636	$844,277	$527,640	62.5%
Home Furnishings & Appliances	$972	$3,554	$91,445	$334,508	$243,063	72.7%
Building Materials	$2,149	$3,577	$202,230	$336,641	$134,411	39.9%
Motor Vehicles & Parts	$6,771	$3,128	$637,281	$294,447	($342,834)	(53.8%)
Service Stations	$2,629	$3,451	$247,454	$324,777	$77,323	23.8%
Other Retail Stores (5)	$3,296	$16,339	$310,195	$1,537,905	$1,227,710	79.8%
Total	$28,573	$56,734	$2,689,341	$5,339,876	$2,650,535	49.6%

Sources: Exhibits 11 and 13; California State Board of Equalization (BOE), Taxable Sales in California, 2007; Claritas; MuniServices; and CBRE Consulting.

(1) All figures are expressed in constant 2007 dollars. Product line control area defined as the Bay Area (San Francisco CMSA). Consumer expenditure control area defined as US West (states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming).
(2) Analysis assumes an average household income of $85,002 in 2007, as shown in Exhibit 13. Household count estimated at 94,123 as shown in Exhibit 11. Average household income for the reference area, California, estimated at $68,757 in 2007.
(3) Includes general merchandise and drug stores. Drug stores are assumed to comprise 21.7 percent of total general merchandise sales based on CBRE Consulting's analysis of 2008 San Francisco County taxable sales data from MuniServices. Taxable sales for drug stores have been adjusted to account for the estimated two-thirds of drug store sales that are non-taxable.
(4) Sales for food stores have been adjusted to account for non-taxable sales; only 30 percent of all food store sales are estimated to be taxable.
(5) Other retail stores includes packaged liquor stores, gifts, art goods and novelties, sporting goods, florists, photographic equipment and supplies, musical instruments, stationary and books, jewelry, office supplies, computer stores, second-hand merchandise, farm and garden supply stores, fuel and ice dealers, and miscellaneous other retail stores.

Exhibit 25
Retail Spending Potential
Candlestick Point Market Area
Inflated to 2009 Dollars

	Candlestick Point Market Area Total Retail Spending Adjustment (2)				Adjusted Market Area Sales Base	Adjusted Market Area Attraction / (Leakage)	
Retail Store Type	2007$'s (1) [A]	2007-2008 [B]	2008-2009 [C]	2009$'s [D = A * (1+B) * (1+C)]	2009$'s (3) [E]	2009$'s [F = E - D]	Percent [G]
Apparel Stores	$131,665,830	-1.5%	-0.8%	$128,718,161	$256,938,275	$128,220,114	49.9%
General Merchandise Stores	$358,339,326	-3.6%	-1.8%	$339,221,206	$816,933,687	$477,712,481	58.5%
Food Stores	$394,094,478	5.6%	0.00%	$416,163,768	$571,848,727	$155,684,959	27.2%
Eating & Drinking Places	$316,636,086	2.9%	1.45%	$330,542,901	$881,357,621	$550,814,720	62.5%
Home Furnishings & Appliances	$91,445,008	-4.6%	-2.3%	$85,232,051	$311,780,876	$226,548,825	72.7%
Building Materials	$202,229,754	-6.8%	-3.4%	$182,069,874	$303,082,132	$121,012,257	39.9%
Motor Vehicles & Parts	$637,281,318	-19.3%	-9.7%	$464,657,422	$214,688,681	($249,968,741)	(53.8%)
Service Stations	$247,454,192	11.8%	-5.0%	$262,821,097	$344,945,809	$82,124,711	23.8%
Other Retail Stores	$310,194,645	2.5%	1.25%	$321,923,880	$1,596,056,982	$1,274,133,102	79.8%
Total	**$2,689,340,636**			**$2,531,350,362**	**$5,297,632,791**	**$2,766,282,429**	**52.2%**

Sources: Exhibits 19 and 24; MuniServices; The HdL Companies; and CBRE Consulting.

(1) See Exhibit 24.

(2) The sales base adjustment figures for 2007-2008 are the actual change in sales taxes in the entire City of San Francisco from 2007 to 2008 based on data from MuniServices and The HdL Companies. CBRE Consulting estimated the trend for 2008 to 2009, assuming one-half the prior year rate of change, with the exception of Service Stations, which are assumed to decline 5.0 percent because of the relatively lower gas prices, and Food Stores, which have been projected by HdL to be flat through 2010.

(3) See Exhibit 19.

Exhibit 26
Retail Demand, Sales Attraction, and Spending Leakage Analysis (1)
Hunters Point Shipyard Phase II Market Area
2007

	Hunters Point Shipyard Phase II Mkt. Area Per Household (2)		Hunters Point Shipyard Phase II Market Area Total (In $ 000's)			
Type of Retailer	Spending	Sales	Spending	Sales	Attraction/ (Leakage)	Percent
Apparel Stores	$1,318	$299	$30,278	$6,872	($23,406)	(77.3%)
General Merchandise Stores (3)	$3,618	$2,865	$83,086	$65,797	($17,289)	(20.8%)
Food Stores (4)	$4,052	$5,016	$93,064	$115,197	$22,133	19.2%
Eating and Drinking Places	$3,179	$2,934	$73,005	$67,376	($5,629)	(7.7%)
Home Furnishings & Appliances	$880	$2,724	$20,210	$62,564	$42,354	67.7%
Building Materials	$1,981	$5,702	$45,499	$130,944	$85,445	65.3%
Motor Vehicles & Parts	$6,381	$1,732	$146,550	$39,785	($106,766)	(72.9%)
Service Stations	$2,549	$970	$58,542	$22,282	($36,260)	(61.9%)
Other Retail Stores (5)	$3,133	$1,885	$71,959	$43,286	($28,673)	(39.8%)
Total	$27,092	$24,127	$622,193	$554,102	($68,091)	(10.9%)

Sources: Exhibits 11 and 13; California State Board of Equalization (BOE), Taxable Sales in California, 2007; Claritas; MuniServices; and CBRE Consulting.

(1) All figures are expressed in constant 2007 dollars. Product line control area defined as the Bay Area (San Francisco CMSA). Consumer expenditure control area defined as US West (states of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming).
(2) Analysis assumes an average household income of $77,277 in 2007, as shown in Exhibit 13. Household count estimated at 22,966 as shown in Exhibit 11. Average household income for the reference area, California, estimated at $68,757 in 2007.
(3) Includes general merchandise and drug stores. Drug stores are assumed to comprise 21.7 percent of total general merchandise sales based on CBRE Consulting's analysis of 2008 San Francisco County taxable sales data from MuniServices. Taxable sales for drug stores have been adjusted to account for the estimated two-thirds of drug store sales that are non-taxable.
(4) Sales for food stores have been adjusted to account for non-taxable sales; only 30 percent of all food store sales are estimated to be taxable.
(5) Other retail stores includes packaged liquor stores, gifts, art goods and novelties, sporting goods, florists, photographic equipment and supplies, musical instruments, stationary and books, jewelry, office supplies, computer stores, second-hand merchandise, farm and garden supply stores, fuel and ice dealers, and miscellaneous other retail stores.

Exhibit 27
Retail Spending Potential
Hunters Point Shipyard Phase II Market Area
Inflated to 2009 Dollars

	Hunters Point Shipyard Phase II Market Area Total Retail Spending Adjustment (2)				Adjusted Market Area Sales Base	Adjusted Market Area Attraction / (Leakage)	
Retail Store Type	2007$'s (1) [A]	2007-2008 [B]	2008-2009 [C]	2009$'s [D = A * (1+B) * (1+C)]	2009$'s (3) [E]	2009$'s [F = E - D]	Percent [G]
Apparel Stores	$30,277,600	-1.5%	-0.8%	$29,599,760	$6,717,679	($22,882,082)	(77.3%)
General Merchandise Stores	$83,085,654	-3.6%	-1.8%	$78,652,868	$62,286,208	($16,366,660)	(20.8%)
Food Stores	$93,064,158	5.6%	0.0%	$98,275,750	$121,648,316	$23,372,566	19.2%
Eating & Drinking Places	$73,004,699	2.9%	1.5%	$76,211,102	$70,334,821	($5,876,281)	(7.7%)
Home Furnishings & Appliances	$20,209,780	-4.6%	-2.3%	$18,836,687	$58,313,316	$39,476,629	67.7%
Building Materials	$45,499,420	-6.8%	-3.4%	$40,963,674	$117,890,439	$76,926,765	65.3%
Motor Vehicles & Parts	$146,550,429	-19.3%	-9.7%	$106,853,508	$29,008,094	($77,845,415)	(72.9%)
Service Stations	$58,542,005	11.8%	-5.0%	$62,177,464	$23,665,313	($38,512,151)	(61.9%)
Other Retail Stores	$71,959,099	2.5%	1.3%	$74,680,052	$44,922,981	($29,757,071)	(39.8%)
Total	**$622,192,844**			**$586,250,866**	**$534,787,167**	**($51,463,699)**	**(8.8%)**

Sources: Exhibits 23 and 26; MuniServices; The HdL Companies; and CBRE Consulting.

(1) See Exhibit 26.
(2) The sales base adjustment figures for 2007-2008 are the actual change in sales taxes in the entire City of San Francisco from 2007 to 2008 based on data from MuniServices and The HdL Companies. CBRE Consulting estimated the trend for 2008 to 2009, assuming one-half the prior year rate of change, with the exception of Service Stations, which are assumed to decline 5.0 percent because of the relatively lower gas prices, and Food Stores, which have been projected by HdL to be flat through 2010.
(3) See Exhibit 23.

Exhibit 28
Estimated Capture Rates of New Household Demand in the Hunters Point Shipyard Phase II Market Area
In 2009 Dollars

Retail Category	Hunters Point Market Area Adjusted Sales Base (1) [A]	Market Area Sales from Hunters Point (2) [B]	Hunters Point Capture Rate of Market Area Sales (3) [C = B / A]
Apparel Stores	$6,717,679	$0	0.0%
General Merchandise Stores	$62,286,208	$5,997,140	9.6%
Food Stores	$121,648,316	$15,635,813	12.9%
Eating & Drinking Places	$70,334,821	$7,326,966	10.4%
Home Furnishings & Appliances	$58,313,316	$1,567,962	2.7%
Building Materials	$117,890,439	$0	0.0%
Motor Vehicles & Parts	$29,008,094	$0	0.0%
Service Stations	$23,665,313	$0	0.0%
Other Retail Stores	$44,922,981	$10,773,412	24.0%
Total	$534,787,167	$41,301,293	7.7%

Sources: Exhibits 8 and 23; and CBRE Consulting.

(1) See Exhibit 23.
(2) See Exhibit 8.
(3) Represents the assumed percentage of new demand that may be captured by Hunters Point Shipyard Phase II Neighborhood Retail within the market area. Capture rates were developed based on comparing the share of the new development's projected sales to the total retail sales in the market area. It is likely that not all the Hunters Point market area sales will be new to the market area; however, this is a conservative approach to provide minimum capture rate assumptions for the project, assuming that all sales are diverted from existing retailers.

Exhibit 29
New Demand Generated by New Households by Type of Unit (1)
Hunters Point Shipyard Phase II Market Area
2009-2030
In 2009 Dollars (2)

	Affordable Rental Units (3)		Affordable For Sale Units (3)		Other New Households in Market Rate Units				
	Per Household Demand 2009$'s	Demand From New Households 2009-2030	Per Household 2009$'s	Demand From New Households 2009-2030	Per Household Demand (4)				Demand From New Mkt Rate HHs 2009-2030
Retail Category	[A]	[B = A * 1,644]	[C]	[D = C * 1,701]	2007$'s [E]	2007-2008 [F]	2008-2009 [G]	2009$'s [H]	[I = H * 10,552]
Apparel Stores	$869	$1,428,967	$1,280	$2,176,906	$1,399	-1.5%	-0.8%	$1,436	$15,147,356
General Merchandise Stores	$2,811	$4,621,615	$3,527	$5,999,422	$3,807	-3.6%	-1.8%	$3,907	$41,224,769
Food Stores	$3,420	$5,623,277	$3,988	$6,783,006	$4,187	5.6%	0.0%	$4,297	$45,338,183
Eating & Drinking Places	$2,212	$3,637,019	$3,090	$5,256,129	$3,364	2.9%	1.5%	$3,452	$36,427,064
Home Furnishings & Appliances	$637	$1,047,284	$836	$1,422,213	$972	-4.6%	-2.3%	$997	$10,520,194
Building Materials	$1,213	$1,993,745	$1,901	$3,233,481	$2,149	-6.8%	-3.4%	$2,205	$23,265,308
Motor Vehicles & Parts	$4,071	$6,692,811	$6,194	$10,536,812	$6,771	-19.3%	-9.7%	$6,948	$73,315,356
Service Stations	$2,012	$3,308,061	$2,511	$4,270,755	$2,629	11.8%	-5.0%	$2,698	$28,468,106
Other Retail Stores	$2,203	$3,621,678	$3,055	$5,197,360	$3,296	2.5%	1.3%	$3,382	$35,686,015
Total	$19,449	$31,974,456	$26,382	$44,876,083	$28,573			$29,321	$309,392,351

Sources: Exhibit 26, Appendix H-1, and Appendix H-2; and CBRE Consulting.

(1) See Exhibit 11 for the household projections. There are 10,552 new housing units projected to be added to the Hunters Point Shipyard Phase II market area between 2009 and 2030. This figure is in addition to the affordable units planned at Hunters Point Shipyard and Candlestick Point, of which there will be 1,644 in affordable rental units and 1,701 in affordable for-sale units.
(2) Figures are in 2009 dollars unless otherwise noted.
(3) See Appendix H-1 and Appendix H-2 for per household demand for affordable rental and for-sale units.
(4) See Exhibit 24 for the 2007 household demand estimate. See Exhibit 27 footnote 2 for the explanation of projecting household demand from 2007 to 2009.

Exhibit 30
New Demand Generated by Household Growth
Hunters Point Shipyard Phase II Market Area
2009-2030
In 2009 Dollars (1)

Retail Category	Demand From New Households 2009-2030 (2) [A]	Hunters Point Shipyard Phase II Market Area Capture Rate (3) [B]	Market Area Sales Captured [C = A * B]	Project Capture Rate of Market Area Sales (4) [D]	Estimated Capture of Demand from New Households [E = C * D]	Remaining Potential Demand (Captured By Other Stores) [F = C - E]
Apparel Stores	$18,753,229	20.0%	$3,750,646	0.0%	$0	$3,750,646
General Merchandise Stores	$51,845,807	30.0%	$15,553,742	9.6%	$1,497,570	$14,056,172
Food Stores	$57,744,465	90.0%	$51,970,019	12.9%	$6,679,858	$45,290,161
Eating & Drinking Places	$45,320,212	50.0%	$22,660,106	10.4%	$2,360,564	$20,299,542
Home Furnishings & Appliances	$12,989,690	30.0%	$3,896,907	2.7%	$104,782	$3,792,125
Building Materials	$28,492,534	20.0%	$5,698,507	0.0%	$0	$5,698,507
Motor Vehicles & Parts	$90,544,978	N/A	N/A	0.0%	N/A	N/A
Service Stations	$36,046,922	N/A	N/A	0.0%	N/A	N/A
Other Retail Stores	$44,505,053	30.0%	$13,351,516	24.0%	$3,201,955	$10,149,560
Total	**$386,242,889**		**$116,881,442**		**$13,844,730**	**$103,036,712**

Sources: Exhibits 11, 26, and 28; and CBRE Consulting.

(1) Figures are in 2009 dollars unless otherwise noted.
(2) See Exhibit 29. New demand includes households living in affordable units.
(3) Capture rates estimated based on the retail offerings within the market area as compared to options outside the market area.
(4) Capture rates reflect that market area residents may choose to shop at retail shopping centers other than Hunters Point Shipyard Phase II, and as such, Hunters Point Shipyard Phase II will only capture a fraction of demand generated by new household growth. See Exhibit 28 for the calculation of the capture rates by retail category.

Exhibit 31
Potential Sales Impacts
Hunters Point Shipyard Phase II Market Area
In 2009 Dollars

Retail Category	Hunters Point Shipyard Phase II Market Area Sales (1) [A]	Hunters Point Shipyard Phase II Capture of New Demand (2) [B]	2009 Market Area Adjusted Sales Base (3) [C]	Potential Absorbed Leakage (4) [D]	Intermediary Potential Sales Impacts: Amount [E = A - B +D]	Intermediary Potential Sales Impacts: Percent [F = E / C]	Remaining Potential Demand from New Households (2) [G]	Sales Diverted From Existing Market Area Retailers: Amount [H = E - G]	Sales Diverted From Existing Market Area Retailers: Percent [I = H / C]
Apparel Stores	$0	$0	$6,717,679	$0	$0	0.0%	$3,750,646	$0	0.0%
General Merchandise Stores	$5,997,140	$1,497,570	$62,286,208	($5,400,998)	$0	0.0%	$14,056,172	$0	0.0%
Food Stores	$15,635,813	$6,679,858	$121,648,316	$0	$8,955,955	7.4%	$45,290,161	$0	0.0%
Eating & Drinking Places	$7,326,966	$2,360,564	$70,334,821	($1,939,173)	$3,027,230	4.3%	$20,299,542	$0	0.0%
Home Furnishings & Appliances	$1,567,962	$104,782	$58,313,316	$0	$1,463,179	2.5%	$3,792,125	$0	0.0%
Building Materials	$0	$0	$117,890,439	$0	$0	0.0%	$5,698,507	$0	0.0%
Motor Vehicles & Parts	$0	N/A	$29,008,094	N/A	N/A	N/A	N/A	$0	0.0%
Service Stations	$0	N/A	$23,665,313	N/A	N/A	N/A	N/A	$0	0.0%
Other Retail Stores	$10,773,412	$3,201,955	$44,922,981	($9,819,833)	$0	0.0%	$10,149,560	$0	0.0%
Total	$41,301,293	$13,844,730	$534,787,167	($17,160,004)	$13,446,364	2.5%	$103,036,712	$0	0.0%

Sources: Exhibits 8, 28, and 30; and CBRE Consulting.

(1) See Exhibit 8.
(2) See Exhibit 30.
(3) See Exhibit 28.
(4) Calculated as 33 percent of leakage amounts in Exhibit 27, for relevant categories with Hunters Point Shipyard Phase II sales.

Exhibit 32
Estimated Capture Rates of New Household Demand in the Candlestick Point Market Area
In 2009 Dollars

Retail Category	Candlestick Point Market Area Adjusted Sales Base (1) [A]	Market Area Sales from Candlestick Point (2) [B]	Candlestick Point Capture Rate of Market Area Sales (3) [C = B / A]
Apparel Stores	$256,938,275	$22,822,800	8.9%
General Merchandise Stores	$816,933,687	$30,065,636	3.7%
Food Stores	$571,848,727	$21,067,200	3.7%
Eating & Drinking Places	$881,357,621	$31,468,275	3.6%
Home Furnishings & Appliances	$311,780,876	$6,338,400	2.0%
Building Materials	$303,082,132	$11,856,000	3.9%
Motor Vehicles & Parts	$214,688,681	$0	0.0%
Service Stations	$344,945,809	$0	0.0%
Other Retail Stores	$1,596,056,982	$49,588,850	3.1%
Total	**$5,297,632,791**	**$173,207,161**	**3.3%**

Sources: Exhibits 6, 7, and 19; and CBRE Consulting.

(1) See Exhibit 19.
(2) See Exhibits 6 and 7.
(3) Represents the assumed percentage of new demand that may be captured by Candlestick Point within the market area. Capture rates were developed based on comparing the share of the new development's projected sales to the total retail sales in the market area. It is likely that not all the Candlestick Point market area sales will be new to the market area; however, this is a conservative approach to provide minimum capture rate assumptions for the project, assuming that all sales are diverted from existing retailers.

Exhibit 33
New Demand Generated by New Households by Type of Unit (1)
Candlestick Point Market Area
2009-2030
In 2009 Dollars (2)

	Affordable Rental Units (3)		Affordable For Sale Units (3)		Other New Households in Market Rate Units				
	Per Household Demand 2009$'s	Demand From New Households 2009-2030	Per Household 2009$'s	Demand From New Households 2009-2030	Per Household Demand (4)				Demand From New Mkt Rate HHs 2009-2030
					2007$'s	2007-2008	2008-2009	2009$'s	
Retail Category	[A]	[B = A * 1,644]	[C]	[D = C * 1,701]	[E]	[F]	[G]	[H]	[I = H * 21,049]
Apparel Stores	$869	$1,428,967	$1,280	$2,176,906	$1,399	-1.5%	-0.8%	$1,436	$30,216,288
General Merchandise Stores	$2,811	$4,621,615	$3,527	$5,999,422	$3,807	-3.6%	-1.8%	$3,907	$82,236,099
Food Stores	$3,420	$5,623,277	$3,988	$6,783,006	$4,187	5.6%	0.0%	$4,297	$90,441,630
Eating & Drinking Places	$2,212	$3,637,019	$3,090	$5,256,129	$3,364	2.9%	1.5%	$3,452	$72,665,529
Home Furnishings & Appliances	$637	$1,047,284	$836	$1,422,213	$972	-4.6%	-2.3%	$997	$20,985,921
Building Materials	$1,213	$1,993,745	$1,901	$3,233,481	$2,149	-6.8%	-3.4%	$2,205	$46,410,162
Motor Vehicles & Parts	$4,071	$6,692,811	$6,194	$10,536,812	$6,771	-19.3%	-9.7%	$6,948	$146,251,126
Service Stations	$2,012	$3,308,061	$2,511	$4,270,755	$2,629	11.8%	-5.0%	$2,698	$56,788,820
Other Retail Stores	$2,203	$3,621,678	$3,055	$5,197,360	$3,296	2.5%	1.3%	$3,382	$71,187,268
Total	**$19,449**	**$31,974,456**	**$26,382**	**$44,876,083**	**$28,573**			**$29,321**	**$617,182,843**

Sources: Exhibit 24, Appendix H-1, and Appendix H-2; and CBRE Consulting.

(1) See Exhibit 11 for the household projections. There are 21,049 new housing units projected to be added to the Candlestick Point market area between 2009 and 2030. This figure is in addition to the affordable units planned at Hunters Point Shipyard Phase II and Candlestick Point, of which there will be 1,644 in affordable rental units and 1,701 in affordable for-sale units.
(2) Figures are in 2009 dollars unless otherwise noted.
(3) See Appendix H-1 and Appendix H-2 for per household demand for affrodable rental and for-sale units.
(4) See Exhibit 24 for the 2007 household demand estimate. See Exhibit 27 footnote 2 for the explanation of projecting household demand from 2007 to 2009.

Exhibit 34
New Demand Generated by Household Growth
Candlestick Point Market Area
2009-2030
In 2009 Dollars (1)

Retail Category	Demand From New Households 2009-2030 (2) [A]	Candlestick Point Market Area Capture Rate (3) [B]	Market Area Sales Captured [C = A * B]	Project Capture Rate of Market Area Sales (4) [D]	Estimated Capture of Demand from New Households [E = C * D]	New Demand Captured by Hunters Point Shipyard Phase II Retail (5) [F]	Other Demand Offsetting Impacts in Hunters Pt. Shipyard Phase II Market Area (6) [G]	Remaining Potential Demand (Captured By Other Stores) [H = C - E - F - G]
Apparel Stores	$33,822,161	50.0%	$16,911,081	8.9%	$1,502,144	$0	$0	$15,408,937
General Merchandise Stores	$92,857,137	50.0%	$46,428,569	3.7%	$1,708,712	$1,497,570	$0	$43,222,286
Food Stores	$102,847,912	85.0%	$87,420,725	3.7%	$3,220,624	$6,679,858	$8,955,955	$68,564,289
Eating & Drinking Places	$81,558,677	50.0%	$40,779,338	3.6%	$1,455,999	$2,360,564	$3,027,230	$33,935,546
Home Furnishings & Appliances	$23,455,417	50.0%	$11,727,708	2.0%	$238,420	$104,782	$1,463,179	$9,921,326
Building Materials	$51,637,388	80.0%	$41,309,910	3.9%	$1,615,966	$0	$0	$39,693,944
Motor Vehicles & Parts	$163,480,748	N/A	N/A	0.0%	N/A	N/A	N/A	N/A
Service Stations	$64,367,636	N/A	N/A	0.0%	N/A	N/A	N/A	N/A
Other Retail Stores	$80,006,306	50.0%	$40,003,153	3.1%	$1,242,882	$3,201,955	$0	$35,558,316
Total	**$694,033,382**		**$284,580,484**		**$10,984,746**	**$13,844,730**	**$13,446,364**	**$246,304,644**

Sources: Exhibits 11, 24, and 32; and CBRE Consulting.

(1) Figures are in 2009 dollars unless otherwise noted.
(2) See Exhibit 33 for the calculation of new demand by unit type.
(3) Capture rates estimated based on the retail offerings within the market area as compared to options outside the market area.
(4) Capture rates reflect that market area residents may choose to shop at retail shopping centers other than Candlestick Point, and as such, Candlestick Point will only capture a fraction of demand generated by new household growth. See Exhibit 32 for the calculation of the capture rates by retail category.

(5) See Exhibit 30. The demand captured by Hunters Point Shipyard Phase II Neighborhood Retail is not available to offset impacts in the Candlestick Point market area; therefore, is taken out to avoid double counting.
(6) See Exhibit 31. The demand available in the Hunters Point Shipyard Phase II Market Area to offset impacts are removed to avoid double counting.

Exhibit 35
Potential Sales Impacts
Candlestick Point Market Area
In 2009 Dollars

Retail Category	Candlestick Point Market Area Sales (1) [A]	Candlestick Point Capture of New Demand (2) [B]	2009 Market Area Adjusted Sales Base (3) [C]	Potential Absorbed Leakage (4) [D]	Intermediary Potential Sales Impacts Amount [E = A - B +D]	Remaining Potential Demand from New Households (5) [F]	Sales Diverted From Existing Market Area Amount [G = E - F]	Sales Diverted From Existing Market Area Percent [H = G / C]
Apparel Stores	$22,822,800	$1,502,144	$256,938,275	$0	$21,320,656	$15,408,937	$5,911,719	2.3%
General Merchandise Stores	$30,065,636	$1,708,712	$816,933,687	$0	$28,356,924	$43,222,286	$0	0.0%
Food Stores	$21,067,200	$3,220,624	$571,848,727	$0	$17,846,576	$68,564,289	$0	0.0%
Eating & Drinking Places	$31,468,275	$1,455,999	$881,357,621	$0	$30,012,276	$33,935,546	$0	0.0%
Home Furnishings & Appliances	$6,338,400	$238,420	$311,780,876	$0	$6,099,980	$9,921,326	$0	0.0%
Building Materials	$11,856,000	$1,615,966	$303,082,132	$0	$10,240,034	$39,693,944	$0	0.0%
Motor Vehicles & Parts	$0	N/A	$214,688,681	$0	N/A	N/A	N/A	N/A
Service Stations	$0	N/A	$344,945,809	$0	N/A	N/A	N/A	N/A
Other Retail Stores	$49,588,850	$1,242,882	$1,596,056,982	$0	$48,345,968	$35,558,316	$12,787,653	0.8%
Total	**$173,207,161**	**$10,984,746**	**$5,297,632,791**	**$0**	**$162,222,414**	**$246,304,644**	**$18,699,372**	**0.4%**

Sources: Exhibits 6, 7, 32, 34, and 30; and CBRE Consulting.

(1) See Exhibit 6 and 7.
(2) See Exhibit 34.
(3) See Exhibit 32.
(4) Since the only category with leakage is the Service Stations category, to which Candlestick Point will not contribute any new sales, there is no potential for recaptured leakage from the project.
(5) Demand remaining after sales captured by Hunters Point retail are accounted for as well as remaining demand available to Hunters Point Shipyard Phase II market area existing retailers.

Exhibit 36: Estimated Trade Areas of Grocery Stores Within and Near the Neighborhood Retail Market Area

San Francisco, CA

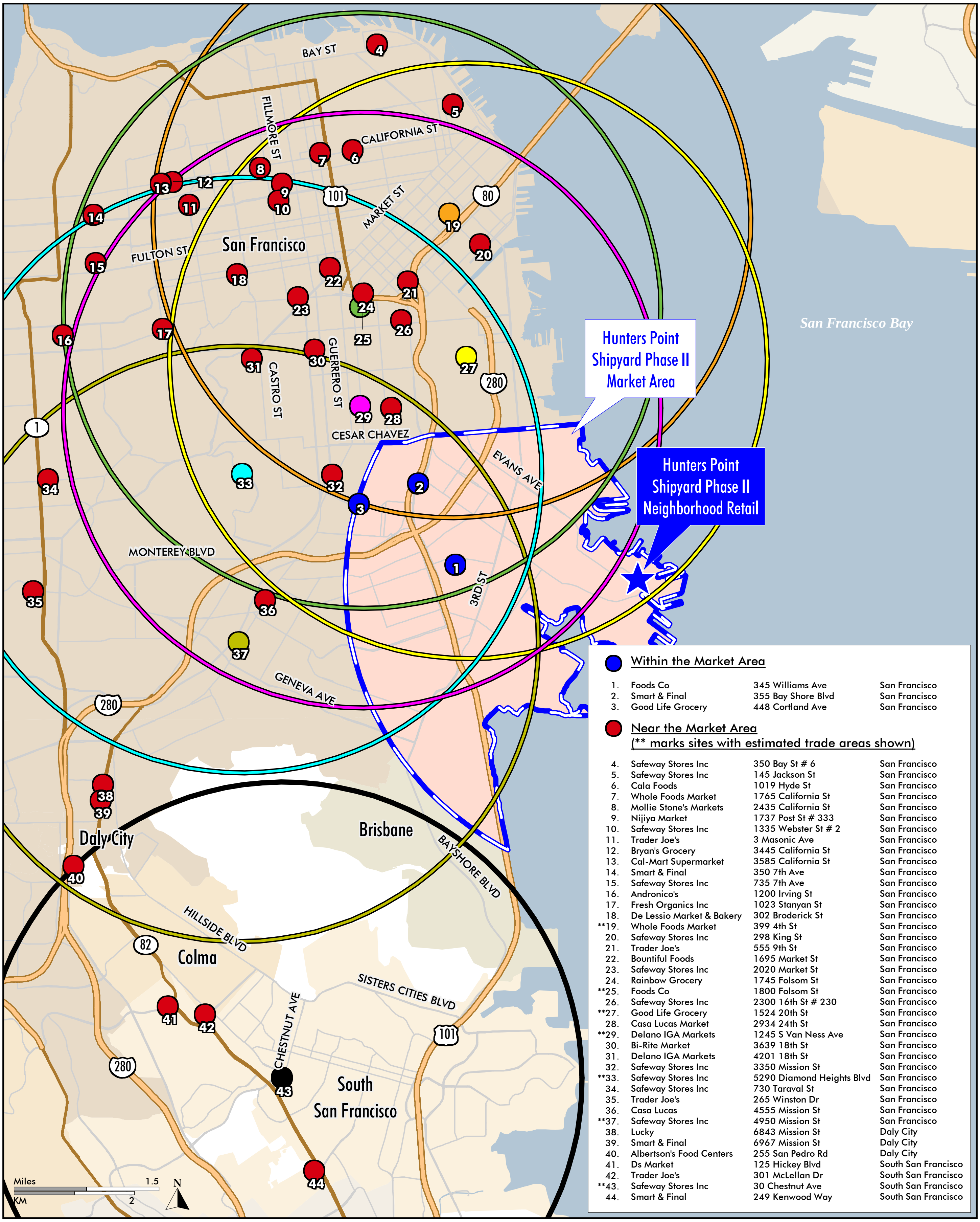

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Exhibit 37
Trade Area Households of Select Grocery Stores
Near the Hunters Point Shipyard Phase II Neighborhood Retail Market Area (1)
2009 and 2030

Store (4)	Trade Area Households 2009 (2) Total	Overlapping With the Hunters Point Shipyard Phase II Market Area	Percent Overlapping With the Project Market Area	Trade Area Households 2030 (3) Total	Increase from 2009
	[A]	[B]	[C = B / A]	[D]	[E = D - A]
19. Whole Foods Market (399 4th St., SF)	200,184	3,385	1.7%	216,328	16,144
25. Foods Co. (1800 Folsom St., SF)	247,754	13,338	5.4%	267,733	19,980
27. Good Life Grocery (1524 20th St., SF)	197,446	19,239	9.7%	213,369	15,923
29. Delano IGA Market (1245 S. Van Ness, SF)	225,244	22,035	9.8%	243,408	18,164
33. Safeway (5290 Diamond Heights Blvd., SF)	206,331	19,330	9.4%	222,970	16,639
37. Safeway (4950 Mission St., SF)	128,274	19,722	15.4%	140,174	11,899
43. Safeway (30 Chestnut Ave., South SF)	50,648	0	0.0%	54,732	N/A

Sources: Exhibit 36; Claritas, Inc.; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; Association of Bay Area Governments (ABAG) "Projections 2007"; International Council of Shopping Centers (ICSC), U.S. Shopping Center Definitions, April 2009 (https://www.icsc.org/srch/lib/2009_S-C_CLASSIFICATION_May09.pdf); and CBRE Consulting.

(1) For the purposes of analysis, the trade area for the stores presented is defined as the area within a 3-mile radius of the respective store based on research prepared by the International Council of Shopping Centers. Household estimates and projections were obtained from Claritas, Inc.

(2) The first column shows the estimates of the total households in each grocery store's trade area in 2009. The second column displays the number of households in each store's trade area that are also within the Hunters Point Shipyard Phase II market area. See Appendices I-1, I-2, and I-3.

(3)The trade areas for store numbers 19, 25, 27, 29 and 33 are fully within the City of San Francisco boundaries. For these stores, a citywide growth rate of 0.37 percent per year has been assumed for the years 2009-2030 based on citywide estimates obtained from the San Francisco Urban Water Management Plan (see Appendix C-1). The 0.37 percent rate excludes major development projects at Treasure Island, Park Merced, and Hunters Point/Candlestick, which raise the San Francisco citywide rate to 0.67 percent annually through 2030. CBRE Consulting made this downward adjustment to the overal growth rate since the local trade areas analyzed may not overlap with the locations of the larger developments. For store number 37, the weighted average household growth rate for the proportional sections of these geographic areas is 0.42 percent per year using the combination of San Francisco estimate and data for other cities obtained from the Association of Bay Area Governments (see Appendix J for details). No estimate was prepared for the store number 43, the Safeway store in South San Francisco, since the associated 3-mile radius trade area does not overlap with the Hunters Point Shipyard Phase II Neighborhood market area.

(4) Store numbering matches the identification in the Exhibit 36 map. If a store from Exhibit 36 is not included in the list, then the store's estimated trade area does not overlap with the market area.

Exhibit 38
Offsetting Effects of Household Growth for Select Grocery Stores
Near the Hunters Point Shipyard Phase II Neighborhood Retail Market Area
2009 - 2030

	Trade Area Households 2009 (1)		Potential Diversion of 2009 Consumer Base (2)		Households Gain 2009-2030 (1)	Net Potential Customer Loss 2030	
	Radius Total	% Overlapping with HP Shipyard Phase II Market Area	Percent	Total	Radius Total	Amount (3)	%
Store (4)	[A]	[B]	[C = B / 2]	[D = A * C]	[E]	[F = D - E]	[G = F/D]
19. Whole Foods Market (399 4th St., SF)	200,184	1.7%	0.8%	1,692	16,144	0	0.0%
25. Foods Co. (1800 Folsom St., SF)	247,754	5.4%	2.7%	6,669	19,980	0	0.0%
27. Good Life Grocery (1524 20th St., SF)	197,446	9.7%	4.9%	9,620	15,923	0	0.0%
29. Delano IGA Market (1245 S. Van Ness, SF)	225,244	9.8%	4.9%	11,018	18,164	0	0.0%
33. Safeway (5290 Diamond Heights Blvd., SF)	206,331	9.4%	4.7%	9,665	16,639	0	0.0%
37. Safeway (4950 Mission St., SF)	128,274	15.4%	7.7%	9,861	11,899	0	0.0%
43. Safeway (30 Chestnut Ave., South SF)	50,648	0.0%	0.0%	0	N/A	0	0.0%

Sources: Exhibits 36 and 37; Claritas, Inc.; and CBRE Consulting.

(1) See Exhibit 37.
(2) Reflects the potential loss in the store's trade area households should one-half (50 percent) of those households divert their grocery purchases to the Hunters Point Shipyard Phase II Neighborhood retc
(3) A "0" is shown if the amount of the difference between column E and column D is less than or equal to zero.

(4) Store numbering matches the identification in the Exhibit 36 map. If a store from Exhibit 36 is not included in the list, then the store's estimated trade area does not overlap with the market area.

Exhibit 39: Regional Shopping Centers and Estimated Trade Area for Westfield San Francisco Centre

San Francisco, CA

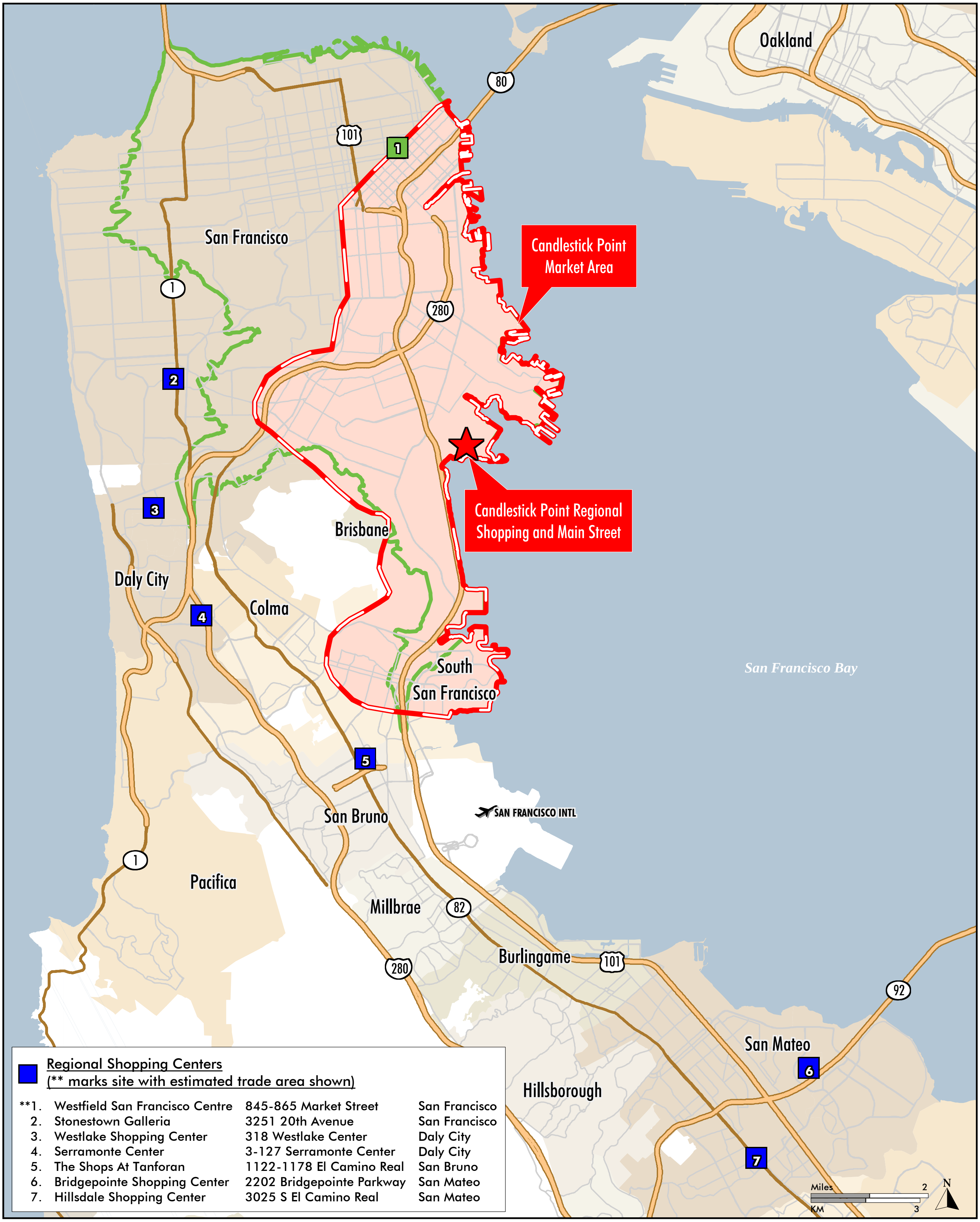

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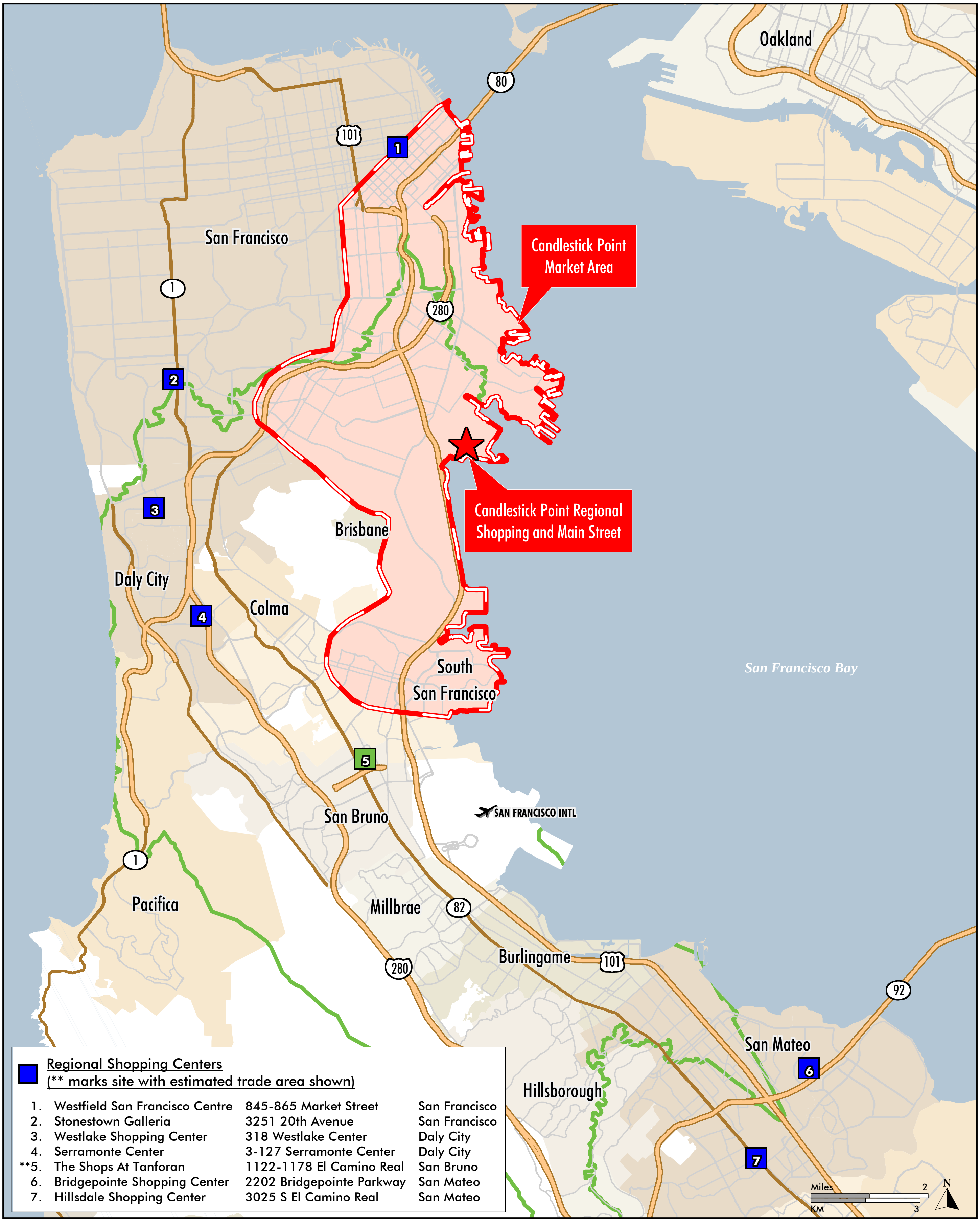
Exhibit 40: Regional Shopping Centers and Estimated Trade Area for the Shops at Tanforan

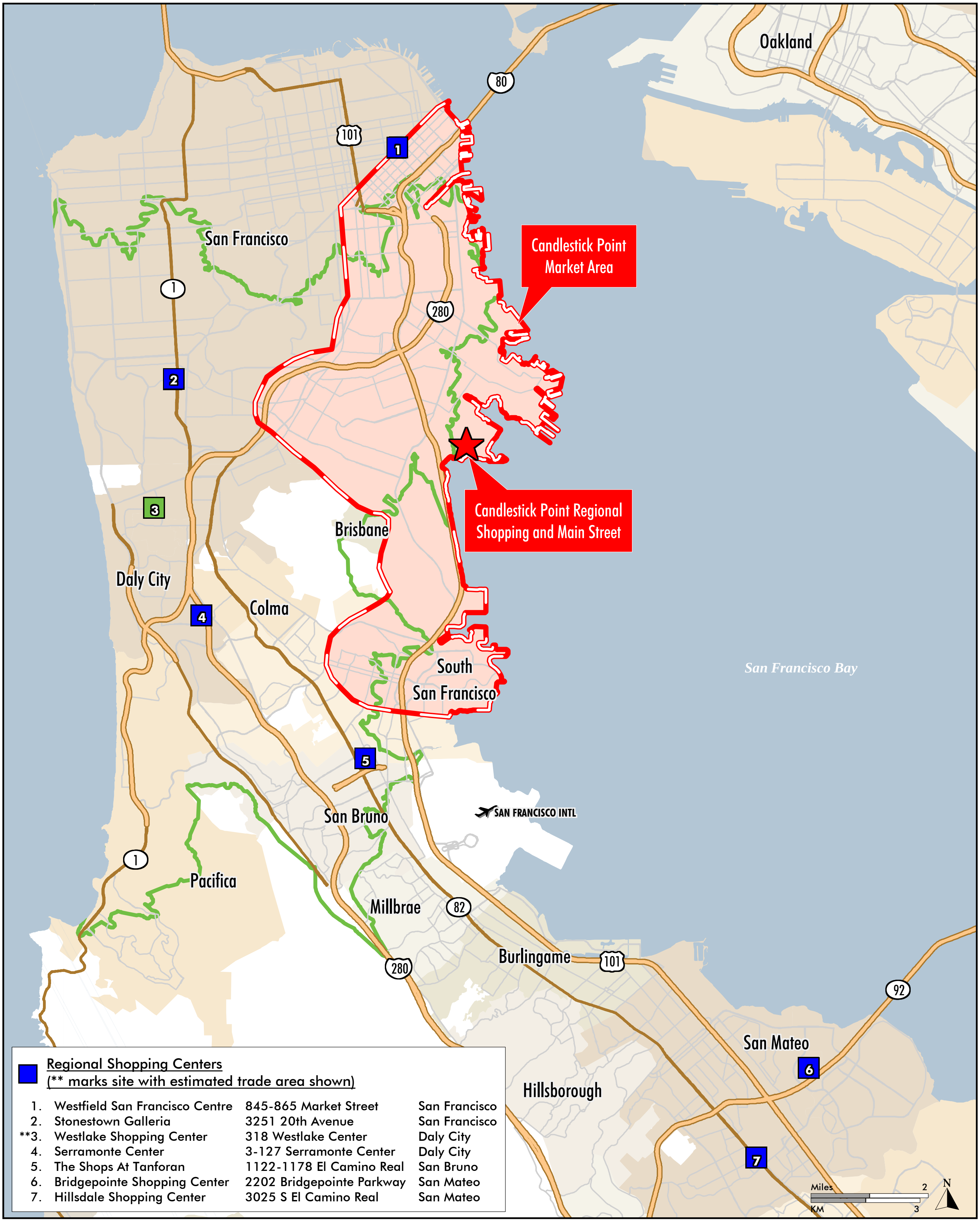
San Francisco, CA



CBRE CB RICHARD ELLIS

Exhibit 41: Regional Shopping Centers and Estimated Trade Area for Westlake Shopping Center

San Francisco, CA



Regional Shopping Centers
(** marks site with estimated trade area shown)

1.	Westfield San Francisco Centre	845-865 Market Street	San Francisco
2.	Stonestown Galleria	3251 20th Avenue	San Francisco
**3.	Westlake Shopping Center	318 Westlake Center	Daly City
4.	Serramonte Center	3-127 Serramonte Center	Daly City
5.	The Shops At Tanforan	1122-1178 El Camino Real	San Bruno
6.	Bridgepointe Shopping Center	2202 Bridgepointe Parkway	San Mateo
7.	Hillsdale Shopping Center	3025 S El Camino Real	San Mateo

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Exhibit 42
Trade Area Households of Select Regional Shopping Centers
Near the Candlestick Point Regional Center Retail Market Area (1)
2009 and 2030

Shopping Center	Trade Area Households 2009 (2) Total	Trade Area Households 2009 (2) Overlapping With the Project Market Area	Percent Overlapping With the Project Market Area	Trade Area Households 2030 (3) Total	Trade Area Households 2030 (3) Increase from 2009
	[A]	[B]	[C = B / A]	[D]	[E = D - A]
Westfield San Francisco Centre	303,645	89,089	29.3%	349,628	45,984
The Shops at Tanforan	167,447	40,546	24.2%	192,170	24,724
Westlake Shopping Center	186,031	60,060	32.3%	214,040	28,009

Sources: Exhibits 39, 40, and 41; Claritas, Inc.; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; Association of Bay Area Governments (ABAG) "Projections 2007"; International Council of Shopping Centers; and CBRE Consulting.

(1) For the purposes of analysis, the trade area for the regional shopping centers is primarily defined as the area within a 15-minute drive-time of the respective center based on research prepared by the International Council of Shopping Centers. Household estimates and projections were derived from Claritas, Inc. data.
(2) The first column shows the estimates of the total households in each shopping center's trade area in 2009. See Appendices K-1, K-2, and K-3.
(3) For the 2030 regional shopping center's household the weighted average household growth rate for the proportional sections of these geographic areas is 0.8 percent per year using data obtained from the Association of Bay Area Governments and the San Francisco Urban Water Management Plan. See Appendix L.

Exhibit 43
Offsetting Effects of Household Growth for Select Regional Shopping Centers
Near the Candlestick Point Regional Center Retail Market Area
2009 - 2030

	Trade Area Households 2009 (1)		Potential Diversion of 2009 Consumer Base (2)		Households Gain 2009-2030 (1)	Net Potential Customer Loss 2030	
	Radius Total	% Overlapping with the CP Market Area	Percent	Total	Radius Total	Amount (3)	%
Shopping Center	[A]	[B]	[C = B / 2]	[D = A * C]	[E]	[F = D - E]	[G]
Westfield San Francisco Centre	303,645	29.3%	14.7%	44,544	45,984	0	0.0%
The Shops at Tanforan	167,447	24.2%	12.1%	20,273	24,724	0	0.0%
Westlake Shopping Center	186,031	32.3%	16.1%	30,030	28,009	2,021	1.1%

Sources: Exhibits 39, 40, 41, and 42; Claritas, Inc.; and CBRE Consulting.

(1) See Exhibit 42.
(2) Reflects the potential loss in the shopping center's trade area households should one-half (50 percent) of those households divert their shopping center purchases to the Candlestick Point Regional Shopping Center.
(3) A "0" is shown if the amount of the difference between column E and column D is less than or equal to zero.

Exhibit 44
Cumulative Retail Development Projects In or Near the Candlestick Point - Hunters Point Shipyard Phase II Development Plan
Market Area (15,000 + Square Feet)
August 2009

Project Name or Applicant/ Location	City	Description	Status	Planned Sq. Ft. (1)	Estimated Opening (2)
Within the Candlestick Point and Hunters Point Shipyard Phase II Market Areas					
1. India Basin	San Francisco	Neighborhood serving retail.	Proposed	100,000	N/A
Within the Candlestick Point Market Area					
2. Brisbane Baylands (3)	Brisbane	The Brisbane Baylands Planning subarea, as defined by the City's General Plan, encompasses approximately 660 acres generally bordered on the west by Bayshore Boulevard, on the north by the City and County of San Francisco, on the east by the U.S. Highway 101 causeway, and on the south by Brisbane Lagoon. Known as the Baylands, the site presents both an opportunity and formidable challenges for the City of Brisbane. The site's history of railyard and landfill activity have left a legacy of contamination requiring millions of dollars and years of remediation, which is still ongoing. The property owner, Universal Paragon Corporation, submitted a Specific Plan in February 2006 for the easterly approximately 300 acres of the site. The City is now in the process of developing alternatives to the proposed project, as part of the Environmental Impact Report. The proposed project includes office, retail, and open space.	Plan Filed	1,775,000	N/A
3. Lowe's (3) 491 Bayshore Boulevard	San Francisco	In April 2009, Lowe's signed a lease for the former Goodman's Lumber site that Home Depot had previously taken through the entitlement process. The Lowe's lease reportedly gives the chain a six-month due diligence period.	In Planning	107,000	N/A
4. Foundry Square III 400 Howard Street	San Francisco	This project is a master-planned urban office complex and would comprise one 9-story and three 10-story office buildings, consisting of 1.14 million square feet of office space, 46,500 square feet of ground-floor retail, and two levels of underground parking.	Building Permit Filed	46,500	2013
5. 250 The Embarcadero	San Francisco	A 15-story office building with 38,000 square feet of retail.	Under Construction	38,000	2011
6. The Infinity 300 Spear Street	San Francisco	A mixed-use project that consists of 800 dwelling units, 36,000 square feet of retail/commercial, and 890 parking spaces.	Under Construction	36,000	2011
7. 836 Brannan Street	San Francisco	Conversion of 27,000-square-foot office/industrial building to retail space with 11,000 square feet of office on the 3rd floor. Proposed tenant is REI.	Plan Approved	30,000	2010
8. Bay West Cove 105-185 Oyster Point Boulevard	South San Francisco	Genentech has secured approval to build 622,000 square feet of office and R&D space, along with 20,000 square feet of restaurant and retail space.	Plan Approved	20,000	N/A
9. 1745 Folsom Street	San Francisco	Proposed demolition of existing parking and construction of 16,000 square feet of retail.	Plan Filed	16,000	2010
Subtotal - Candlestick Point Market Area				**2,068,500**	

Exhibit 44
Cumulative Retail Development Projects In or Near the Candlestick Point - Hunters Point Shipyard Phase II Development Plan
Market Area (15,000 + Square Feet)
August 2009

Project Name or Applicant/ Location	City	Description	Status	Planned Sq. Ft. (1)	Estimated Opening (2)
Outside of the Candlestick Point Market Area					
10. Piers 27-31	San Francisco	To develop and rehabilitate Piers 27, 29, 29 1/2, and 31 into a 1.1 million-square-foot mixed-use recreational, commercial, maritime, and open space complex including 446,000 square feet of retail.	Plan Filed	446,000	2029
11. Piers 30-32	San Francisco	Currently under construction, this project comprises a new cruise terminal, office space, residential units or a hotel/timeshare, and retail spaces on the seawall lot.	Under Construction	221,500	2011
12. Pier 45	San Francisco	To develop an educational and entertainment attraction within Shed A on Pier 45 to include 121,195 square feet of retail.	Plan Filed	121,195	2029
13. Bay Meadows	San Mateo	Wilson Meany Sullivan has received approval to develop approximately 100,000 square feet of retail space as part of a larger mixed use office/residential/retail project at the site of the former Bay Meadows race track.	Approved	100,000	N/A
14. Westlake Shopping Center Expansion	Daly City	Tenant improvements are underway for 96,000 square feet of new commercial space, some of which appears to have opened in 2009.	Tenant Improvements Underway	96,000	2009
15. 180 El Camino Real	South San Francisco	The demolition and redevelopment of a 141,194-square-foot retail center that is currently anchored by a Safeway, a Long's, and a Bally Fitness. Marketing materials posted on the developer's web site, www.wtmitchellgroup.com, indicate that 225,000 square feet of retail is planned, for a net increase of 83,806 square feet.	Plan Filed	83,806	2011
16. Lucas Film 1110 Gorgas Avenue	San Francisco		Under Construction	50,000	2011
17. Mirabella Parkview Plaza	Foster City	A mixed-use senior living development with 50,000 square feet of retail space.	Plan Filed	50,000	N/A
18. 1450 Howard Avenue	Burlingame	A new Safeway store and a retail/office building are planned at the site of an existing 23,000-square-foot Safeway and a 12,400-square-foot Walgreens, which will be demolished. The new Safeway will be a 44,982-square-foot store and other retail totaling 20,197 square feet is planned such that the net addition will be 29,779 square feet.	Plan Filed	29,779	N/A
19. Macy's O'Farrell and Stockton streets	San Francisco	Currently under construction, this is an addition of 28,000 square feet of retail to the existing store by demolishing two buildings in Union Square, rebuilding one of the buildings, to unify the adjoining Macy's complex. The new building will be about 30 feet higher than the existing building.	Under Construction	28,000	2009

Exhibit 44
Cumulative Retail Development Projects In or Near the Candlestick Point - Hunters Point Shipyard Phase II Development Plan
Market Area (15,000 + Square Feet)
August 2009

Project Name or Applicant/ Location	City	Description	Status	Planned Sq. Ft. (1)	Estimated Opening (2)
Outside of the Candlestick Point Market Area (continued)					
20. Landmark Plaza Mission Street and Hillside	Daly City	The expansion of a mixed use development that will include 27,000 square feet of new retail space.	Under	27,000	2010
21. 245-249 Hyde Street	San Francisco	Proposed demolition of two existing 2-story buildings to construct an 8-story, 105-270-square-foot building to include 150 residential units and 25,580 square feet of retail space on the first two floors.	Plan Filed	25,580	2019
22. 400-406 Sutter Street	San Francisco	This project consists of the demolition of an existing building and then the construction of a 68-room hotel with 20,880 square feet of ground floor retail.	Under Construction	20,880	2010
23. 479 Castro Street	San Francisco	This project is the construction of an interior connection between two retail stores to create one large store.	Building Permit Issued	19,200	2011
24. 160 Jefferson Street	San Francisco	Proposed demolition of an existing 9,820-square-foot retail/bakery and the construction of a two-story, 27,032-square-foot center including bakery, retail, and a restaurant, for a net increase of 17,212 square feet.	Plan Filed	17,212	2011
25. 5 Masonic	San Francisco	Proposed demolition of nine buildings to construct a mixed-use building with 57 dwelling units and 17,000 square feet of ground floor retail.	Plan Filed	17,000	2011
26. 165 Pierce Street	Daly City	A 14,000-square-foot Walgreens store and 1,400 square feet of other retail planned as part of a mixed-used senior housing development.	Approved	15,400	2011
Subtotal - Outside of the Candlestick Point Market Area:				1,368,552	
GRAND TOTAL - All Projects:				3,537,052	

Sources: The Planning Departments of the cities of San Francisco, Brisbane, South San Francisco, Daly City, Millbrae, Burlingame, Foster City, San Mateo, and San Bruno, and the Town of Colma; PBS&J; Fehr & Peers; and CBRE Consulting.

(1) Square footages reflect future retail or commercial space, and therefore exclude retail space already built and occupied by retail tenants.
(2) The development schedules for many of the cumulative retail projects on this list do not have specified timing. Consequently, the Estimated Opening for these projects is denoted as "N/A", which stands for Not Available. The factors that contribute to this uncertainty include: lack of financing; the unpredictability of the land use entitlements process; and the possibility that most projects will require a general economic recovery in order to become financially feasible.
(3) Brisbane Baylands and Lowe's are both located in the Hunters Point Shipyard Phase II market area, but due to their size and nature have a much larger draw and are not deemed competitive with the Hunters Point Shipyard Phase II Neighborhood Retail.

Exhibit 45
Estimated Development Schedules for Cumulative Retail Projects with Unknown Development Schedules (1)

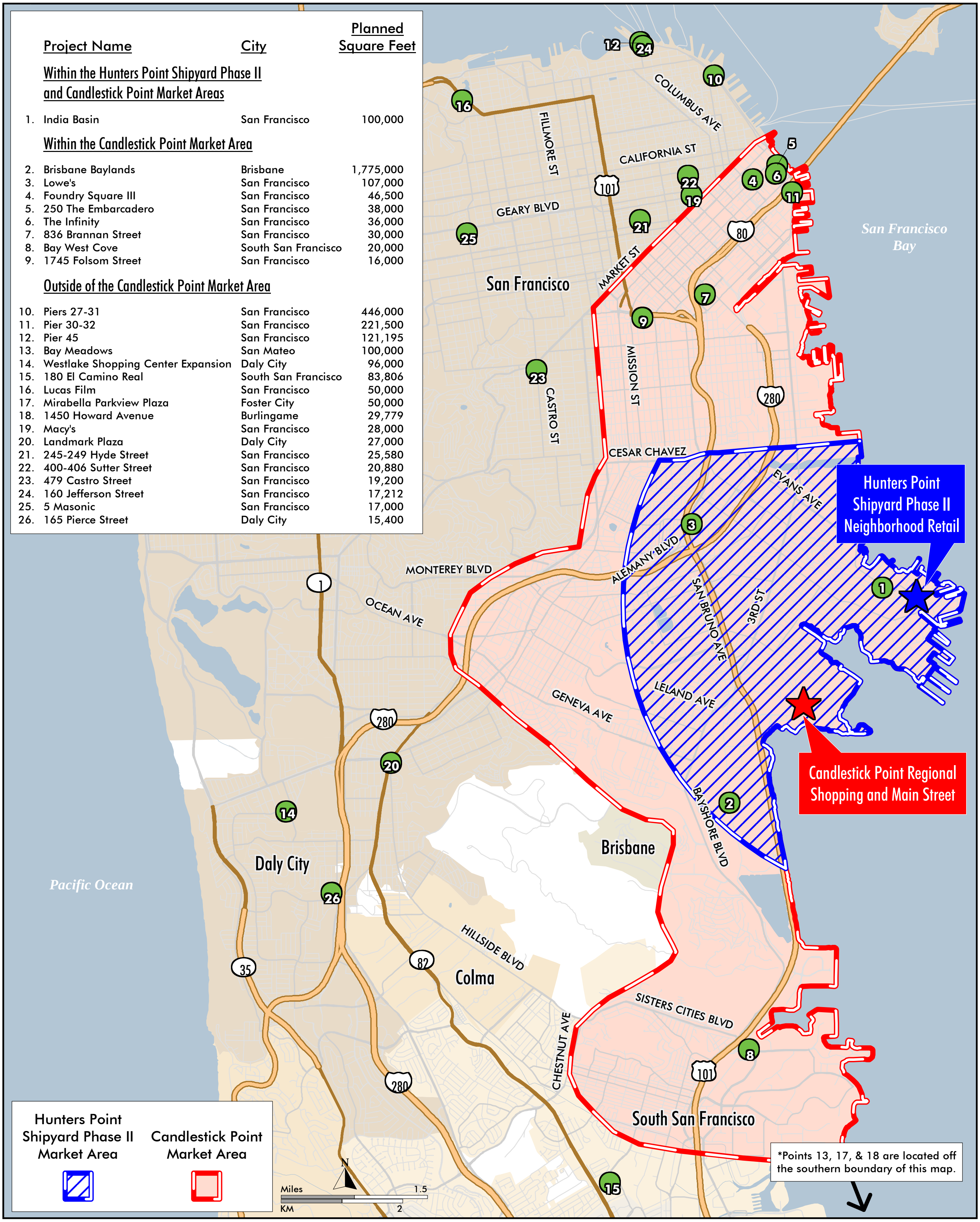
Project Name or Applicant (1)	Planned Retail Sq. Ft. (1) [A]	Rate of Project Attrition (2) [B]	Estimated Sq. Ft. Delivered [C = A * (1 - B)]	Within CP and HP Market Areas Est. Sq. Ft. Delivered 2030 [D = C * 100%]	Within Only Candlestick Point Market Area Est. Sq. Ft. Delivered 2030 [D = C * 100%]	Outside Candlestick Point Market Area Est. Sq. Ft. Delivered 2030 [E = C * 100%]
Within the Candlestick Point and Hunters Point Shipyard Phase II Market Areas						
1. India Basin	100,000	20%	80,000	80,000	0	0
Within Candlestick Point Market Area						
2. Brisbane Baylands (3)	1,775,000	20%	1,420,000	0	1,420,000	0
3. Lowe's (3)	107,000	20%	85,600	0	85,600	0
4. Foundry Square III	46,500	20%	37,200	0	37,200	0
5. 250 The Embarcadero	38,000	20%	30,400	0	30,400	0
6. The Infinity	36,000	20%	28,800	0	28,800	0
7. 836 Brannan Street	30,000	20%	24,000	0	24,000	0
8. Bay West Cove	20,000	20%	16,000	0	16,000	0
9. 1745 Folsom Street	16,000	20%	12,800	0	12,800	0
Outside Both Market Areas						
10. Piers 27-31	446,000	20%	356,800	0	0	356,800
11. Piers 30-32	221,500	20%	177,200	0	0	177,200
12. Pier 45	121,195	20%	96,956	0	0	96,956
13. Bay Meadows	100,000	20%	80,000	0	0	80,000
14. Westlake Shopping Center Expansion	96,000	20%	76,800	0	0	76,800
15. 180 El Camino Real	83,806	20%	67,045	0	0	67,045
16. Lucas Film	50,000	20%	40,000	0	0	40,000
17. Mirabella Parkview Plaza	50,000	20%	40,000	0	0	40,000
18. 1450 Howard Avenue	29,779	20%	23,823	0	0	23,823
19. Macy's	28,000	20%	22,400	0	0	22,400
20. Landmark Plaza	27,000	20%	21,600	0	0	21,600
21. 245-249 Hyde Street	25,580	20%	20,464	0	0	20,464
22. 400-406 Sutter Street	20,880	20%	16,704	0	0	16,704
23. 479 Castro Street	19,200	20%	15,360	0	0	15,360
24. 160 Jefferson Street	17,212	20%	13,770	0	0	13,770
25. 5 Masonic	17,000	20%	13,600	0	0	13,600
26. 165 Pierce Street	15,400	20%	12,320	0	0	12,320
TOTAL	**3,537,052**		**2,829,642**	**80,000**	**1,654,800**	**1,094,842**

Sources: Exhibit 44; and CBRE Consulting.

(1) See Exhibit 44.
(2) Some development projects will be delayed, cancelled, or repositioned because of economic, market, or financial difficulties. These possibilities are accounted for in the attrition rate, which is assumed at 20 percent.
(3) Brisbane Baylands and Lowe's are both located in the Hunters Point market area, but due to their size and nature have a much larger draw and are not deemed competitive with the Hunters Point Shipyard Phase II Neighborhood Retail.

Exhibit 46: Cumulative Retail Development Projects
In or Near the Candlestick Point and Hunters Point Shipyard Phase II Market Areas

San Francisco, CA



	Project Name	City	Planned Square Feet
	Within the Hunters Point Shipyard Phase II and Candlestick Point Market Areas		
1.	India Basin	San Francisco	100,000
	Within the Candlestick Point Market Area		
2.	Brisbane Baylands	Brisbane	1,775,000
3.	Lowe's	San Francisco	107,000
4.	Foundry Square III	San Francisco	46,500
5.	250 The Embarcadero	San Francisco	38,000
6.	The Infinity	San Francisco	36,000
7.	836 Brannan Street	San Francisco	30,000
8.	Bay West Cove	South San Francisco	20,000
9.	1745 Folsom Street	San Francisco	16,000
	Outside of the Candlestick Point Market Area		
10.	Piers 27-31	San Francisco	446,000
11.	Pier 30-32	San Francisco	221,500
12.	Pier 45	San Francisco	121,195
13.	Bay Meadows	San Mateo	100,000
14.	Westlake Shopping Center Expansion	Daly City	96,000
15.	180 El Camino Real	South San Francisco	83,806
16.	Lucas Film	San Francisco	50,000
17.	Mirabella Parkview Plaza	Foster City	50,000
18.	1450 Howard Avenue	Burlingame	29,779
19.	Macy's	San Francisco	28,000
20.	Landmark Plaza	Daly City	27,000
21.	245-249 Hyde Street	San Francisco	25,580
22.	400-406 Sutter Street	San Francisco	20,880
23.	479 Castro Street	San Francisco	19,200
24.	160 Jefferson Street	San Francisco	17,212
25.	5 Masonic	San Francisco	17,000
26.	165 Pierce Street	Daly City	15,400

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Exhibit 47
Sales Estimates for Cumulative Retail Projects Completed Prior to 2030
In 2007 Dollars (1)

Project Name or Applicant	Square Feet (2)	Sales Per Sq. Ft. (3)		Annual Sales
Within the Candlestick Point and Hunters Point Shipyard Phase II Market Areas				
1. India Basin				
Unknown Retail	80,000	$331		$26,480,000
Within Candlestick Point Market Area				
2. Brisbane Baylands				
Unknown Retail	1,420,000	$324		$460,080,000
3. Lowe's	85,600	$258	(4)	$22,084,800
4. Foundry Square III				
Unknown Retail	37,200	$364		$13,540,800
5. 250 The Embarcadero				
Unknown Retail	30,400	$364		$11,065,600
6. The Infinity				
Unknown Retail	28,800	$364		$10,483,200
7. 836 Brannan Street				
REI	24,000	$254	(5)	$6,091,247
8. Bay West Cove				
Unknown Retail	16,000	$364		$5,824,000
9. 1745 Folsom Street				
Unknown Retail	12,800	$364		$4,659,200
Total - Candlestick Point Market Area:	**1,654,800**			**$533,828,847**
Outside of the Candlestick Point Market Area				
10. Piers 27-31				
Unknown Retail	356,800	$356		$127,020,800
11. Piers 30-32				
Unknown Retail	177,200	$331		$58,653,200
12. Pier 45				
Unknown Retail	96,956	$331		$32,092,436
13. Bay Meadows				
Unknown Retail	80,000	$331		$26,480,000
14. Westlake Shopping Center Expansion				
Unknown Retail	76,800	$356		$27,340,800
15. 180 El Camino Real				
Unknown Retail	67,045	$364		$24,404,307
16. Lucas Film				
Unknown Retail	40,000	$364		$14,560,000
17. Mirabella Parkview Plaza				
Unknown Retail	40,000	$364		$14,560,000
18. 1450 Howard Avenue				
Safeway	17,586	$527	(6)	$9,267,611
Unknown Retail	6,238	$364		$2,270,486
Subtotal	23,823			$11,538,098

Exhibit 47
Sales Estimates for Cumulative Retail Projects Completed Prior to 2030
In 2007 Dollars (1)

Project Name or Applicant	Square Feet (2)	Sales Per Sq. Ft. (3)	Annual Sales
19. Macy's	22,400	$170 (7)	$3,808,000
20. Landmark Plaza			
Unknown Retail	21,600	$364	$7,862,400
21. 145-249 Hyde Street			
Unknown Retail	20,464	$364	$7,448,896
22. 400-406 Sutter Street			
Unknown Retail	16,704	$364	$6,080,256
23. 479 Castro Street			
Unknown Retail	15,360	$364	$5,591,040
24. 160 Jefferson Street (8)			
Restaurant	3,000	$433 (9)	$1,300,300
Bakery	1,500	$433 (9)	$650,150
Unknown Retail	9,270	$364	$3,374,134
Subtotal	13,770		$5,324,585
25. 5 Masonic			
Unknown Retail	13,600	$364	$4,950,400
26. 165 Pierce Street			
Walgreens	11,200	$812 (10)	$9,094,400
Unknown Retail	1,120	$364	$407,680
Subtotal	12,320		$9,502,080
Total - Outside of Candlestick Point Market Area	**1,094,842**		**$387,217,298**

Sources: International Council of Shopping Centers (ICSC), U.S. Shopping Center Definitions, April 2009 (https://www.icsc.org/srch/lib/2009_S-C_CLASSIFICATION_May09.pdf); Dollars & Cents of Shopping Centers/The Score 2008; Retail MAXIM, "Alternative Retail Risk Analysis for Alternative Capital", 2008; Lowe's Companies Inc. Form 10-K for period ending January 31, 2009; The Nielsen Company, "2009 Retail Tenant Directory"; and CBRE Consulting.

(1) CBRE Consulting has assumed that sales will remain flat consistent with the project assumptions.
(2) Unless otherwise noted, see Exhibit 44.
(3) CBRE Consulting has defined the shopping center type for each cumulative project based on ICSC U.S. Shopping Center definitions matching the square footages used from Exhibit 39. Sales per square foot are in 2007 dollars. For each shopping center type the sales per square foot are estimated based on average sales per square foot figures for shopping centers in the Western U.S. provided by Dollars & Cents of Shopping Centers/The Score 2008 Unless otherwise noted. Neighborhood Centers are defined as under 100,000 square feet with an average sales per square foot of $364; Community Centers are defined as 100,000 - 399,999 square feet with an average sales per square foot of $331; Regional Centers are defined as 400,000-799,999 square feet with an average sales per square foot of $356; and Super Regional Centers are defined as 800,000+ square feet with an average sales per square foot of $324.
(4) Sales per square foot from Lowe's Companies Inc. Form 10-K for the period ending January 31, 2009.
(5) See Exhibit 4. The Sports category is estimated at $254 per square foot.
(6) Based on the average sales per square foot for Safeway provided by Retail Maxim.
(7) Based on the average sales per square foot for Macys provided by Retail Maxim.
(8) Square footages for the restaurant and bakery estimated by CBRE Consulting.
(9) Based on the average sales per square foot for the Restaurants category as calculated in Exhibit 4.
(10) Based on the average sales per square foot for Walgreens provided by Retail Maxim.

Exhibit 48
Extent of Cumulative Projects' Trade Area Overlap with Candlestick Point and Hunters Point Shipyard Phase II Market Areas (1)

Hunters Point Shipyard Phase II and Candlestick Point Market Areas Project Name	Planned Project Trade Area Radius (Miles) or Drive-Time (2)	2009 Radius Households (3) Total	2009 Radius Households (3) Overlapping With HP Shipyard Phase II Market Area	Est. Percent Share Overlapping with HP Shipyard Phase II Market Area
1. India Basin	3 Miles	43,875	22,140	50.5%

Candlestick Point Market Area Project Name	Planned Project Trade Area Radius (Miles) or Drive-Time (2)	2009 Radius Households (2) Total	2009 Radius Households (2) Overlapping With Candlestick Point Market Area	Est. Percent Share Overlapping with Candlestick Point Market Area
2. Brisbane Baylands	15 Minutes	207,716	92,818	44.7%
3. Lowe's	15 Minutes	335,521	92,825	27.7%
7. 836 Brannan Street	3 Miles	213,025	57,397	26.9%
10. Piers 27-31	15 Minutes	242,616	67,874	28.0%
11. Piers 30-32	15 Minutes	303,577	82,968	27.3%
12. Pier 45	3 Miles	140,954	19,003	13.5%
14. Westlake Shopping Center Expansion	15 Minutes	193,502	61,268	31.7%
15. 180 El Camino Real	3 Miles	44,240	7,502	17.0%
16. Lucas Film	3 Miles	178,690	11,863	6.6%
19. Macy's	3 Miles	302,642	85,419	28.2%
20. Landmark Plaza	15 Minutes	81,864	19,631	24.0%
21. 245-249 Hyde Street	3 Miles	212,174	46,393	21.9%
22. 400-406 Sutter Street	3 Miles	187,296	41,472	22.1%
23. 479 Castro Street	3 Miles	258,083	64,061	24.8%
24. 160 Jefferson Street	3 Miles	142,360	19,897	14.0%
25. 5 Masonic	3 Miles	234,478	31,192	13.3%
26. 165 Pierce Street	3 Miles	63,424	4,107	6.5%
Candlestick Point Total / Average		**3,342,162**	**805,690**	**24.1%**

Sources: Claritas; International Council of Shopping Centers (ICSC), U.S. Shopping Center Definitions, April 2009 (https://www.icsc.org/srch/lib/2009_S-C_CLASSIFICATION_May09.pdf); and CBRE Consulting.

(1) Includes only projects from Exhibits 44-47 that have estimated trade area overlap with Candlestick Point and Hunters Point Shipyard Phase II; therefore some project numbers are not listed.
(2) Trade area radii were approximated by CBRE Consulting based on the type of planned cumulative retail project. Neighborhood centers and community centers are estimated to have radii of 3.0 miles. Power centers, regional malls, and lifestyle centers are estimated to have a 15-minute drive time trade area.
(3) The first column indicates the total households in each development's estimated trade area. The second column displays the number of households in each center's trade area that also are part of the associated Market Area. These figures are used to estimate the percentage of households within each cumulative project's market area that is also located within the Candlestick Point or Hunters Point Shipyard Phase II Market Areas. The 2009 data are the most recent data available, and are believed by CBRE Consulting to be an accurate approximation for 2009.

Exhibit 49
Estimation of Cumulative Project Sales Estimates Originating from the Project Market Area
Projects Completed Prior to 2030
In 2009 Dollars

Project Name or Applicant (4)	Total Annual Store Sales (1) [A]	Share Overlap With HP Shipyard Phase II Market Area (2) [B]	Percent of Sales Originating From Market Area (3) [C]	Total Store Sales Originating From Market Area [D = A * B * C]
Within Hunters Point Shipyard Phase II Market Area				
1. India Basin				
Unknown Retail	$26,480,000	50.5%	95%	$12,694,105

Project Name or Applicant	Total Annual Store Sales (1) [A]	Share Overlap With Candlestick Point Market Area (2) [B]	Percent of Sales Originating From Market Area (3) [C]	Total Store Sales Originating From Market Area [D = A * B * C]
Within Candlestick Point Market Area				
1. India Basin				
Unknown Retail	$26,480,000	100.0%	95%	$25,156,000
2. Brisbane Baylands				
Unknown Retail	$460,080,000	44.7%	85%	$174,748,934
3. Lowe's	$22,084,800	27.7%	85%	$5,193,470
7. 836 Brannan Street				
REI	$6,091,247	26.9%	90%	$1,477,091
Total - Candlestick Point Market Area:	**$514,736,047**			**$206,575,496**
Outside of the Candlestick Point Market Area				
10. Piers 27-31				
Unknown Retail	$127,020,800	28.0%	90%	$31,981,686
11. Piers 30-32				
Unknown Retail	$58,653,200	27.3%	90%	$14,426,998
12. Pier 45				
Unknown Retail	$32,092,436	13.5%	90%	$3,893,946
14. Westlake Shopping Center Expansion				
Unknown Retail	$27,340,800	31.7%	90%	$7,791,157
15. 180 El Camino Real				
Unknown Retail	$24,404,307	17.0%	90%	$3,724,525
16. Lucas Film				
Unknown Retail	$14,560,000	6.6%	90%	$869,958
19. Macy's	$3,808,000	28.2%	90%	$967,308
20. Landmark Plaza				
Unknown Retail	$7,862,400	24.0%	90%	$1,696,864
21. 145-249 Hyde Street				
Unknown Retail	$7,448,896	21.9%	90%	$1,465,867
22. 400-406 Sutter Street				
Unknown Retail	$6,080,256	22.1%	90%	$1,211,688
23. 479 Castro Street				
Unknown Retail	$5,591,040	24.8%	90%	$1,249,020
24. 160 Jefferson Street (7)				
Restaurant	$1,300,300	14.0%	90%	$163,563
Bakery	$650,150	14.0%	90%	$81,782
Unknown Retail	$3,374,134	14.0%	90%	$424,428
Subtotal	$5,324,585			$669,773
25. 5 Masonic				
Unknown Retail	$4,950,400	13.3%	90%	$592,685
26. 165 Pierce Street				
Walgreens	$9,094,400	6.5%	90%	$530,014
Unknown Retail	$407,680	6.5%	90%	$23,759
Subtotal	$9,502,080			$553,774
Total - Outside of Candlestick Point Market Area	**334,639,200**			**$71,095,251**

Sources: Exhibits 48 and 47; and CBRE Consulting.

(1) See Exhibit 47.
(2) See Exhibit 48.
(3) Estimated by CBRE Consulting.
(4) Included only projects listed from Exhibits 44-47 that have estimated trade area overlap with Candlestick Point and Hunters Point Shipyard Phase II; therefore some project numbers are not listed.

Exhibit 50
BOE Categorization of Sales Estimates for Cumulative Retail Projects Completed Prior to 2030
Projects In or Near the Hunters Point Shipyard Phase II and Candlestick Point Market Areas
In 2009 Dollars

Project Name or Applicant / Store Name or Type	Market Area Total Annual Sales (1)	Apparel	General Merchandise	Food Stores	Eating & Drinking Places	Home Furnishings & Appliances	Building Materials	Other Retail
Within Hunters Point Shipyard Phase II Market Area								
1. India Basin Unknown Retail	$12,694,105	$1,904,116	$5,077,642	$634,705	$634,705	$634,705	$634,705	$3,173,526
Less Vacancy Allowance (4)	$12,059,399	$1,808,910	$4,823,760	$602,970	$602,970	$602,970	$602,970	$3,014,850
Within Candlestick Point Market Area								
1. India Basin Unknown Retail	$25,156,000	$3,773,400	$10,062,400	$1,257,800	$1,257,800	$1,257,800	$1,257,800	$6,289,000
2. Brisbane Baylands Unknown Retail (2)	$174,748,934	$17,474,893	$34,949,787	$17,474,893	$17,474,893	$17,474,893	$0	$69,899,574
3. Lowe's (3)	$5,193,470	$0	$0	$0	$0	$1,246,433	$3,168,017	$779,021
7. 836 Brannan Street REI	$1,477,091	$0	$0	$0	$0	$0	$0	$1,477,091
Subtotal - Candlestick Point Market Area	$206,575,496	$21,248,293	$45,012,187	$18,732,693	$18,732,693	$19,979,126	$4,425,817	$78,444,686
Less Vacancy Allowance (4)	$196,246,721	$20,185,879	$42,761,578	$17,796,059	$17,796,059	$18,980,170	$4,204,526	$74,522,451
Outside of the Candlestick Point Market Area								
10. Piers 27-31 Unknown Retail (2)	$31,981,686	$4,797,253	$11,193,590	$3,198,169	$1,599,084	$1,599,084	$1,599,084	$7,995,422
11. Piers 30-32 Unknown Retail (2)	$14,426,998	$2,164,050	$1,442,700	$1,442,700	$3,606,750	$1,442,700	$0	$4,328,099
12. Pier 45 Unknown Retail (2)	$3,893,946	$584,092	$389,395	$389,395	$973,487	$389,395	$0	$1,168,184
13. Westlake Shopping Center Expansion Unknown Retail (2)	$7,791,157	$1,168,674	$779,116	$779,116	$1,947,789	$779,116	$0	$2,337,347
15. 180 El Camino Real Unknown Retail (2)	$3,724,525	$558,679	$372,453	$372,453	$931,131	$372,453	$0	$1,117,358
16. Lucas Film Unknown Retail (2)	$869,958	$130,494	$86,996	$86,996	$217,489	$86,996	$0	$260,987
19. Macy's	$967,308	$967,308	$0	$0	$0	$0	$0	$0
20. Landmark Plaza Unknown Retail (2)	$1,696,864	$254,530	$169,686	$169,686	$424,216	$169,686	$0	$509,059

Exhibit 50
BOE Categorization of Sales Estimates for Cumulative Retail Projects Completed Prior to 2030
Projects In or Near the Hunters Point Shipyard Phase II and Candlestick Point Market Areas
In 2009 Dollars

Project Name or Applicant / Store Name or Type	Market Area Total Annual Sales (1)	Apparel	General Merchandise	Food Stores	Eating & Drinking Places	Home Furnishings & Appliances	Building Materials	Other Retail
21. 145-249 Hyde Street								
Unknown Retail (2)	$1,465,867	$219,880	$146,587	$146,587	$366,467	$146,587	$0	$439,760
22. 400-406 Sutter Street								
Unknown Retail (2)	$1,211,688	$181,753	$121,169	$121,169	$302,922	$121,169	$0	$363,506
23. 479 Castro Street								
Unknown Retail (2)	$1,249,020	$187,353	$124,902	$124,902	$312,255	$124,902	$0	$374,706
24. 160 Jefferson Street (7)								
Restaurant	$163,563	$0	$0	$0	$163,563	$0	$0	$0
Bakery	$81,782	$0	$0	$0	$81,782	$0	$0	$0
Unknown Retail (2)	$424,428	$63,664	$42,443	$42,443	$106,107	$42,443	$0	$127,329
Subtotal	$669,773							
25. 5 Masonic								
Unknown Retail (2)	$592,685	$88,903	$59,268	$59,268	$148,171	$59,268	$0	$177,805
26. 165 Pierce Street								
Walgreens	$530,014	$0	$530,014	$0	$0	$0	$0	$0
Unknown Retail (2)	$23,759	$3,564	$2,376	$2,376	$5,940	$2,376	$0	$7,128
Subtotal	$553,774							
Total - Outside of Candlestick Point Market Area	$71,095,251	$11,370,195	$15,460,694	$6,935,258	$11,187,154	$5,336,174	$1,599,084	$19,206,691
Less Vacancy Allowance (4)	$67,540,489	$10,801,686	$14,687,660	$6,588,495	$10,627,796	$5,069,365	$1,519,130	$18,246,356
GRAND TOTAL CANDLESTICK POINT OCCUPIED SPACE - ALL PROJECTS	$263,787,209	$30,987,564	$57,449,237	$24,384,554	$28,423,855	$24,049,535	$5,723,656	$92,768,808

Sources: Exhibits 49; Lowe's Companies Inc 2008 Annual Report; and CBRE Consulting.

(1) See Exhibit 49.
(2) Planned retail space with unknown orientation or product type was allocated into BOE categories by CBRE Consulting based on the estimated size of the project and analysis of various existing shopping centers in the Bay Area. Super regional centers sales are allocated as 15 percent apparel, 40 percent general merchandise, 5 percent food stores, 5 percent eating and drinking, 5 percent home furnishings and appliances, 5 percent building materitals, and 25 percent other retail. Regional centers sales are allocated as 15 percent apparel, 35 percent general merchandise, 10 percent food stores, 5 percent eating and drinking, 5 percent home furnishings and appliances, 5 percent building materitals, and 25 percent other retail.The remaining center types sales are allocated as 15 percent apparel, 10 percent general merchandise, 10 percent food stores, 25 percent eating and drinking, 10 percent home furnishings and appliances, and 35 percent other retail.
(3) The BOE category breakdown for Lowe's based on data given in the Lowe's Companies Inc. 2008 Annual Report.
(4) CBRE Consulting estimates that the market vacancy rate for new shopping centers is 5 percent.

Exhibit 51
Estimated Capture Rates of New Household Demand for All Hunters Point Shipyard Phase II Market Area Cumulative Projects
In 2009 Dollars

Retail Category	Hunters Point Shipyard Phase II Market Area Adjusted Sales Base (1) [A]	Hunters Point Shipyard Phase II Project Sales (2) [B]	Total HP Shipyard Phase II Market Area Cumulative Projects Occupied Space Sales (3) [C]	Hunters Point Shipyard Phase II Plus Cumul. Projects in HP Market Area Total Sales [D = B + C]	All Cumulative Projects Capture Rate of Market Area Sales (4) [E = D / (A + D)]
Apparel Stores	$6,717,679	$0	$1,808,910	$1,808,910	21.2%
General Merchandise Stores	$62,286,208	$5,997,140	$4,823,760	$10,820,900	14.8%
Food Stores	$121,648,316	$15,635,813	$602,970	$16,238,782	11.8%
Eating & Drinking Places	$70,334,821	$7,326,966	$602,970	$7,929,936	10.1%
Home Furnishings & Appliances	$58,313,316	$1,567,962	$602,970	$2,170,932	3.6%
Building Materials	$117,890,439	$0	$602,970	$602,970	0.5%
Motor Vehicles & Parts	$29,008,094	$0	$0	$0	0.0%
Service Stations	$23,665,313	$0	$0	$0	0.0%
Other Retail Stores	$44,922,981	$10,773,412	$3,014,850	$13,788,262	23.5%
Total	**$534,787,167**	**$41,301,293**	**$12,059,399**	**$53,360,692**	**9.1%**

Sources: Exhibits 8, 23, and 50; and CBRE Consulting.

(1) See Exhibit 23.
(2) See Exhibit 8.
(3) See Exhibit 50. This reflects the planned India Basin project less a vacancy allowance.
(4) Represents the assumed percentage of new demand that may be captured by all the cumulative projects including the Hunters Point Shipyard Phase II Neighborhood Retail project within the market area. Capture rates were developed based on comparing the share of the cumulative projects' projected sales to the total retail sales in the market area. It is likely that not all the market area sales will be new to the market area; however, this is a conservative approach to provide minimum capture rate assumptions for the project, assuming that all sales are diverted from existing retailers.

Exhibit 52
Capture of New Household Demand
Within the Hunters Point Shipyard Phase II Market Area
2030

Retail Category	Demand from New Households 2009-2030 (1) [A]	All Cumul. Projects Mkt Area Capture Rate (2) [B]	Market Area Sales Captured [C = A * B]	All Cumul. Projects Capture Rate of Mkt Area Sales (3) [D]	Estimated Capture of Demand from New Households [E = C * D]	Remaining Demand [F = C - E]
Apparel Stores	$18,753,229	20.0%	$3,750,646	21.2%	$795,697	$2,954,949
General Merchandise Stores	$51,845,807	30.0%	$15,553,742	14.8%	$2,302,177	$13,251,565
Food Stores	$57,744,465	90.0%	$51,970,019	11.8%	$6,120,441	$45,849,578
Eating and Drinking Places	$45,320,212	50.0%	$22,660,106	10.1%	$2,295,966	$20,364,140
Home Furnishings and Appliances	$12,989,690	30.0%	$3,896,907	3.6%	$139,870	$3,757,037
Building Materials	$28,492,534	20.0%	$5,698,507	0.5%	$28,998	$5,669,509
Motor Vehicles & Parts	$90,544,978	N/A	N/A	0.0%	N/A	N/A
Service Stations	$36,046,922	N/A	N/A	0.0%	N/A	N/A
Other Retail Stores	$44,505,053	30.0%	$13,351,516	23.5%	$3,135,587	$10,215,929
Total	**$386,242,889**	--	**$116,881,442**	--	**$14,818,734**	**$102,062,708**

Sources: Exhibits 30 and 51; and CBRE Consulting.

(1) See Exhibit 30.
(2) Capture rates estimated based on the retail offerings within the market area as compared to options outside the market area.
(3) See Exhibit 51.

Exhibit 53
Potential Cumulative Sales Impacts
Within the Hunters Point Shipyard Phase II Market Area
In 2009 Dollars

Retail Category	Hunters Point Shipyard Phase II Plus Cumul. Projects in HP Market Area Total Sales (1) [A]	Estimated Capture of Demand from New Households (2) [B]	2009 Market Area Adjusted Sales Base (3) [C]	Potential Sales Impacts Amount [D = A - B]	Net Remaining Potential Demand from New Households (4) [E]	Sales Diverted From Existing Market Area Amount [F = D - E]	Sales Diverted From Existing Market Area Percent [G = F / C]	Final Remaining New Demand [H = E - F]
Apparel Stores	$1,808,910	$795,697	$6,717,679	$1,013,213	$2,954,949	$0	0.0%	$2,954,949
General Merchandise Stores	$10,820,900	$2,302,177	$62,286,208	$8,518,723	$13,251,565	$0	0.0%	$13,251,565
Food Stores	$16,238,782	$6,120,441	$121,648,316	$10,118,342	$45,849,578	$0	0.0%	$45,849,578
Eating & Drinking Places	$7,929,936	$2,295,966	$70,334,821	$5,633,971	$20,364,140	$0	0.0%	$20,364,140
Home Furnishings & Appliances	$2,170,932	$139,870	$58,313,316	$2,031,062	$3,757,037	$0	0.0%	$3,757,037
Building Materials	$602,970	$28,998	$117,890,439	$573,972	$5,669,509	$0	0.0%	$5,669,509
Motor Vehicles & Parts	$0	N/A	$29,008,094	$0	N/A	N/A	N/A	$0
Service Stations	$0	N/A	$23,665,313	$0	N/A	N/A	N/A	$0
Other Retail Stores	$13,788,262	$3,135,587	$44,922,981	$10,652,675	$10,215,929	$436,746	1.0%	$0
Total	**$53,360,692**	**$14,818,734**	**$534,787,167**	**$38,541,958**	**$102,062,708**	**$436,746**	**0.1%**	**$91,846,778**

Sources: Exhibits 23, 51, and 52; and CBRE Consulting.

(1) See Exhibit 51.
(2) See Exhibit 52.
(3) See Exhibit 23.
(4) See Exhibit 52. Demand remaining after sales captured by Hunters Point retail are accounted for as well as remaining demand available to Hunters Point Shipyard Phase II market area existing retailers.

Exhibit 54
Estimated Capture Rates of New Household Demand for All Cumulative Projects
Candlestick Point Market Area
In 2009 Dollars

Retail Category	Candlestick Point Market Area Adjusted Sales Base (1) [A]	Candlestick Point Project Sales (2) [B]	Total Cumulative Projects Occupied Space Sales (3) [C]	Candlestick Point Plus Cumul. Projects in CP Market Area Total Sales [D = B + C]	All Cumulative Projects Capture Rate of Market Area Sales (4) [E = D / (A + D)]
Apparel Stores	$256,938,275	$22,822,800	$30,987,564	$53,810,364	17.3%
General Merchandise Stores	$816,933,687	$30,065,636	$57,449,237	$87,514,873	9.7%
Food Stores	$571,848,727	$21,067,200	$24,384,554	$45,451,754	7.4%
Eating & Drinking Places	$881,357,621	$31,468,275	$28,423,855	$59,892,130	6.4%
Home Furnishings & Appliances	$311,780,876	$6,338,400	$24,049,535	$30,387,935	8.9%
Building Materials	$303,082,132	$11,856,000	$5,723,656	$17,579,656	5.5%
Motor Vehicles & Parts	$214,688,681	$0	$0	$0	0.0%
Service Stations	$344,945,809	$0	$0	$0	0.0%
Other Retail Stores	$1,596,056,982	$49,588,850	$92,768,808	$142,357,658	8.2%
Total	**$5,297,632,791**	**$173,207,161**	**$263,787,209**	**$436,994,370**	**7.6%**

Sources: Exhibits 6, 7, 19, and 50; and CBRE Consulting.

(1) See Exhibit 19.
(2) See Exhibits 6 and 7.
(3) See Exhibit 50.
(4) Represents the assumed percentage of new demand that may be captured by all the cumulative projects including the Candlestick Point Project within the market area. Capture rates were developed based on comparing the share of the cumulative projects projected sales to the total retail sales in the market area. It is likely that not all the market area sales will be new to the market area; however, this is a conservative approach to provide minimum capture rate assumptions for the project, assuming that all sales are diverted from existing retailers.

Exhibit 55
Capture of New Household Demand
Within the Candlestick Point Market Area
2030

Retail Category	Demand from New Households 2009-2030 (1) [A]	All Cumul. Projects Mkt Area Capture Rate (2) [B]	Market Area Sales Captured [C = A * B]	All Cumul. Projects Capture Rate of Mkt Area Sales (3) [D]	Estimated Capture of Demand from New Households [E = C * D]	Remaining Demand [F = C - E]	Hunters Point Project Sales (4) [G]	Net Remaining Demand [H = F - G]
Apparel Stores	$33,822,161	90.0%	$30,439,945	17.3%	$5,271,092	$25,168,853	$0	$25,168,853
General Merchandise Stores	$92,857,137	90.0%	$83,571,424	9.7%	$8,086,411	$75,485,013	$5,997,140	$69,487,872
Food Stores	$102,847,912	95.0%	$97,705,517	7.4%	$7,194,044	$90,511,472	$15,635,813	$74,875,660
Eating and Drinking Places	$81,558,677	90.0%	$73,402,809	6.4%	$4,670,653	$68,732,157	$7,326,966	$61,405,190
Home Furnishings and Appliances	$23,455,417	90.0%	$21,109,875	8.9%	$1,874,763	$19,235,112	$1,567,962	$17,667,150
Building Materials	$51,637,388	90.0%	$46,473,649	5.5%	$2,547,827	$43,925,822	$0	$43,925,822
Motor Vehicles & Parts	$163,480,748	N/A	N/A	0.0%	N/A	N/A	$0	N/A
Service Stations	$64,367,636	N/A	N/A	0.0%	N/A	N/A	$0	N/A
Other Retail Stores	$80,006,306	90.0%	$72,005,675	8.2%	$5,896,498	$66,109,177	$10,773,412	$55,335,765
Total	**$694,033,382**	--	**$424,708,894**	--	**$35,541,288**	**$389,167,605**	**$41,301,293**	**$347,866,312**

Sources: Exhibit 34; and CBRE Consulting.

(1) See Exhibit 34.
(2) Capture rates estimated based on the retail offerings within the market area as compared to options outside the market area.
(3) See Exhibit 54.
(4) See Exhibits 6 and 7.

Exhibit 56
Potential Cumulative Sales Impacts
Within and Near the Candlestick Point Market Area
In 2009 Dollars

Retail Category	Candlestick Point Project Plus Cumul. Projects in CP Market Area Total Sales (1) [A]	Estimated Capture of Demand from New Households (2) [B]	2009 Candlestick Point Market Area Adjusted Sales Base (3) [C]	Intermediary Potential Sales Impacts Amount [D = A - B]	Net Remaining Potential Demand from New Households (4) [E]	Sales Diverted From Existing Market Area Retailers Amount [F = D - E]	Sales Diverted From Existing Market Area Retailers Percent [G = F / C]	Final Remaining New Demand [H = E - F]
Apparel Stores	$53,810,364	$5,271,092	$256,938,275	$48,539,273	$25,168,853	$23,370,419	9.1%	$0
General Merchandise Stores	$87,514,873	$8,086,411	$816,933,687	$79,428,462	$69,487,872	$9,940,590	1.2%	$0
Food Stores	$45,451,754	$7,194,044	$571,848,727	$38,257,710	$74,875,660	$0	0.0%	$74,875,660
Eating & Drinking Places	$59,892,130	$4,670,653	$881,357,621	$55,221,477	$61,405,190	$0	0.0%	$61,405,190
Home Furnishings & Appliances	$30,387,935	$1,874,763	$311,780,876	$28,513,172	$17,667,150	$10,846,022	3.5%	$0
Building Materials	$17,579,656	$2,547,827	$303,082,132	$15,031,829	$43,925,822	$0	0.0%	$43,925,822
Motor Vehicles & Parts	$0	N/A	$214,688,681	N/A	N/A	$0	N/A	N/A
Service Stations	$0	N/A	$344,945,809	N/A	N/A	$0	N/A	N/A
Other Retail Stores	$142,357,658	$5,896,498	$1,596,056,982	$136,461,159	$55,335,765	$81,125,395	5.1%	$0
Total	**$436,994,370**	**$35,541,288**	**$5,297,632,791**	**$401,453,082**	**$347,866,312**	**$125,282,425**	**2.4%**	**$180,206,672**

Sources: Exhibits 6, 7, 19, 50, and 55; and CBRE Consulting.

(1) See Exhibit 6, 7, and 50.
(2) See Exhibit 55.
(3) See Exhibit 19.
(4) See Exhibit 55. Demand remaining after sales captured by the Candlestick Point Project are accounted for as well as remaining demand available to Hunters Point Shipyard Phase II market area existing retailers.

APPENDIX B: CBRE CONSULTING RETAIL DEMAND, SALES ATTRACTION, AND SPENDING LEAKAGE ANALYSIS METHODOLOGY

APPENDIX B: RETAIL DEMAND, SALES ATTRACTION, AND SPENDING LEAKAGE ANALYSIS METHODOLOGY

This Appendix provides detailed documentation for CBRE Consulting's Retail Demand, Sales Attraction, and Spending Leakage Analysis, a tool frequently used in the firm's retail studies. The tool has several applications, which primarily includes forecasting retail demand generated by residents of a defined geographic area, comparing actual area sales to anticipated resident demand, and characterizing a market's relative strengths and weaknesses. CBRE Consulting's Retail Demand, Sales Attraction, and Spending Leakage Analysis involves many computational steps, relying on publicly available data resources. The purpose of this Appendix is to explain the approach to the analysis and to document, to the extent possible, the general formulation of the analysis. The intent of the Appendix is to provide a description that can be followed and generally understood by a reader with knowledge of the data resources and general principles involved in this type of analysis.

APPROACH

CBRE Consulting has developed a model that estimates retail spending potential for a market area (usually a city, grouping of cities, or county) based upon population, income, and consumer spending patterns. The model then computes the extent to which a market area is or is not capturing this sales potential based upon taxable sales data published by the State of California Board of Equalization or provided by local government municipal tax consultants. For any study area, retail categories in which spending by residents is not fully captured are called "leakage" categories, while retail categories in which more sales are captured than are generated by residents are called "attraction" categories. Thus, the model is called a "Retail Demand, Sales Attraction, and Spending Leakage Analysis." Generally, attraction categories signal particular strengths of a retail market, while leakage categories signal particular weaknesses.

In order to determine the anticipated pattern of retail spending for a market area, the Retail Demand, Sales Attraction, and Spending Leakage Analysis uses several benchmarked control areas. These control areas are representative of characteristics of consumer expenditures and retail product line sales by store type sales generated by resident populations. The results of the Retail Demand, Sales Attraction, and Spending Leakage Analysis provide a general barometer for the characterization of the retail market under study. The purpose of the control areas is to control for characteristics unique to specific geographies that affect the spending pattern of area residents.

While presented as a unique formulation, CBRE Consulting's Retail Demand and Sales Attraction, and Spending Leakage Analysis is not conceptually unique. The same type of analysis is conducted by many other real estate-based economic consulting firms, with the premise being the comparison of expected resident spending to actual sales. These other firms have a range of labels for the analysis, including "Retail Sales Leakage" (Bay Area Economics, 2004), "Retail Sales and Estimated Demand" (Economic Planning Systems, 2005), "Retail Demand and Sales Leakage Analysis" (Williams Kuebelbeck & Associates, Inc., 2003), and "Regional Trade Area Household Demand and Retail Demand and Sales Leakage Analysis" (Applied Development Economics, 2004).

METHODOLOGY

The methodology to estimate the retail spending potential of residents in a market area relative to actual sales involves the following steps:

1. Benchmark **Consumer Retail Expenditures** of the residents of the market area against a control area, of which the market area is a part, and that is reasonably representative of the spending patterns of the residents within that geography. This spending pattern is profiled for different average household income brackets.
2. Estimate the retail expenditures for the **Target Income Level** (market area's average household income) from among the different income brackets from step 1, adjusted based on consumer expenditure control area averages.
3. Align the consumer expenditure categories in step 1 with the **Economic Census Retail Product Line**. This establishes what product line retail items per the Economic Census ("EC") comprise specific consumer expenditure categories per the Consumer Expenditure Survey ("CES").
4. Distribute **Product Line Expenditures to Retail Store Categories** where the products are sold, per the product line control area pattern.
5. **Aggregate Product Lines and Retail Businesses**, to correspond with the Board of Equalization and municipal tax consultants retail store classifications. The aggregate consumer expenditures at the respective retail businesses are the average household spending potentials by market area residents at those retail store types.
6. Multiply the imputed household averages for potential market area resident spending into total potential spending and **Compare with the Actual Retail Sales**, thus profiling retail sales leakage/attraction in the market area. This becomes the Retail Demand, Sales Attraction, and Spending Leakage Analysis for the market area.

A detailed description of the above steps follows, profiled by data source and the analytic steps involved.

Consumer Expenditure Survey ("CES")

The CES, released annually by the Bureau of Labor Statistics, tabulates household expenditures for various categories, including retail items. This is available for different household income brackets for the U.S. Western Region, as well as other geographic regions. The CES provides all household expenditures, some of which, such as shelter, education, day-care, taxes, etc., are not relevant to retail analysis, and are therefore not incorporated in this analysis. Certain expenditure categories may have partial retail components that are estimated. For example, the household repairs expenditure category includes home insurance, which is estimated by CBRE Consulting based on industry sources for average home insurance in California, and deducted from that category for analytic purposes. Exhibit B-1 presents the retail expenditures component of the Western Region's 2004 Consumer Expenditure Survey, by category and by household income bracket.[1] Exhibit B-2 profiles the retail expenditure variation in every income bracket from the average expenditure for that category across all households. The reason for this approach is elaborated in the next step.

[1] At the time the study was conducted, 2004 was the most recently published survey year.

Consumer Expenditure Control Area

At the smaller metropolitan statistical area (MSA) geographies, household expenditures are available only as an average across all income brackets (see Exhibit B-3). To estimate expenditures across all income brackets, CBRE Consulting utilized the Western Region's spending pattern across individual income brackets relative to overall average. The expenditure variation for each income bracket from the average expenditure across all households was tabulated, for each retail category (see Exhibit B-2). For example, if in the "food at home" category, an average household in a particular income bracket spends $80 and another household in a different income bracket spent $120, while the overall average across all income brackets is $100, then the variance for the respective income bracket in this retail item would be 80 percent and 120 percent, where the overall average is 100 percent. This variance was applied to the given MSA level average (assumed to be 100 percent) for all households, to generate estimated retail expenditures by income bracket. In California, these MSAs are Los Angeles, San Francisco, and San Diego, for a total of four consumer expenditure control areas (including the Western US). These areas' expenditure characteristics 'control' the market area's household expenditure patterns across income brackets.

Target Income Bracket and Income Sensitivity

Given a market area's average household income, the model selects the corresponding CES income bracket, for analytical purposes. However, the CES income brackets do not have a uniform range, varying from $5,000 to $20,000. Thus, the expenditure estimates need to be sensitive to, and be correspondingly adjusted to, reflect the market area's average household income. This refinement is made by adjusting for the difference between the market area's average household income and that income bracket's average figure. The expenditure estimates would therefore vary even within an income bracket, depending on how close or far the market area's average household income is from the average income in that bracket. For example, for a market area with average household income of $83,300, its pattern of consumer expenditures for each retail category would be expected to vary between the pattern of the target income bracket as well as the preceding or subsequent income bracket (see Exhibit B-4). How much that pattern would vary will be determined by the extent to which $83,300 lies between the average incomes in the preceding or subsequent and target income brackets ($59,100 and $118,500 in this case). The overall retail expenditure average per household therefore gets adjusted to approximately $30,930, between the averages of the preceding ($26,100) and the target income bracket ($37,930). This adjustment is made to every retail expenditure category.

Product Line Adjustments by Kind of Business

The consumer expenditure estimates that are computed represent expenses for separate retail items. In order for these expenses by item to be allocated to the respective retail stores where those items are sold, CBRE Consulting utilized data from the Census Bureau's Economic Census Subject Series for Retail Trade ("EC"). The EC profiles 45 retail items by five-digit codes (product line items) tracking their sales in 65 different retail store and non-store categories. These stores are classified per their four, five, or six-digit NAICS codes[2]. Of the 45 product line items, three relate to non-retail store goods, and are excluded from the analysis (e.g., non-merchandise

[2] The North American Industry Classification System (NAICS, pronounced Nakes) was developed as the standard for use by Federal statistical agencies in classifying business establishments for the collection, analysis, and publication of statistical data related to the business economy of the U.S. NAICS was developed under the auspices of the Office of Management and Budget (OMB), and adopted in 1997 to replace the old Standard Industrial Classification (SIC) system. It was also developed in cooperation with the statistical agencies of Canada and Mexico to establish a 3-country standard that allows for a high level of comparability in business statistics among the three countries.

goods, crude oil, and household fuels). For comparability with the CES, the product line items relevant to building materials (product line item codes 20600 thru 20670, and 20690) are analyzed in aggregate form, resulting in a total of 38 product line items. Exhibit B-5 details the percentage of sales for each of the 38 product line items by the category of store at which they are sold, e.g., of all sales of paper and related products (product line item code 20190), 39 percent transpire at general merchandise stores, 53 percent at food stores, and the rest at various other retail stores.

It is important to note that the consumer expenditure retail categories from the CES do not necessarily directly correspond with the product line item codes from the EC. Therefore, based on the nature of these items and their relevance to the respective expenditure categories, a "bridge" between the two datasets needed to be established to facilitate analysis. Exhibit B-6 profiles the "bridge" established; the EC product line codes are presented, and matched with the CES categories contributing to the respective item sales. For example, grocery and meal products from the EC were matched with CES 'food at home' expenditures; soaps, detergents and paper towel products matched to 'housekeeping supplies in laundry and cleaning' expenditures; and footwear products matched to 'other apparel products' expenditures, etc. A few CES categories may include more than one product line item from the EC. Such retail expenditures are split between those product items per their relative actual sales in the relevant 'product line control area'. For example, the CES category of TV, radio and sound equipment expenditure is distributed between the EC product line items of 20320 and 20330 (see Exhibit B-6) based on the actual relative sales of the items in 'product line control areas'. Also, the CES does not directly provide the categories relevant to building materials product items. Therefore, CBRE Consulting assumed that all the 'other household expenses' under the household operations category, 'other household products' under the housekeeping supplies, and 75 percent of the 'maintenance, repair, insurance & other expenses' under housing will be spent on building material items. This 75 percent figure was selected due to the retailing dominance of major US home improvement retailers.

Product Line Control Areas

The EC provides the product line data for various geographies, with MSA's being the smallest. However, due to proprietary sales data disclosure issues at the MSA level, detailed product line items sales may not be available for all 65 of the four, five, or six-digit NAICS retail categories' classifications. For those categories, the analysis assumes that the share of six-digit codes within four-digit or five-digit codes would be the same in that geography as they are statewide. Thus, CBRE Consulting generated a matrix of 38 product line items by their share of sales at 65 retail store categories, and collapsed them to correspond with the State of California Board of Equalization ("BOE") retail store categories, as pointed out above. CBRE Consulting thus developed a matrix of product line characteristics at retail stores for five geographies, which represent the 'product line control area' for market areas within California. These control areas are: California statewide, Los Angeles-Long Beach-Riverside Consolidated Metropolitan Statistical Area ("CMSA"), San Francisco-San Jose-Oakland CMSA, Sacramento-Arden-Arcade-Truckee CMSA, and Fresno-Madera CMSA.

Expenditure Potential by Aggregated Retail Products and Stores

Based on the above methodology, an end product generated for the Retail Demand, Sales Attraction, and Spending Leakage Analysis is a matrix of product line retail items aggregated by type, and sorted by their sales at various retail store categories, per BOE classification. The 38 product line items and the 65 retail categories are each aggregated to correspond with the BOE retail store categories. Exhibit B-7 summarizes the sales and percentage shares of the aggregated product line items by the retail stores. Footnotes to the same exhibit detail the EC codes and the

NAICS codes that are aggregated to generate the product line categories and the retail store categories, respectively.

Three out of the 65 EC business categories are electronic mail-order shopping, vending machine operators, and direct selling establishments, which form non-store retail sales and are profiled as such. It should be noted that the EC does not include eating and drinking places in the Retail Trade Subject series. However, this retail store category has very limited overlap with other retail stores in terms of the retail product line items. CBRE Consulting therefore assumed that all the consumer expenditure in the 'Food away from home' category is spent at Eating & Drinking places.

Retail Sales Attraction/Spending Leakage

The expenditure potentials generated thus, for each of the retail store categories, are then multiplied by the total number of households in the market area to arrive at the 'total spending potential' of the residents therein. This comprises the expected level of retail demand for the market area. These spending potentials for each retail store category are then compared with the actual retail sales in the market area, as available from BOE or municipal tax consultants. The result is the "Retail Demand, Sales Attraction, and Spending Leakage Analysis". For any market area, retail categories in which spending by locals is not fully captured, i.e., potential exceeds sales, are called "leakage" categories, while retail categories in which more sales are captured than are generated by residents are called "attraction" categories.

A presumption behind the interpretation of the Retail Demand, Sales Attraction, and Spending Leakage Analysis is that a community with no identified net spending leakage or sales attraction is capturing 100 percent of resident spending potential. This presumption is a generalization for analytic purposes, as there are almost always net outflows of retail expenditures by local residents. The level of this outflow will vary depending upon the size of the geography, with the likelihood that the larger the geography, the greater the potential of retaining resident sales. However, as CBRE Consulting's Retail Demand, Sales Attraction, and Spending Leakage Analysis is a tool designed to characterize the relative strengths and weaknesses of a retail market, as are comparable models supported by other economic consulting firms, it is conceived that identified leakage comprises lost resident retail spending potential and that attraction comprises net inflows of retail sales generated variously by residents, businesses, and tourists located outside the area of study.

DEMOGRAPHIC ESTIMATES AND RETAIL SALES ADJUSTMENTS

Demographic Estimates

For the Retail Demand, Sales Attraction, and Spending Leakage Analysis, different sources are used for population and mean household income figures and projections. Figures are derived from data compiled by the local Council of Governments (COG), State Department of Finance, or other private market research and data collection companies, e.g., Claritas. The population estimates are projected forward using a compound average growth rate, derived from relevant projected population data. The intermediary years are calculated by interpolation.

Non-Taxable Sales Adjustments

Actual sales are provided by BOE or municipal tax consultants. However, they include only taxable sales, not non-taxable. These non-taxable sales primarily include pharmaceutical sales at drug stores and a portion of food sales at grocery stores. Based upon detailed analysis of sales trends reported by the EC and supplemented by discussions with BOE representatives, CBRE Consulting's analysis assumes that 30 percent of drug store sales and 30 percent of food store sales are taxable. Sales adjustments to these retail sales categories are reflected in the Retail Demand, Sales Attraction, and Spending Leakage Analysis. Therefore, CBRE Consulting's Retail Demand, Sales Attraction, and Spending Leakage Analysis conducts the analysis for all retail sales in an area, including taxable and nontaxable.

Drug Store Share of General Merchandise

The BOE categorizes drug store sales under the general merchandise stores category. As discussed in the preceding paragraph, drug stores have a component of non-taxable sales. It is therefore important to separate the drug stores sales component from the total general merchandise sales. The BOE or the local government municipal tax consultants may provide this break-down of sales for select market areas. For market areas where drug store sales are not separately provided, CBRE Consulting assumes the drug store sales component to be the same as in the County in which the market area lies.

Analytic Adjustment Required Due to Data Confidentiality

The Retail Demand, Sales Attraction, and Spending Leakage Analysis sometimes involves an analytic adjustment due to data limitations. When BOE publicly reports data, or data are provided by municipal tax consultants, they do not report data for a sales category if it violates certain disclosure prohibitions necessary to protect proprietary business information. For example, if there are four or fewer stores in a category or if one retailer greatly dominates the category in sales volume (i.e. comprising 80 percent or more of category sales), then the sales in that category will not be publicly released. Instead, sales data will be combined with the sales in the next most relevant category to preserve confidentiality. To remain consistent and accurate in leakage/attraction estimation, CBRE Consulting therefore reallocates the retail spending in the relevant categories for methodological purposes.

TARGET YEAR PROJECTIONS

The Retail Demand, Sales Attraction, and Spending Leakage Analysis is often conducted for a 'base' year, and extrapolated to a future 'target' year. The target year is chosen as relevant for the respective study, such as estimating demand generated by residents of a new subdivision or estimating the sale impacts of a new store or retail development upon stabilization. The base year is the most recent full year for which annual retail sales data are available from the BOE/municipal tax consultants at the time the study was initiated.

Population Growth Adjustments

The retail expenditure pattern per household from the base year is assumed to be equivalent to the target year pattern, with adjustments for interim population growth and inflation. The purpose of this adjustment is to more appropriately benchmark the analysis to the target year.

Retail Sales Base Adjustment

The retail sales base is grown out to the target year pursuant to the study's inflationary assumptions.

Existing Stores Capture of New Demand

The population growth in the market area between base and target years will create additional spending potential. A certain portion of this new resident spending potential is likely to be absorbed by the existing retailers in the market area, or by planned retailers if a new development is anticipated. Therefore, the analysis requires the formulation of capture rates for relevant retail categories, for which there can be several approaches.

In the absence of planned retailers, where the analysis is being conducted to characterize the future retail market, the following approach is programmed into the model: for retail categories where attraction is less than five percent, the analysis assumes no new capture; if attraction is less then 50 percent, the analysis assumes the same percentage for capture as is the leakage; and, for greater then 50 percent attraction, the analysis assumes 50 percent capture by existing retailers. Alternatively, where the analysis pertains to analysis of new retailers, capture rates are developed in a customized manner based on variety of different factors, including the existing retailers in the market by category, competitiveness of existing retailers, size of existing retail base, projected location of new households, and current retail patterns of existing households based on interviews with commercial real estate brokers.

Leakage Adjustments for New Competitive Stores or Store Closures

CBRE Consulting makes adjustments to the projected retail sales base to account for new stores that have located in the market area since the base year, the most recent year with complete actual annual sales data. The purpose of this adjustment is to estimate more accurate retail sales base for analytic purposes. Thus, an adjustment in the Retail Demand, Sales Attraction, and Spending Leakage Analysis results, reflecting estimated new store sales, is required. These new store sales are generally estimated using store sales performance data reported in store's 10-K report filed with the Securities and Exchange Commission or other published data source. In like manner, a similar adjustment is made for stores anticipated to close between the base year and target year. This could include stores that have already announced their anticipated closure or relocation out of a community, or stores that will be replaced by new or expanded stores operated by the same retailer.

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MODEL CUSTOMIZATION FOR CURRENT STUDY

Highlighted below are the assumptions feeding into the above methodology, as relevant to this study:

- *Population Source:* Claritas, Inc. and San Francisco Urban Water Management Plan Projections from email sent by PBS&J dated July 2, 2009
- *Income Source:* Claritas, Inc.
- *Actual Retail Sales Source:* BOE and Claritas, Inc.
- *Base Year for Analysis:* 2007-2008
- *Target Years for Analysis:* 2030
- *Consumer Expenditure Control Area:* US Western Region
- *Product Line Control Area:* San Francisco CMSA
- *Drug Store Share of General Merchandise:* 21.7%

Inflation Indices N/A

- *Base to Current Year Annual Inflation for Spending:* N/A
- *Base to Current Year Annual Inflation for Sales:* N/A
- *Current to Target Year Annual Inflation for Spending:* N/A
- *Current to Target Year Annual Inflation for Sales:* N/A

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Exhibit B-1: Consumer Expenditure Survey, 2005 for the Western Region
Average Annual Household Expenditure by Household Income, and Retail Category

US WESTERN REGION	Total Complete Reporting	Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $29,999	$30,000 to $39,999	$40,000 to $49,999	$50,000 to $69,999	$70,000 and over
Number of consumer units (in thousands)	24,064	1,064	1,531	1,787	1,634	2,976	2,715	2,343	3,573	6,441
Income before taxes	$54,416	$466	$7,816	$12,480	$17,351	$24,859	$34,543	$44,499	$59,076	$118,492
Income after taxes	51,815	531	7,874	12,534	17,305	24,472	33,581	43,358	56,884	110,964
Average number in consumer unit:	2.6	1.6	1.6	1.7	2.3	2.4	2.5	2.7	2.8	3.2
Average annual expenditures	$47,527	$22,470	$17,262	$22,178	$25,678	$30,850	$37,586	$42,313	$52,315	$81,900
Average annual retail expenditures (1)	$25,566	$11,909	$8,862	$11,956	$13,703	$16,056	$20,035	$22,100	$27,462	$41,767
Food at home	3,635	2,055	1,798	2,387	2,453	2,819	3,235	3,616	3,860	4,948
Food away from home	2,742	1,253	981	1,095	1,277	1,623	2,077	2,330	2,951	4,566
Alcoholic beverages	534	289	284	179	221	274	374	495	637	861
Maintenance, repairs, insurance, other expenses	1,125	447	196	706	553	778	702	723	1,190	1,992
Other household expenses	705	223	152	315	543	390	385	450	587	1,377
Laundry and cleaning supplies	150	63	82	102	130	121	153	161	168	181
Other household products	328	173	106	171	253	199	267	245	350	514
Household textiles	156	62	19	52	161	86	189	107	174	230
Furniture	560	103	123	182	192	198	365	410	445	1,183
Floor coverings	68	222	23	16	7	19	14	67	80	144
Major appliances	255	54	45	69	189	143	171	201	270	459
Small appliances, miscellaneous	156	43	31	99	84	102	138	133	127	267
Miscellaneous household equipment	975	185	240	348	403	487	1,100	798	915	1,678
Men, 16 and over	416	136	180	153	204	255	356	266	393	728
Boys, 2 to 15	93	42	42	41	52	66	72	90	110	140
Women, 16 and over	706	341	377	310	290	457	557	420	805	1,161
Girls, 2 to 15	130	25	26	63	50	57	90	134	135	230
Children under 2	141	46	54	59	120	164	95	117	127	216
Footwear	331	114	278	188	181	250	312	276	342	475
Other apparel products and services	395	111	143	213	198	247	292	280	334	723
Vehicle purchases (net outlay)	4,295	2,758	1,126	1,286	1,534	2,393	2,929	3,555	4,872	7,785
Gasoline and motor oil	1,979	797	667	919	1,068	1,406	1,701	1,976	2,291	2,960
Vehicle maintenance and repair	843	302	276	284	524	524	712	732	938	1,365
Postage and stationery	186	64	46	88	170	109	177	170	214	269
Drugs	457	258	205	435	458	368	392	542	423	574
Medical supplies	119	49	31	61	98	79	92	94	138	184
Television, radios, sound equipment	923	347	331	450	509	612	752	795	980	1,495
Pets, toys, hobbies, and playground equipment	490	260	113	217	258	224	335	410	479	884
Other entertainment	596	180	129	298	423	297	286	649	744	973
Personal care products and services	648	290	255	344	324	446	472	618	654	1,042
Reading	154	68	59	66	83	90	106	140	149	266
Tobacco products and smoking supplies	239	161	192	197	239	205	315	244	282	224
Miscellaneous	1,036	387	250	563	453	568	822	856	1,298	1,672

Sources: Bureau of Labor Statistics, Consumer Expenditure Survey, 2004-05, Table 34; and CBRE Consulting.

(1) CBRE Consulting included expenditures on gifts for relevant categories in total retail expenditures.

Exhibit B-2: Consumer Expenditure Survey, 2005 for the Western Region
Average Annual Household Expenditure by Household Income, and Retail Category – Variance from Average (1)

WESTERN REGION	Total Complete Reporting	Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $29,999	$30,000 to $39,999	$40,000 to $49,999	$50,000 to $69,999	$70,000 and over
% VARIANCE FROM AVERAGE (Per Household)										
Income before taxes	100.0%	0.9%	14.4%	22.9%	31.9%	45.7%	63.5%	81.8%	108.6%	217.8%
Average annual expenditures	100.0%	47.3%	36.3%	46.7%	54.0%	64.9%	79.1%	89.0%	110.1%	172.3%
Average annual retail expenditure	100.0%	46.6%	34.7%	46.8%	53.6%	62.8%	78.4%	86.4%	107.4%	163.4%
Food at home	100.0%	56.5%	49.5%	65.7%	67.5%	77.6%	89.0%	99.5%	106.2%	136.1%
Food away from home	100.0%	45.7%	35.8%	39.9%	46.6%	59.2%	75.7%	85.0%	107.6%	166.5%
Alcoholic beverages	100.0%	54.1%	53.2%	33.5%	41.4%	51.3%	70.0%	92.7%	119.3%	161.2%
Maintenance, repairs, insurance, other expenses	100.0%	39.7%	17.4%	62.8%	49.2%	69.1%	62.4%	64.2%	105.8%	177.0%
Other household expenses	100.0%	31.6%	21.6%	44.7%	77.0%	55.3%	54.6%	63.8%	83.3%	195.3%
Laundry and cleaning supplies	100.0%	41.8%	54.8%	68.0%	86.6%	80.4%	101.9%	107.2%	111.4%	120.3%
Other household products	100.0%	52.9%	32.4%	52.1%	77.1%	60.8%	81.5%	74.8%	106.9%	156.8%
Household textiles	100.0%	39.7%	12.2%	33.3%	103.2%	55.1%	121.2%	68.6%	111.5%	147.4%
Furniture	100.0%	18.4%	22.0%	32.5%	34.3%	35.4%	65.2%	73.2%	79.5%	211.3%
Floor coverings	100.0%	326.5%	33.8%	23.5%	10.3%	27.9%	20.6%	98.5%	117.6%	211.8%
Major appliances	100.0%	21.2%	17.6%	27.1%	74.1%	56.1%	67.1%	78.8%	105.9%	180.0%
Small appliances, miscellaneous	100.0%	27.6%	19.9%	63.5%	53.8%	65.4%	88.5%	85.3%	81.4%	171.2%
Miscellaneous household equipment	100.0%	19.0%	24.6%	35.7%	41.3%	49.9%	112.8%	81.8%	93.8%	172.1%
Men, 16 and over	100.0%	32.6%	43.3%	36.8%	49.1%	61.3%	85.7%	63.9%	94.5%	175.1%
Boys, 2 to 15	100.0%	45.4%	45.2%	44.0%	55.7%	70.8%	76.7%	96.9%	118.1%	150.0%
Women, 16 and over	100.0%	48.3%	53.5%	44.0%	41.1%	64.7%	78.9%	59.6%	114.1%	164.5%
Girls, 2 to 15	100.0%	19.3%	19.7%	48.1%	38.5%	44.0%	69.1%	102.5%	103.5%	176.6%
Children under 2	100.0%	32.6%	38.3%	41.8%	85.1%	116.3%	67.4%	83.0%	90.1%	153.2%
Footwear	100.0%	34.4%	84.0%	56.8%	54.7%	75.5%	94.3%	83.4%	103.3%	143.5%
Other apparel products and services	100.0%	28.1%	36.2%	53.9%	50.1%	62.5%	73.9%	70.9%	84.6%	183.0%
Vehicle purchases (net outlay)	100.0%	64.2%	26.2%	29.9%	35.7%	55.7%	68.2%	82.8%	113.4%	181.2%
Gasoline and motor oil	100.0%	40.3%	33.7%	46.4%	54.0%	71.0%	86.0%	99.9%	115.8%	149.6%
Vehicle maintenance and repair	100.0%	35.9%	32.7%	33.7%	62.2%	62.2%	84.4%	86.7%	111.2%	161.9%
Postage and stationery	100.0%	34.4%	25.0%	47.3%	91.5%	58.5%	95.0%	91.3%	115.2%	144.9%
Drugs	100.0%	56.5%	44.8%	95.3%	100.4%	80.5%	85.9%	118.7%	92.7%	125.8%
Medical supplies	100.0%	41.4%	26.2%	51.0%	82.8%	66.7%	77.5%	79.3%	116.0%	155.3%
Television, radios, sound equipment	100.0%	37.6%	35.9%	48.8%	55.2%	66.4%	81.4%	86.1%	106.2%	161.9%
Pets, toys, hobbies, and playground equipment	100.0%	53.1%	23.1%	44.3%	52.7%	45.7%	68.4%	83.7%	97.8%	180.4%
Other entertainment	100.0%	30.2%	21.6%	49.9%	70.9%	49.7%	48.0%	108.9%	124.8%	163.3%
Personal care products and services	100.0%	44.8%	39.4%	53.1%	50.0%	68.8%	72.8%	95.4%	100.9%	160.8%
Reading	100.0%	44.2%	38.3%	42.9%	53.9%	58.4%	68.8%	90.9%	96.8%	172.7%
Tobacco products and smoking supplies	100.0%	67.4%	80.3%	82.4%	100.0%	85.8%	131.8%	102.1%	118.0%	93.7%
Miscellaneous	100.0%	37.4%	24.1%	54.3%	43.7%	54.8%	79.3%	82.6%	125.3%	161.4%

Sources: Bureau of Labor Statistics, Consumer Expenditure Survey, 2004-05, Table 34; and CBRE Consulting.

(1) CBRE Consulting calculated the expenditures in each income bracket relative to the average across all households, for each expenditure category.

Exhibit B-3: Consumer Expenditure Survey, 2005 for Select Western MSA's

Average Annual Household Expenditure by Retail Category (1)

	Los Angeles	San Francisco	San Diego	Portland	Seattle	Honolulu	Anchorage	Phoenix	Denver
Number of consumer units (in thousands)	5,112	2,724	892	1,052	1,801	278	119	1,423	1,270
Income before taxes	$65,810	$86,935	$69,067	$56,702	$63,888	$70,104	$71,031	$60,726	$65,224
Age of reference person	46.9	47	50.1	47.9	47.8	51.8	45.8	45.7	45.6
Average number in consumer unit: Persons	2.9	2.6	2.6	2.5	2.3	2.8	2.5	2.6	2.4
Average annual expenditures	$55,760	$60,992	$59,805	$50,313	$54,027	$54,937	$59,427	$49,009	$49,996
Average annual retail expenditures	**$27,540**	**$27,080**	**$27,404**	**$24,530**	**$26,016**	**$27,282**	**$28,949**	**$25,252**	**$23,301**
Food at home	3,876	3,909	3,462	3,557	3,908	4,231	3,713	3,599	3,789
Food away from home	3,185	3,672	2,976	2,820	2,996	3,858	2,698	2,835	2,462
Alcoholic beverages	485	628	613	526	781	463	636	585	635
Maintenance, repairs, insurance, other expenses	1,346	1,668	1,511	1,102	1,184	1,079	1,295	979	1,096
Other household expenses	784	886	1,000	598	464	443	631	630	462
Laundry and cleaning supplies	143	144	146	125	160	185	175	137	124
Other household products	312	313	319	273	348	403	381	299	270
Household textiles	149	156	141	128	179	154	168	117	99
Furniture	585	610	551	500	701	604	659	458	389
Floor coverings	71	74	67	61	85	73	80	56	47
Major appliances	260	271	245	222	312	269	293	203	173
Small appliances, miscellaneous	139	145	131	119	166	144	156	109	92
Miscellaneous household equipment	916	956	865	784	1,099	948	1,033	718	610
Men, 16 and over	452	451	366	345	347	408	345	355	332
Boys, 2 to 15	101	101	82	77	78	92	77	80	75
Women, 16 and over	773	772	627	590	594	699	590	608	569
Girls, 2 to 15	143	143	116	109	110	129	109	112	105
Children under 2	115	115	93	88	88	104	88	90	84
Footwear	404	404	328	309	311	365	308	318	297
Other apparel products and services	398	397	323	304	306	360	304	313	293
Vehicle purchases (net outlay)	4,996	3,347	5,681	3,964	3,897	4,768	6,082	5,490	3,529
Gasoline and motor oil	2,312	1,922	2,094	1,742	1,914	1,658	2,157	1,769	1,755
Vehicle maintenance and repair	955	1,039	816	801	887	765	1,021	918	811
Postage and stationery	177	177	181	155	198	229	216	169	153
Drugs	393	480	525	466	503	450	587	500	471
Medical supplies	102	125	137	121	131	117	153	130	122
Television, radios, sound equipment	915	989	893	1,029	1,010	1,052	1,151	792	1,086
Pets, toys, hobbies, and playground equipment	479	517	467	538	528	550	602	415	568
Other entertainment	591	639	577	665	653	680	743	512	701
Personal care products and services	798	664	805	578	625	772	615	666	636
Reading	158	212	192	188	214	128	218	132	144
Tobacco products and smoking supplies	179	143	136	344	236	241	440	373	308
Miscellaneous	848	1,014	940	1,303	1,004	861	1,227	786	1,010

Sources: Bureau of Labor Statistics, Consumer Expenditure Survey, 2004-05, Table 24; and CBRE Consulting.

(1) CBRE Consulting split expenditures in Home Furnishings and Appliances, Apparel, and some Other Retail categories per Western Region shares, in order to get comparable sub-categories corresponding to the Western Region dataset.

Exhibit B-4: Consumer Expenditure Imputation for Illustrative Market Area's Average Household Income
Per Household Retail Expenditure Estimates at a Hypothetical Household Income of $83,300

	All HH Average	Target Estimates	- 5,000	5,000 10,000	10,000 15,000	15,000 20,000	20,000 30,000	30,000 40,000	40,000 50,000	50,000 70,000	70,000 -
Household Average Income before taxes	$54,416	$83,297	$466	$7,816	$12,480	$17,351	$24,859	$34,543	$44,499	$59,076	$118,492
Per HH avg. annual retail expenditure	$23,080	$30,931	$10,654	$8,423	$11,200	$13,211	$15,804	$19,324	$20,606	$26,115	$37,928
Food at home	$3,531	$4,163	$2,199	$1,829	$2,308	$2,690	$2,980	$3,283	$3,562	$3,766	$4,740
Food away from home	2,520	3,416	1,271	857	965	1,253	1,606	1,992	2,213	2,793	4,321
Alcoholic beverages	477	659	276	177	194	228	266	360	392	541	832
Maintenance, repairs, insurance, other expenses	$1,045	$1,401	$504	$264	$628	$553	$795	$773	$835	$1,103	$1,833
Other household expenses	529	699	216	114	248	431	343	338	394	469	1,034
Laundry and cleaning supplies	138	163	71	52	111	119	121	133	147	157	172
Other household products	262	346	155	74	158	153	161	213	195	278	445
Household textiles	$160	$195	$55	$54	$70	$154	$84	$173	$113	$140	$275
Furniture	496	743	143	121	215	182	211	322	345	538	1,041
Floor coverings	76	117	39	7	60	15	21	28	81	94	151
Major appliances	230	319	43	55	96	173	140	216	244	291	359
Small appliances, miscellaneous housewares	119	142	24	34	53	66	89	129	115	106	195
Miscellaneous household equipment	786	1,150	289	156	362	383	482	507	657	982	1,395
Men, 16 and over	$328	$431	$231	$145	$120	$161	$174	$304	$238	$330	$577
Boys, 2 to 15	88	115	38	32	37	56	68	67	72	86	157
Women, 16 and over	659	906	280	264	285	356	408	517	398	712	1,188
Girls, 2 to 15	106	152	49	26	33	77	69	77	92	135	176
Children under 2	91	114	36	33	39	86	74	63	79	87	153
Footwear	313	381	165	242	206	272	214	266	241	321	469
Other apparel products and services	300	391	122	118	160	155	166	267	256	281	551
Vehicle purchases (net outlay)	$4,004	$5,919	$1,459	$1,207	$1,407	$1,449	$2,655	$3,206	$3,386	$5,182	$6,992
Gasoline and motor oil	1,618	2,151	719	607	804	989	1,185	1,489	1,695	1,961	2,426
Maintenance and repairs	822	1,099	346	283	308	585	564	732	800	944	1,324
Postage and stationery	$171	$235	$50	$61	$106	$145	$95	$148	$141	$216	$262
Drugs	449	475	227	371	437	467	414	397	452	418	557
Medical supplies	138	173	36	51	94	122	117	148	95	155	199
Television, radios, sound equipment	778	1,035	326	302	374	431	581	661	777	893	1,240
Pets, toys, hobbies, and playground equipment	442	617	235	84	184	199	250	325	447	502	784
Other entertainment	666	933	214	59	276	227	262	800	513	717	1,247
Personal care products and services	613	786	320	243	423	304	404	476	588	632	1,011
Reading	148	194	67	57	76	81	94	104	144	147	263
Tobacco products and smoking supplies	224	241	129	164	181	228	233	253	259	257	218
Miscellaneous	752	1,073	324	299	207	385	514	585	690	939	1,266

Source: CBRE Consulting.

Exhibit B-5: Economic Census Retail Trade Subject Series [1]
Illustrative [2] Product Line [3] Sales by Kind of Business [4]

STATEWIDE CALIFORNIA	20100	20120	20130	20140	20150	20160	20180	20190	20200	20220	20240	20260	20270	20280
Clothing & accessories stores	0.00%	0.00%	0.00%	0.00%	0.00%	0.94%	0.00%	0.00%	52.26%	58.46%	43.87%	14.48%	0.10%	5.16%
Shoes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.93%	0.57%	0.68%	48.20%	0.00%	0.00%
Apparel stores group	0.00%	0.00%	0.00%	0.00%	0.00%	0.94%	0.00%	0.00%	54.19%	59.03%	44.54%	62.67%	0.10%	5.16%
General merchandise stores	13.97%	14.38%	0.00%	7.05%	34.00%	19.85%	42.65%	35.81%	37.13%	34.52%	51.45%	22.92%	24.74%	38.43%
Drug stores	1.32%	0.14%	0.00%	7.65%	3.07%	50.79%	3.52%	2.89%	0.08%	0.38%	0.26%	0.35%	0.20%	0.01%
General merchandise group	15.30%	14.52%	0.00%	14.70%	37.07%	70.64%	46.17%	38.70%	37.21%	34.90%	51.70%	23.27%	24.94%	38.43%
Gifts, art goods, and novelties	0.08%	0.17%	0.00%	0.07%	0.25%	0.06%	0.08%	1.24%	0.16%	0.17%	1.13%	0.05%	0.00%	0.03%
Sporting goods	0.01%	0.06%	0.00%	0.02%	0.01%	0.00%	0.00%	0.00%	3.66%	1.08%	0.59%	9.10%	0.00%	0.00%
Florists	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Photographic equipment and supplies	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Musical instruments & Music stores	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stationery and books	0.02%	1.85%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.17%	0.04%	0.02%	0.00%	0.00%	0.00%
Jewelry	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Office, store, and school supplies	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Radio, television, & other electronics stores	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%
Other specialties	0.36%	0.68%	2.28%	0.12%	8.91%	8.30%	1.09%	0.26%	0.19%	0.18%	0.10%	0.28%	66.33%	1.72%
Specialty stores group	0.47%	2.76%	2.28%	0.22%	9.23%	8.36%	1.20%	1.60%	4.18%	1.49%	1.83%	9.42%	66.38%	1.75%
All food stores	78.47%	66.80%	83.34%	54.19%	25.43%	14.56%	47.38%	52.71%	0.03%	0.16%	0.17%	0.07%	0.58%	0.13%
Food stores group	78.47%	66.80%	83.34%	54.19%	25.43%	14.56%	47.38%	52.71%	0.03%	0.16%	0.17%	0.07%	0.58%	0.13%
Household and home furnishings	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%	0.16%	0.00%	0.49%	35.60%
Household appliance dealers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.46%	0.52%
Household group	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%	0.16%	0.00%	0.94%	36.12%
Lumber and other building materials	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%
Hardware stores and Home Centers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.83%	0.00%	0.03%	0.00%	0.00%	0.02%	0.17%	6.09%
Farm & garden supply stores	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.04%	0.00%	0.00%
Building material group	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	3.92%	0.00%	0.10%	0.00%	0.00%	0.05%	0.17%	6.14%
Motor vehicle dealers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.30%	0.15%	0.00%	0.01%	0.00%	0.00%
Automotive supplies and parts	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Service stations	2.53%	10.90%	3.06%	5.88%	23.70%	0.23%	0.62%	0.63%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Automotive group	2.53%	10.90%	3.06%	5.88%	23.70%	0.23%	0.62%	0.63%	0.30%	0.15%	0.00%	0.01%	0.00%	0.00%
Packaged liquor stores	0.62%	0.79%	11.31%	22.69%	4.19%	0.11%	0.33%	0.37%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Second-hand merchandise	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.86%	0.96%	1.28%	0.44%	0.13%	0.49%
Fuel and ice dealers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mobile homes, trailers, and campers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
All other retail stores group	0.62%	0.79%	11.31%	22.69%	4.19%	0.12%	0.33%	0.37%	0.86%	0.96%	1.28%	0.44%	0.13%	0.49%
All Retail Stores Totals	97.46%	95.76%	100.00%	97.68%	99.62%	94.84%	99.62%	94.01%	96.89%	96.68%	99.70%	95.94%	93.25%	88.22%
Non-Store Outlets	2.54%	4.24%	0.00%	2.32%	0.38%	5.16%	0.38%	5.99%	3.11%	3.32%	0.30%	4.06%	6.75%	11.78%
Total All Outlets	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: US Census Bureau – Economic Census 2002: Retail Trade Subject Series, Product Lines by Kind of Business; and CBRE Consulting.

(1) Exhibit details the sales of product line items by the retail store at which the sales are made.
(2) Figures represent California statewide product line sales by kind of business.
(3) Refer to Exhibit B-6 for description of product line item codes 20100 through 29810.
(4) Retail businesses classification and categorization per EC.

Exhibit B-5: Economic Census Retail Trade Subject Series (1)
Illustrative (2) Product Line (3) Sales by Kind of Business (4) (continued)

STATEWIDE CALIFORNIA	20300	20310	20320	20330	20340	20360	20370	20380	20400	20420	20440	20460	20490	20500
Clothing & accessories stores	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	5.61%	5.11%	0.00%	0.00%	12.19%	1.90%	0.72%
Shoes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.33%	0.00%	0.00%	0.00%	0.00%	0.35%
Apparel stores group	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	5.61%	5.44%	0.00%	0.00%	12.19%	1.90%	1.07%
General merchandise stores	36.14%	55.04%	25.26%	18.29%	12.03%	3.52%	6.99%	27.92%	21.80%	19.70%	22.97%	32.17%	21.24%	16.89%
Drug stores	0.00%	11.61%	0.24%	2.91%	0.00%	0.00%	0.00%	1.88%	1.70%	2.30%	26.48%	2.26%	6.33%	0.15%
General merchandise group	36.14%	66.65%	25.51%	21.20%	12.03%	3.52%	6.99%	29.80%	23.50%	22.00%	49.45%	34.43%	27.57%	17.04%
Gifts, art goods, and novelties	0.00%	0.04%	0.78%	0.27%	0.23%	0.00%	0.02%	3.20%	1.64%	1.16%	0.03%	2.47%	0.02%	0.06%
Sporting goods	0.00%	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%	0.07%	0.34%	0.00%	0.00%	0.09%	2.46%	47.79%
Florists	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.27%	0.00%	0.02%	0.00%	0.07%	0.00%	0.00%
Photographic equipment and supplies	0.00%	0.00%	0.18%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	36.41%	0.00%	0.00%	0.00%
Musical instruments & Music stores	0.00%	0.00%	3.25%	31.64%	0.00%	0.00%	0.10%	0.01%	0.02%	0.42%	0.00%	0.40%	0.00%	0.00%
Stationery and books	0.00%	0.00%	1.14%	2.39%	0.00%	0.00%	0.39%	0.20%	0.12%	56.51%	0.00%	0.13%	0.00%	0.00%
Jewelry	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.55%	58.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Office, store, and school supplies	0.00%	0.00%	0.00%	0.01%	3.14%	0.00%	4.80%	0.08%	0.00%	0.22%	0.00%	0.05%	0.00%	0.01%
Radio, television, & other electronics stores	6.44%	0.93%	52.46%	25.96%	0.73%	0.00%	18.37%	0.00%	0.02%	0.06%	4.18%	7.39%	0.11%	0.00%
Other specialties	3.23%	2.16%	8.66%	7.04%	1.58%	0.00%	32.82%	2.80%	0.61%	3.08%	0.00%	33.45%	65.51%	1.37%
Specialty stores group	9.67%	3.13%	66.48%	67.35%	5.69%	0.00%	56.50%	7.17%	60.76%	61.48%	40.63%	44.05%	68.11%	49.23%
All food stores	0.00%	2.37%	0.01%	1.34%	0.00%	0.00%	0.00%	4.31%	0.41%	4.75%	8.20%	1.70%	0.00%	0.06%
Food stores group	0.00%	2.37%	0.01%	1.34%	0.00%	0.00%	0.00%	4.31%	0.41%	4.75%	8.20%	1.70%	0.00%	0.06%
Household and home furnishings	2.38%	7.02%	0.95%	0.39%	69.08%	59.25%	0.08%	33.96%	0.26%	0.13%	0.00%	0.45%	0.00%	0.05%
Household appliance dealers	35.77%	3.12%	1.47%	0.60%	0.16%	0.23%	0.08%	0.25%	0.00%	0.00%	0.05%	0.00%	0.00%	0.02%
Household group	38.15%	10.14%	2.42%	0.99%	69.24%	59.48%	0.16%	34.21%	0.26%	0.13%	0.05%	0.45%	0.00%	0.07%
Lumber and other building materials	0.56%	0.03%	0.00%	0.00%	0.07%	11.15%	0.01%	0.49%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Hardware stores and Home Centers	10.23%	9.78%	0.01%	0.01%	4.35%	21.21%	0.00%	3.47%	0.00%	0.00%	0.00%	0.06%	0.00%	0.18%
Farm & garden supply stores	0.00%	0.00%	0.00%	0.00%	0.30%	0.00%	0.00%	0.21%	0.00%	0.00%	0.00%	0.01%	0.00%	0.11%
Building material group	10.79%	9.81%	0.01%	0.01%	4.73%	32.36%	0.01%	4.16%	0.00%	0.00%	0.00%	0.07%	0.00%	0.29%
Motor vehicle dealers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.75%
Automotive supplies and parts	0.12%	0.00%	0.11%	3.12%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
Service stations	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.15%	0.03%	0.01%	0.00%	0.17%
Automotive group	0.12%	0.00%	0.11%	3.12%	0.00%	0.01%	0.00%	0.00%	0.00%	0.15%	0.03%	0.01%	0.00%	25.93%
Packaged liquor stores	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%	0.05%	0.04%	0.00%	0.03%	0.00%	0.00%
Second-hand merchandise	0.31%	1.29%	0.14%	0.56%	1.85%	0.14%	0.07%	1.32%	0.96%	1.99%	0.04%	0.20%	0.02%	0.19%
Fuel and ice dealers	0.37%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mobile homes, trailers, and campers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
All other retail stores group	0.68%	1.29%	0.14%	0.56%	1.85%	0.14%	0.07%	1.43%	1.01%	2.03%	0.04%	0.23%	0.02%	0.19%
All Retail Stores Totals	95.54%	93.39%	94.68%	94.56%	93.55%	95.51%	63.73%	86.70%	91.38%	90.54%	98.40%	93.13%	97.60%	93.88%
Non-Store Outlets	4.46%	6.61%	5.32%	5.44%	6.45%	4.49%	36.27%	13.30%	8.62%	9.46%	1.60%	6.87%	2.40%	6.12%
Total All Outlets	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: US Census Bureau – Economic Census 2002: Retail Trade Subject Series, Product Lines by Kind of Business; and CBRE Consulting.

(1) Exhibit details the sales of product line items by the retail store at which the sales are made.
(2) Figures represent California statewide product line sales by kind of business.
(3) Refer to Exhibit B-6 for description of product line item codes 20100 through 29810.
(4) Retail businesses classification and categorization per EC.

Exhibit B-5: Economic Census Retail Trade Subject Series [1]
Illustrative [2] Product Line [3] Sales by Kind of Business [4] (continued)

STATEWIDE CALIFORNIA	20580	20680	20700	20720	20730	20740	20800	20850	29810	20600-20670, 20690	Retail Total
Clothing & accessories stores	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.50%	2.58%	0.00%	4.84%
Shoes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.22%	0.00%	0.81%
Apparel stores group	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.52%	2.80%	0.00%	**5.65%**
General merchandise stores	0.00%	0.00%	0.00%	0.03%	9.08%	4.28%	22.59%	10.93%	26.87%	6.55%	13.47%
Drug stores	0.00%	0.00%	0.00%	0.00%	3.38%	0.03%	1.12%	4.11%	29.67%	0.36%	5.05%
General merchandise group	0.00%	0.00%	0.00%	0.03%	12.46%	4.31%	23.72%	15.04%	56.54%	6.90%	**18.52%**
Gifts, art goods, and novelties	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	11.98%	2.30%	0.01%	0.73%
Sporting goods	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	1.01%	0.00%	0.93%
Florists	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.21%	0.17%	2.00%	0.17%
Photographic equipment and supplies	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.11%
Musical instruments & Music stores	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	0.52%	0.00%	0.53%
Stationery and books	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.74%	0.54%	0.00%	0.60%
Jewelry	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	1.20%	0.00%	0.81%
Office, store, and school supplies	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	14.72%	1.62%	0.00%	0.82%
Radio, television, & other electronics stores	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	6.82%	2.72%	0.06%	2.06%
Other specialties	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.64%	12.56%	7.39%	0.21%	3.60%
Specialty stores group	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	50.67%	48.27%	17.48%	2.29%	**10.37%**
All food stores	0.00%	0.00%	0.00%	0.65%	4.60%	0.06%	22.06%	4.25%	3.17%	2.38%	16.77%
Food stores group	0.00%	0.00%	0.00%	0.65%	4.60%	0.06%	22.06%	4.25%	3.17%	2.38%	**16.77%**
Household and home furnishings	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.88%	1.90%	0.24%	3.24%
Household appliance dealers	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.15%	0.28%	0.17%	0.47%
Household group	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.04%	2.18%	0.42%	**3.71%**
Lumber and other building materials	0.00%	0.00%	0.00%	0.00%	0.11%	0.01%	0.01%	0.04%	1.61%	33.78%	2.80%
Hardware stores and Home Centers	0.00%	0.00%	0.00%	0.00%	0.81%	0.08%	0.58%	0.03%	1.05%	44.33%	4.12%
Farm & garden supply stores	0.26%	0.00%	0.00%	0.00%	0.11%	0.01%	1.72%	0.19%	1.20%	7.51%	0.64%
Building material group	0.26%	0.00%	0.00%	0.00%	1.03%	0.10%	2.31%	0.27%	3.85%	85.62%	**7.56%**
Motor vehicle dealers	99.71%	1.12%	99.51%	0.10%	30.44%	29.71%	0.00%	1.63%	4.37%	0.04%	23.15%
Automotive supplies and parts	0.00%	0.00%	0.01%	0.03%	23.53%	56.66%	0.00%	0.01%	0.56%	0.22%	1.83%
Service stations	0.00%	0.00%	0.00%	98.71%	22.33%	2.80%	0.40%	0.24%	5.54%	0.05%	6.61%
Automotive group	99.71%	1.12%	99.52%	98.85%	76.30%	89.17%	0.40%	1.89%	10.47%	0.32%	**31.59%**
Packaged liquor stores	0.00%	0.00%	0.00%	0.00%	0.41%	0.00%	0.13%	0.24%	0.26%	0.00%	0.66%
Second-hand merchandise	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.46%	0.18%	0.01%	0.31%
Fuel and ice dealers	0.00%	0.00%	0.00%	0.46%	5.18%	0.00%	0.00%	0.00%	0.19%	0.02%	0.04%
Mobile homes, trailers, and campers	0.03%	98.88%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.00%	0.13%
All other retail stores group	0.03%	98.88%	0.00%	0.46%	5.59%	0.00%	0.13%	2.70%	0.71%	0.03%	**1.14%**
All Retail Stores Totals	100.00%	100.00%	99.52%	100.00%	99.98%	93.66%	99.29%	73.95%	97.21%	97.96%	**95.30%**
Non-Store Outlets	0.00%	0.00%	0.48%	0.00%	0.02%	6.34%	0.71%	26.05%	2.79%	2.04%	4.70%
Total All Outlets	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	**100.00%**

Source: US Census Bureau – Economic Census 2002: Retail Trade Subject Series, Product Lines by Kind of Business; and CBRE Consulting.

(1) Exhibit details the sales of product line items by the retail store at which the sales are made.
(2) Figures represent California statewide product line sales by kind of business.
(3) Refer to Exhibit B-6 for description of product line item codes 20100 through 29810.
(4) Retail businesses classification and categorization per EC.

Exhibit B-6: CES and EC Bridge (1)
Allocation of CES Category Expenditures to the EC Product Line Items

Code	Economic Census Product Line Description	Consumer Expenditure Survey Category Description	Share of CES categories' Allocation (2) CA	Bay Ar.	So. CA	No. CA	Cen. CA
20100	Groceries & other foods for human consumption off the premises	Food - Food at Home	96.0%	96.0%	96.0%	96.0%	96.0%
20120	Meals, unpack snacks, sandwiches, etc for immediate consumption	Food - Food at Home	4.0%	4.0%	4.0%	4.0%	4.0%
20130	Alcoholic drinks served at the establishment	Food - Alcoholic Beverages	0.4%	0.5%	0.5%	0.5%	0.5%
20140	Packaged liquor, wine, & beer	Food - Alcoholic Beverages	99.6%	99.5%	99.5%	99.5%	99.5%
20150	Cigars, cigarettes & smokers' accessories, excl. sales from vending	Tobacco Products & Smoking Supplies	100.0%	100.0%	100.0%	100.0%	100.0%
20160	Drugs, health aids, beauty aids, including cosmetics	Health Care - Drugs	100.0%	100.0%	100.0%	100.0%	100.0%
		Health Care - Medical Supplies	100.0%	100.0%	100.0%	100.0%	100.0%
		Personal Care Products & Services	100.0%	100.0%	100.0%	100.0%	100.0%
20180	Soaps, detergents, & household cleaners	Housekeeping Supplies - Laundry & Cleaning	52.7%	53.7%	51.3%	52.9%	51.4%
20190	Paper & related prod, incl paper towels, toilet tissue, wraps,etc	Housekeeping Supplies - Laundry & Cleaning	47.3%	46.3%	48.7%	47.1%	48.6%
20200	Men's wear	Apparel - Men 16 and over	100.0%	100.0%	100.0%	100.0%	100.0%
20220	Women's, juniors', & misses' wear	Apparel - Women 16 and over	100.0%	100.0%	100.0%	100.0%	100.0%
20240	Children's wear, incl boys, girls, & infants & toddlers	Apparel - Children under 2	100.0%	100.0%	100.0%	100.0%	100.0%
		Apparel - Boys 2 to 15	100.0%	100.0%	100.0%	100.0%	100.0%
		Apparel - Girls 2 to 15	100.0%	100.0%	100.0%	100.0%	100.0%
20260	Footwear, including accessories	Apparel - Footwear	100.0%	100.0%	100.0%	100.0%	100.0%
		Apparel - Other Apparel Products and Services	49.5%	45.5%	50.3%	52.1%	50.2%
20270	Sewing, knitting materials & supplies, needlework goods	Apparel - Other Apparel Products and Services	6.0%	5.9%	5.3%	2.7%	2.5%
20280	Curtains, draperies, blinds, slipcovers, bed & table coverings	Household Furnishing - Household Textiles	100.0%	100.0%	100.0%	100.0%	100.0%
20300	Major household appliances	Household Furnishing - Major Appliances	100.0%	100.0%	100.0%	100.0%	100.0%
20310	Small electric appliances & personal care appliances	Household Furnishing - Small Appliances	100.0%	100.0%	100.0%	100.0%	100.0%
20320	TVs, video recorders, video cameras, video tapes, DVDs	Entertainment - Television, Radios & Sound Equipments	49.8%	48.2%	50.7%	48.4%	49.5%
20330	Audio equip, musical instr, radios, stereos, CDs, records	Entertainment - Television, Radios & Sound Equipments	50.2%	51.8%	49.3%	51.6%	50.5%
20340	Furniture, sleep equipment & outdoor/patio furniture	Household Furnishing - Furniture	100.0%	100.0%	100.0%	100.0%	100.0%
20360	Flooring & floor coverings	Household Furnishing - Floor Covering	100.0%	100.0%	100.0%	100.0%	100.0%
20370	Computer hardware, software, & supplies	Entertainment - Other Entertainment Supplies, Equipment & Services	51.7%	68.5%	61.8%	43.2%	31.4%
		Miscellaneous	28.9%	37.2%	30.4%	25.3%	14.2%
20380	Kitchenware & home furnishings	Household Furnishing - Miscellaneous Household equipment	71.0%	76.9%	70.4%	62.2%	71.5%
20400	Jewelry, incl watches, watch attach, novelty jewelry	Apparel - Other Apparel Products and Services	44.5%	48.6%	44.4%	45.2%	47.3%
20420	Books	Reading	100.0%	100.0%	100.0%	100.0%	100.0%
20440	Photographic equipment & supplies	Entertainment - Other Entertainment Supplies, Equipment & Services	7.9%	6.8%	7.4%	7.3%	12.2%
20460	Toys, hobby goods, & games	Entertainment - Pets, Toys, and Playground Equipment	37.1%	39.9%	39.3%	31.7%	37.0%
20490	Optical goods, incl eyeglasses, contact lenses, sunglasses	Miscellaneous	3.5%	3.1%	3.3%	4.3%	6.0%
20500	Sporting goods	Entertainment - Pets, Toys, and Playground Equipment	42.2%	40.5%	40.5%	46.5%	37.5%
		Entertainment - Other Entertainment Supplies, Equipment & Services	40.4%	24.7%	30.8%	49.5%	56.4%
20580	RVs, incl camping trailers travel trailers, truck campers	Transportation - Vehicle Purchases (Net Outlay)	2.8%	1.7%	2.3%	5.6%	7.1%
20600	Hardware, tools, & plumbing & electrical supplies						
20620	Lawn, garden, & farm equipment & supplies						
20640	Dimensional lumber & oth bldg/structural materials & supplies	BM Group (3)	98.4%	98.7%	98.6%	98.0%	98.4%
20670	Paint & sundries	Household Furnishing - Miscellaneous Household Equipment	29.0%	23.1%	29.6%	37.8%	28.5%
20690	Wallpaper & other flexible wallcoverings						
20680	Manufactured (mobile) homes	BM Group *	1.6%	1.3%	1.4%	2.0%	1.6%
20700	Automobiles, cars, vans, trucks, motorcycles, motor scooters	Transportation - Vehicle Purchases (Net Outlay)	97.2%	98.3%	97.7%	94.4%	92.9%
20720	Automotive fuels	Transportation - Gasoline & Motor Oil	100.0%	100.0%	100.0%	100.0%	100.0%
20730	Automotive lubricants, including oil, greases	Transportation - Other Vehicle Expenses - Maintenance & Repairs	5.1%	4.7%	4.7%	4.0%	4.5%
20740	Automotive tires, tubes, batteries, parts, accessories	Transportation - Other Vehicle Expenses - Maintenance & Repairs	94.9%	95.3%	95.3%	96.0%	95.5%
20800	Pets, pet foods, & pet supplies	Entertainment - Pets, Toys, and Playground Equipment	20.7%	19.6%	20.2%	21.8%	25.5%
20850	Other merchandise (Stationery, office products, luggage, machine parts, etc.)	Miscellaneous	56.5%	48.0%	58.1%	56.6%	52.3%
		Postage and Stationery	100.0%	100.0%	100.0%	100.0%	100.0%
29810	All other merchandise	Miscellaneous	11.1%	11.7%	8.2%	13.8%	27.5%

Sources: US Bureau of Census, Economic Census 2002 "Retail Trade Subject Series: Product Lines by Kind of Business, 2002"; US Department of Commerce, Bureau of Labor Statistics, Consumer Expenditure Survey - 2003-04; and CBRE Consulting.

(1) CBRE Consulting established which CES expenditure categories comprise spending on what EC products items to establish a bridge between the two datasets.

(2) The CES category allocation into product items will vary for different 'product line control areas' based on consumer propensity for certain kinds of goods in these areas, for instance, Bay Area consumers spend less on apparel accessories but more on computers than the rest of the state, while Northern California consumers spend more on sporting goods than other regions.

(3) BM (Building Materials) Group for consumer expenditure includes all of 'Other household products' under housekeeping supplies; all of 'Other household expenses' under household operations; and three-fourths of expenditures under 'Maintenance, repair, insurance and other expenses' under household operation.

Exhibit B-7: Aggregated Product Line Sales by Kind of Retailers (1)
Per Household Estimates at a Hypothetical Average Household Retail Expenditure of $27,600

BOE Retail Category (3)	Product Line Items Aggregated by Product Type - By Amount (2)								Total
	BM	AS	HF	AD	GS	FS	GM & OR	ED	
Apparel Stores (AS)	0	1,308	56	0	0	0	57	0	1,420
General Merchandise Stores (GM)	165	854	622	52	1	732	1,970	0	4,396
Food Stores (FS)	57	3	39	3	14	3,605	446	0	4,168
Eating and Drinking Places (ED)	0	0	0	0	0	0	0	3,416	3,416
Home Furnishings & Appliance Stores (HF)	10	1	1,070	0	0	2	32	0	1,116
Building Materials' Stores (BM)	2,052	1	167	2	0	0	16	0	2,238
Auto Dealers & Parts Stores (AD)	6	3	0	4,908	3	0	366	0	5,287
Gasoline Stations (GS)	1	0	0	42	2,123	158	72	0	2,396
Other Retail (OR)	56	235	170	3	10	200	2,445	0	3,120
TOTAL	**2,347**	**2,405**	**2,125**	**5,010**	**2,151**	**4,699**	**5,403**	**3,416**	**27,555**

BOE Retail Category (3)	Product Line Items Aggregated by Product Type - By Percent (2)								Total
	BM	AS	HF	AD	GS	FS	GM & OR	ED	
Apparel Stores (AS)	0.0%	52.5%	2.4%	0.0%	0.0%	0.0%	0.9%	0.0%	4.9%
General Merchandise Stores (GM)	6.9%	34.3%	26.7%	1.0%	0.0%	15.2%	32.2%	0.0%	15.2%
Food Stores (FS)	2.4%	0.1%	1.7%	0.1%	0.7%	74.8%	7.3%	0.0%	14.5%
Eating and Drinking Places (ED)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	11.8%
Home Furnishings & Appliance Stores (HF)	0.4%	0.1%	45.9%	0.0%	0.0%	0.0%	0.5%	0.0%	3.9%
Building Materials' Stores (BM)	85.6%	0.0%	7.2%	0.0%	0.0%	0.0%	0.3%	0.0%	7.8%
Auto Dealers & Parts Stores (AD)	0.3%	0.1%	0.0%	96.3%	0.1%	0.0%	6.0%	0.0%	18.3%
Gasoline Stations (GS)	0.1%	0.0%	0.0%	0.8%	98.7%	3.3%	1.2%	0.0%	8.3%
Other Retail (OR)	2.3%	9.5%	7.3%	0.1%	0.5%	4.2%	39.9%	0.0%	10.8%
TOTAL (4)	**98.0%**	**96.6%**	**91.1%**	**98.3%**	**100.0%**	**97.4%**	**88.2%**	**100.0%**	**95.6%**

Sources: US Bureau of Census, Economic Census 2002 "Retail Trade Subject Series: Kind of Business by Product Lines, 2002"; US Department of Commerce, Bureau of Labor Statistics, Consumer Expenditure Survey - 2004-05; and CBRE Consulting.

(1) Kind of Retailer categorized to facilitate use of BOE/municipal tax consultant data.
(2) Apparel Store product line (AS) includes codes 20200, 20220, 20240, 20260, 20270 and 20400; Grocery product line includes 20100, 20120, 20130, and 20140;Home Furnishings/Appliance product line (HF) includes 20280, 20300, 20310, 20340, 20360, and 20380; Building materials product line includes 20600, 20620, 20640, 20670, and 20690; Automobile product line includes 20700, 20730 and 20740; Gasoline station product line includes 20720; General merchandise and other retail product codes includes rest of the codes.
(3) Auto Dealers and Parts stores categorized by 4-digit NAICS codes 4411, 4412, and 4413; Home Furnishings and Appliance stores by 6-digit NAICS codes 442110, 442210, 442291, 442299, and 443111; Building Materials stores by 3-digit NAICS code 444; Grocery and Convenience stores by 3-digit NAICS code 445; Gasoline Stations by 3-digit NAICS code 447; Apparel stores by 3-digit NAICS code 448; General Merchandise stores by 3-digit NAICS code 452 and 5-digit 44611; Non-store retailers are categorized in 3-digit NAICS code 454; and Specialty and Other Retail stores include the rest of the NAICS codes between 3-digit 441 and 454, which is the range of businesses classified as Retail by the Economic Census.
(4) The percentages do not total to 100% due to non-store sales' (electronic mail-order shopping, vending machine operators, and direct selling establishments) component.

APPENDIX C: BENCHMARK CALCULATION OF HOUSEHOLDS, CANDLESTICK POINT MARKET AREA

Appendix C-1
Benchmark Calculation of Households
Candlestick Point Market Area
San Francisco's Portion

	Claritas Data (1)		Ratio of		
	San Francisco County	San Francisco's Portion of the Market Area	San Francisco's Portion to Entire County	San Francisco (2)	San Francisco's Portion of the Market Area
Year	[A]	[B]	[C = B / A]	[D]	[E = D * C]
2000	**329,700**	**76,414**	23.2%	--	--
2005	331,306	80,301	24.2%	**341,478** (3)	82,767
2007	331,950	81,911	24.7%	344,038	84,894
2009	**332,596**	**83,553**	25.1%	346,618	87,076
2014	**339,598**	**88,341**	26.0%	353,152	91,867
2030	--	--	--	**374,900** (3)	97,524

Sources: Claritas Inc., 2009; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting, Inc.

(1) Claritas data interpolated from 2000 data, 2009 estimates, and 2014 projections. Base figures bolded.
(2) San Francisco Urban Water Management Plan data interpolated from 2005 and 2030 estimates and projections. Base figures bolded.
(3) San Francisco's portion of the market area 2030 household forecast is based on the San Francisco Urban Water Management Plan household forecast of 403,300 for San Francisco in 2030. The overall annual growth rate from 2005 to 2030 is 0.67 percent. However, Treasure Island, Park Merced, and Hunters Point / Candlestick Point plan to have extraordinary growth. Subtracting out that growth (28,400 households), the average annual growth rate for San Francisco is 0.37 percent. This 2030 forecast uses the lower growth rate to determine the natural growth in households.

Appendix C-2
Benchmark Calculation of Households
Candlestick Point Market Area
City of South San Francisco's Portion

	Claritas Data (1)			ABAG Data (2)	
	City of S. San Francisco	City of S. San Francisco's Portion of the Market Area	Ratio of S. San Francisco's Portion to Entire City	City of S. San Francisco	S. San Francisco's Portion of the Market Area
Year	[A]	[B]	[C = B / A]	D	[E = D * C]
2000	**19,671**	**6,139**	31.2%	**19,677**	6,141
2005	19,972	6,083	30.5%	**20,130**	6,131
2007	20,094	6,060	30.2%	20,431	6,162
2009	**20,216**	**6,307**	31.2%	20,737	6,470
2014	**20,854**	**6,500**	31.2%	21,522	6,708
2030	--	--	--	**24,240**	7,555

Sources: Claritas Inc., 2009; Association of Bay Area Governments (ABAG), "Projections 2007"; and CBRE Consulting, Inc.

(1) Claritas data interpolated from 2000 data, 2009 estimates, and 2014 projections. Base figures bolded.
(2) ABAG data interpolated from 2000 data, 2005 estimates, and 2030 projections. Base figures bolded.

Appendix C-3
Benchmark Calculation of Households
Candlestick Point Market Area
City of Daly City's Portion

	Claritas Data (1)			ABAG Data (2)	
	City of Daly City	City of Daly City Portion of the Market Area	Ratio of Daly City Portion to Entire City	City of Daly City	Daly City's Portion of the Market Area
Year	[A]	[B]	[C = B / A]	D	[E = D * C]
2000	**30,771**	**1,501**	4.9%	**30,777**	1,501
2005	30,208	1,487	4.9%	**31,210**	1,537
2007	29,986	1,482	4.9%	31,571	1,560
2009	**29,765**	**1,524**	5.1%	31,937	1,635
2014	**29,779**	**1,542**	5.2%	32,869	1,702
2030	--	--	--	**36,040**	1,866

Sources: Claritas Inc., 2009; Association of Bay Area Governments (ABAG), "Projections 2007"; and CBRE Consulting, Inc.

(1) Claritas data interpolated from 2000 data, 2009 estimates, and 2014 projections. Base figures bolded.
(2) ABAG data interpolated from 2000 data, 2005 estimates, and 2030 projections. Base figures bolded.

Appendix C-4
Benchmark Calculation of Households
Candlestick Point Market Area
City of Brisbane's Portion

	Claritas Data (1)			ABAG Data (2)	
	City of Brisbane	City of Brisbane's Portion of the Market Area	Ratio of Brisbane's Portion to Entire City	City of Brisbane	Brisbane's Portion of the Market Area
Year	[A]	[B]	[C = B / A]	D	[E = D * C]
2000	**1,620**	**1,456**	89.9%	**1,620**	1,456
2005	1,648	1,443	87.5%	**1,690**	1,479
2007	1,660	1,437	86.6%	1,740	1,507
2009	**1,671**	**1,432**	85.7%	1,792	1,536
2014	**1,736**	**1,469**	84.6%	1,929	1,632
2030	--	--	--	**2,440**	2,065

Sources: Claritas Inc., 2009; Association of Bay Area Governments (ABAG), "Projections 2007"; and CBRE Consulting, Inc.

(1) Claritas data interpolated from 2000 data, 2009 estimates, and 2014 projections. Base figures bolded.
(2) ABAG data interpolated from 2000 data, 2005 estimates, and 2030 projections. Base figures bolded.

APPENDIX D: BENCHMARK CALCULATION OF HOUSEHOLDS, HUNTERS POINT SHIPYARD PHASE II MARKET AREA

Appendix D-1
Benchmark Calculation of Households
Hunters Point Shipyard Phase II Market Area
City of San Francisco's Portion

	Claritas Data (1)		Ratio of		
	San Francisco County	San Francisco's Portion of the Market Area	San Francisco's Portion to Entire County	San Francisco (2)	San Francisco's Portion of the Market Area
Year	[A]	[B]	[C = B / A]	[D]	[E = D * C]
2000	**329,700**	**22,069**	6.7%	--	--
2005	331,306	22,025	6.6%	**341,478** (3)	22,701
2007	331,950	22,008	6.6%	344,038	22,809
2009	**332,596**	**21,990**	6.6%	346,618	22,917
2014	**339,598**	**22,366**	6.6%	353,152	23,259
2030	--	--	--	**374,900** (3)	24,691

Sources: Claritas Inc., 2009; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting, Inc.

(1) Claritas data interpolated from 2000 data, 2009 estimates, and 2014 projections. Base figures bolded.

(2) San Francisco Urban Water Management Plan data interpolated from 2005 and 2030 estimates and projections. Base figures bolded.

(3) San Francisco's portion of the market area 2030 household forecast is based on the San Francisco Urban Water Management Plan household forecast of 403,300 for San Francisco in 2030. The overall annual growth rate from 2005 to 2030 is 0.67 percent. However, Treasure Island, Park Merced, and Hunters Point / Candlestick Point plan to have extraordinary growth. Subtracting out that growth (28,400 households), the average annual growth rate for San Francisco is 0.37 percent. This 2030 forecast uses the lower growth rate to determine the natural growth in households.

Appendix D-2
Benchmark Calculation of Households
Hunters Point Shipyard Phase II Market Area
City of Daly City's Portion

	Claritas Data (1)			ABAG Data (2)	
	City of Daly City	City of Daly City's Portion of the Market Area	Ratio of Daly City's Portion to Entire City	City of Daly City	Daly City's Portion of the Market Area
Year	[A]	[B]	[C = B / A]	D	[E = D * C]
2000	**30,771**	**147**	0.5%	**30,777**	147
2005	30,208	149	0.5%	**31,210**	154
2007	29,986	149	0.5%	31,571	157
2009	**29,765**	**150**	0.5%	31,937	161
2014	**29,779**	**152**	0.5%	32,869	168
2030	--	--	--	**36,040**	184

Sources: Claritas Inc., 2009; Association of Bay Area Governments (ABAG), "Projections 2007"; and CBRE Consulting, Inc.

(1) Claritas data interpolated from 2000 data, 2009 estimates, and 2014 projections. Base figures bolded.
(2) ABAG data interpolated from 2000 data, 2005 estimates, and 2030 projections. Base figures bolded.

APPENDIX E: TRANSLATION OF US ECONOMIC CENSUS RETAIL SALES CATEGORIES TO BOE CATEGORIES, TYPES OF BUSINESSES BY BROAD PRODUCT LINE

Appendix E
Translation of U.S. Economic Census Retail Sales Categories to BOE Categories
Types of Businesses by Broad Product Line
General Merchandise Stores
2002 Dollars ($000's) (1)

US Census Sales Category	Retail Sales (in 000's)	BOE Category	Percentage of Total Sales	BOE Category Percentage
Children's wear, including boys' (sizes 2 to 7 & 8 to 20), girls' (sizes 4 to 6x & 7 to 14), & infants' & toddlers' clothing & accessories	$19,496,298	Apparel	4.45%	
Footwear, including accessories	$10,205,733	Apparel	2.33%	24.9%
Jewelry, including watches, watch attachments, novelty jewelry etc	$7,818,804	Apparel	1.78%	
Men's wear	$24,881,238	Apparel	5.67%	
Women's, juniors', & misses' wear	$46,770,091	Apparel	10.67%	
Automotive fuels	$130,831	Auto Dealers and Auto Supplies	0.03%	
Automotive lubricants, I ncluding oil, greases, etc	$1,109,606	Auto Dealers and Auto Supplies	0.25%	1.6%
Automotive tires, tubes, batteries, parts accessories	$5,834,640	Auto Dealers and Auto Supplies	1.33%	
Dimensional lumber & other building/structural materials & supplies, including heating stoves & prefabricated fireplaces, spas, hot tubs & saunas, stock kitchen & bathroom cabinets to be installed	$84,712	Building Materials	0.02%	
Hardware, tools, & plumbing & electrical supplies, including ceiling fans & light fixtures	$8,996,682	Building Materials	2.05%	4.6%

Appendix E
Translation of U.S. Economic Census Retail Sales Categories to BOE Categories
Types of Businesses by Broad Product Line
General Merchandise Stores
2002 Dollars ($000's) (1)

US Census Sales Category	Retail Sales (in 000's)	BOE Category	Percentage of Total Sales	BOE Category Percentage
Lawn, garden, & farm equipment & supplies, cut flowers; plants & shrubs; fertilizers; animal feed, other than for pets, etc	$9,423,200	Building Materials	2.15%	
Paint and Sundries	$1,859,594	Building Materials	0.42%	
Wallpaper & other flexible wallcoverings	$186	Building Materials	0.00%	
Meals, unpackaged snacks, sandwiches, ice cream & yogurt, baker items & non-alcoholic beverages generally served for immediate consumption.		Eating & Drinking Places	0.00%	
Groceries & other food items for human consumption off the premises, including bottles, canned, or packaged soft drinks; candy; gum; packaged snacks; etc.	$80,007,499	Food Stores	18.25%	19.0%
Packaged Liquor, wine & beer	$3,136,009	Food Stores	0.72%	
Drugs, health aids, beauty aids, including cosmetics	$53,481,662	General Merchandise	12.20%	
Paper & related products, including paper towels, toilet tissue, wraps, bags, foils, etc.	$9,517,305	General Merchandise	2.17%	17.1%
Soaps, detergents and household cleaners	$11,921,033	General Merchandise	2.72%	
Curtains, draperies, blinds, slipcovers, bed & table coverings	$12,402,090	Home Furnishings & Appliances	2.83%	
Flooring and floor coverings	$845,853	Home Furnishings & Appliances	0.19%	
Furniture, sleep equipment & outdoor/patio furniture	$8,035,151	Home Furnishings & Appliances	1.83%	
Kitchen & home furn, incl cookware, cooking access, dinnerware, glassware, giftware, decorative access & lighting, clocks, mirrors, closet & bathroom access, outdoor charcoal grills, planters, etc	$14,403,319	Home Furnishings & Appliances	3.29%	
Major household appl incl vacuum cleaners, sewing machines, refrigerators, freezers, dehumidifiers, room air-conditioners, dishwashers, ranges, microwaves, washers & dryers, outdoor gas grills, etc.	$10,641,300	Home Furnishings & Appliances	2.43%	14.5%

Appendix E
Translation of U.S. Economic Census Retail Sales Categories to BOE Categories
Types of Businesses by Broad Product Line
General Merchandise Stores
2002 Dollars ($000's) (1)

US Census Sales Category	Retail Sales (in 000's)	BOE Category	Percentage of Total Sales	BOE Category Percentage
Small electric appliances, including mixers, blenders, can openers, toasters, coffee makers, fry pans & personal care appliances, such as hair dryers, curling irons, shavers, etc.	$5,725,410	Home Furnishings & Appliances	1.31%	
Televisions, video records, video cameras, video tapes, DVDs, etc including electronic game/dvd combination devices, parts and accessories	$11,412,022	Home Furnishings & Appliances	2.60%	
All other merchandise	$17,408,161	Other Retail	3.97%	
All other merchandise	$3,882,957	Other Retail	0.89%	
Audio equipment, musical instruments, radios, stereos, compact discs, records, tapes, audio tape books, sheet music, accessories	$9,815,273	Other Retail	2.24%	
Books	$2,613,668	Other Retail	0.60%	
Cigars, cigarettes, tobacco, & smoker's accessories, excluding sales from vending machines operated by others	$7,107,737	Other Retail	1.62%	
Computer hardware, software, & supplies, including computer game software	$3,856,557	Other Retail	0.88%	
Household fuels, including oil, LP gas, wood, coal	$66,316	Other Retail	0.02%	
Optical goods, including eyeglasses, contact lenses, sunglasses, etc	$1,816,227	Other Retail	0.41%	18.3%
Pets, pet foods & pet supplies	$6,067,104	Other Retail	1.38%	
Photographic equipment & supplies	$2,323,042	Other Retail	0.53%	
Sewing, knitting materials & supplies, needlework goods, including fabrics, patters, sewing supplies, notions, yarns, laces, trimmings, needlework kits, etc.	$2,253,502	Other Retail	0.51%	

Appendix E
Translation of U.S. Economic Census Retail Sales Categories to BOE Categories
Types of Businesses by Broad Product Line
General Merchandise Stores
2002 Dollars ($000's) (1)

US Census Sales Category	Retail Sales (in 000's)	BOE Category	Percentage of Total Sales	BOE Category Percentage
Sporting goods, including saddlery, boats, personal watercraft, snowmobiles, al-terrain vehicles (ATVs), golf cars, & other motorizes sport vehicles, bicycles, parts & accessories, etc	$9,114,181	Other Retail	2.08%	
Toys, hobby goods, & games, including stuffed animals, video & electronic games, electronic game devices & wheel goods, except bicycles	$13,985,515	Other Retail	3.19%	
Total	$438,450,508		100.0%	

Sources: U.S. Census Bureau, "2002 Economic Census, Table 2, Kinds of Business by Broad Product Line for the United States"; State Board of Equalization; CBRE Consulting.

APPENDIX F: TRANSLATION OF CLARITAS RETAIL SALES CATEGORIES TO BOE CATEGORIES, CANDLESTICK POINT MARKET AREA, 2008

Appendix F-1
Translation of Claritas Retail Sales Categories to BOE Categories
San Francisco County
In 2008 Dollars (Millions)

Claritas Sales Category	Claritas Retail Sales 2008 2008 $'s	BOE Category
Motor Vehicle & Parts Dealers		
- Automotive Dealers	$476.60	Motor Vehicles & Parts
- Other Motor Vehicle Dealers	$33.80	
- Automotive Parts, Accessories, & Tire Stores	$59.70	
Furniture & Home Furnishings Stores		
- Furniture Stores	$206.60	Home Furnishings and Appliances
- Home Furnishing Stores	$319.10	
Electronics & Appliance Stores		
- Appliance, Television, and Other Electronics	$325.70	
- Household Appliances Stores	$49.60	
- Radio Television and Other Electronics	$276.00	
- Computer and Software Stores	$107.50	Other Retail Stores
- Camera & Photographic Equipment Stores	$52.70	
Building Material & Garden Equipment & Supply Dealers		
- Building Material & Supply Dealers	$431.80	Building Materials and Farm Implements
- Home Centers	$60.20	
- Paint and Wallpaper Stores	$26.30	
- Hardware Stores	$13.10	
- Other Building Materials Dealers	$332.20	
- Building Materials, Lumberyards	$113.30	
- Lawn and Garden Equipment and Supplies	$18.50	Other Retail Stores
- Outdoor Power Equipment Stores	$1.20	
- Nursery and Garden Centers	$17.30	
Food & Beverage Stores		
- Grocery Stores	$1,678.30	Food Stores
- Supermarkets and Other Grocery Stores	$1,647.10	
- Convenience Stores	$31.10	
- Specialty Food Stores	$212.90	
- Beer, Wine, & Liquor Stores	$141.90	
Health & Personal Care Stores		General Merchandise
- Pharmacies and Drug Stores	$664.40	
- Cosmetics, Beauty Supplies and Perfume Stores	$39.50	Other Retail Stores
- Optical Goods Stores	$21.80	
- Other Health and Personal Care Stores	$53.20	
Gasoline Stations		
- Gasoline Stations with Convenience Stores	$293.30	Service Stations
- Other Gasoline Stations	$184.00	
Clothing & Clothing Accessories Stores		
- Clothing Stores	$1,277.90	Apparel Stores
- Men's Clothing Stores	$52.70	
- Women's Clothing Stores	$347.90	
- Children's and Infants' Clothing Stores	$23.40	
- Family Clothing Stores	$719.80	
- Clothing Accessories Stores	$36.00	
- Other Clothing Stores	$98.10	
- Shoe Stores	$174.10	
- Jewelry, Luggage, & Leather Goods Stores	$325.30	Other Retail Stores
- Jewelry Stores	$287.60	
- Luggage, & Leather Goods Stores	$37.80	
Sporting Goods, Hobby, Book, & Music Stores		
- Sporting Goods, Hobby, & Musical Instruments	$151.30	Other Retail Stores
- Sporting Goods Stores	$69.80	
- Hobby, Toys and Games Stores	$39.90	
- Sew, Needlework, Piece Goods Stores	$21.90	
- Musical Instrument and Supplies Stores	$19.70	
- Book, Periodical, & Music Stores	$204.10	
- Book Stores and News Dealers	$114.80	
- Book Stores	$107.40	
- News Dealers and Newsstands	$7.50	
- Prerecorded Tape, Compact Disc, & Records	$89.20	
General Merchandise Stores		
- Department Stores excluding Leased Dept Stores	$560.10	General Merchandise Stores
- Other General Merchandise Stores	$232.20	
- Warehouse Clubs and Super Stores	$84.70	
- All Other General Merchandise Stores	$147.60	
Miscellaneous Store Retailers		
- Florists	$35.20	Other Retail Stores
- Office Supplies, Stationery, & Gift Stores	$248.50	
- Office Supplies and Stationery Stores	$79.00	
- Gift, Novelty, and Souvenir Stores	$169.50	
- Used Merchandise Stores	$93.20	
- Other Miscellaneous Store Retailers	$269.40	
Non-store Retailers		
- Electronic Shopping and Mail-order Houses	$3,170.20	Other Retail Stores
- Vending Machine Operators	$11.70	
- Direct Selling Establishments	$238.90	
Foodservice & Drinking Places		
- Full-Service Restaurants	$1,797.50	Eating and Drinking Places
- Limited-service Eating Places	$733.60	
- Special Foodservices	$233.10	
- Drinking Places - Alcoholic Beverages	$264.60	
TOTAL RETAIL STORES	$15,342.20	

Summary by BOE Category

BOE Category	In Millions
Apparel Stores	$1,452.0
General Merchandise Stores	$1,456.7
Food Stores	$2,033.1
Eating & Drinking Places	$3,028.8
Home Furnishings and Appliances	$851.4
Building Materials	$431.8
Motor Vehicles & Parts	$570.1
Service Stations	$477.3
Other Retail Stores	$5,041.0
Retail Total	$15,342.2

Sources: Claritas; State of California Board of Equalization; and CBRE Consulting.

Appendix F-2
Translation of Claritas Retail Sales Categories to BOE Categories
San Francisco's Portion of Candlestick Point Market Area
In 2008 Dollars (Millions)

Claritas Sales Category	Claritas Retail Sales 2008 2008 $'s	BOE Category
Motor Vehicle & Parts Dealers		
- Automotive Dealers	$248.80	Motor Vehicles & Parts
- Other Motor Vehicle Dealers	$17.20	
- Automotive Parts, Accessories, & Tire Stores	$35.70	
Furniture & Home Furnishings Stores		
- Furniture Stores	$111.00	Home Furnishings and Appliances
- Home Furnishing Stores	$165.10	
Electronics & Appliance Stores		
- Appliance, Television, and Other Electronics	$158.00	
- Household Appliances Stores	$28.60	
- Radio Television and Other Electronics	$129.50	
- Computer and Software Stores	$54.90	Other Retail Stores
- Camera & Photographic Equipment Stores	$18.70	
Building Material & Garden Equipment & Supply Dealers		
- Building Material & Supply Dealers	$288.60	Building Materials and Farm Implements
- Home Centers	$44.10	
- Paint and Wallpaper Stores	$16.50	
- Hardware Stores	$4.60	
- Other Building Materials Dealers	$223.50	
- Building Materials, Lumberyards	$76.20	
- Lawn and Garden Equipment and Supplies	$7.40	Other Retail Stores
- Outdoor Power Equipment Stores	$0.30	
- Nursery and Garden Centers	$7.20	
Food & Beverage Stores		
- Grocery Stores	$537.30	Food Stores
- Supermarkets and Other Grocery Stores	$528.40	
- Convenience Stores	$8.90	
- Specialty Food Stores	$66.00	
- Beer, Wine, & Liquor Stores	$48.30	
Health & Personal Care Stores		General Merchandise Stores
- Pharmacies and Drug Stores	$195.70	
- Cosmetics, Beauty Supplies and Perfume Stores	$13.10	Other Retail Stores
- Optical Goods Stores	$6.90	
- Other Health and Personal Care Stores	$19.80	
Gasoline Stations		
- Gasoline Stations with Convenience Stores	$157.90	Service Stations
- Other Gasoline Stations	$81.10	
Clothing & Clothing Accessories Stores		
- Clothing Stores	$320.00	Apparel Stores
- Men's Clothing Stores	$21.30	
- Women's Clothing Stores	$104.60	
- Children's and Infants' Clothing Stores	$4.30	
- Family Clothing Stores	$144.60	
- Clothing Accessories Stores	$19.20	
- Other Clothing Stores	$26.00	
- Shoe Stores	$48.00	
- Jewelry, Luggage, & Leather Goods Stores	$105.90	Other Retail Stores
- Jewelry Stores	$93.80	
- Luggage, & Leather Goods Stores	$12.10	
Sporting Goods, Hobby, Book, & Music Stores		
- Sporting Goods, Hobby, & Musical Instruments	$78.50	Other Retail Stores
- Sporting Goods Stores	$42.30	
- Hobby, Toys and Games Stores	$23.60	
- Sew, Needlework, Piece Goods Stores	$5.80	
- Musical Instrument and Supplies Stores	$6.70	
- Book, Periodical, & Music Stores	$44.90	
- Book Stores and News Dealers	$25.90	
- Book Stores	$23.70	
- News Dealers and Newsstands	$2.30	
- Prerecorded Tape, Compact Disc, & Records	$19.00	
General Merchandise Stores		
- Department Stores excluding Leased Dept Stores	$295.60	General Merchandise Stores
- Other General Merchandise Stores	$52.00	
- Warehouse Clubs and Super Stores	$23.70	
- All Other General Merchandise Stores	$28.30	
Miscellaneous Store Retailers		
- Florists	$12.60	Other Retail Stores
- Office Supplies, Stationery, & Gift Stores	$77.10	
- Office Supplies and Stationery Stores	$38.00	
- Gift, Novelty, and Souvenir Stores	$39.10	
- Used Merchandise Stores	$39.30	
- Other Miscellaneous Store Retailers	$104.10	
Non-store Retailers		
- Electronic Shopping and Mail-order Houses	$2,230.70	Other Retail Stores
- Vending Machine Operators	$6.00	
- Direct Selling Establishments	$108.00	
Foodservice & Drinking Places		
- Full-Service Restaurants	$551.60	Eating and Drinking Places
- Limited-service Eating Places	$187.10	
- Special Foodservices	$103.30	
- Drinking Places - Alcoholic Beverages	$72.40	
TOTAL RETAIL STORES	$6,668.60	

Summary by BOE Category

BOE Category	In Millions
Apparel Stores	$368.0
General Merchandise Stores	$543.3
Food Stores	$651.6
Eating & Drinking Places	$914.4
Home Furnishings and Appliances	$434.1
Building Materials	$288.6
Motor Vehicles & Parts	$301.7
Service Stations	$239.0
Other Retail Stores	$2,927.9
Retail Total	$6,668.6

Sources: Claritas; State of California Board of Equalization; and CBRE Consulting.

Appendix F-3
Translation of Claritas Retail Sales Categories to BOE Categories
San Mateo County
In 2008 Dollars (Millions)

Claritas Sales Category	Claritas Retail Sales 2008 2008 $'s	BOE Category
Motor Vehicle & Parts Dealers		
- Automotive Dealers	$2,441.00	Motor Vehicles & Parts
- Other Motor Vehicle Dealers	$56.10	
- Automotive Parts, Accessories, & Tire Stores	$142.70	
Furniture & Home Furnishings Stores		Home Furnishings and Appliances
- Furniture Stores	$106.30	
- Home Furnishing Stores	$98.40	
Electronics & Appliance Stores		
- Appliance, Television, and Other Electronics	$268.10	
- Household Appliances Stores	$55.10	
- Radio Television and Other Electronics	$213.00	
- Computer and Software Stores	$78.80	Other Retail Stores
- Camera & Photographic Equipment Stores	$3.70	
Building Material & Garden Equipment & Supply Dealers		
- Building Material & Supply Dealers	$1,221.70	Building Materials and Farm Implements
- Home Centers	$516.50	
- Paint and Wallpaper Stores	$63.00	
- Hardware Stores	$179.20	
- Other Building Materials Dealers	$463.10	
- Building Materials, Lumberyards	$157.90	
- Lawn and Garden Equipment and Supplies	$43.80	Other Retail Stores
- Outdoor Power Equipment Stores	$2.20	
- Nursery and Garden Centers	$41.60	
Food & Beverage Stores		
- Grocery Stores	$1,659.90	Food Stores
- Supermarkets and Other Grocery Stores	$1,615.80	
- Convenience Stores	$44.10	
- Specialty Food Stores	$71.50	
- Beer, Wine, & Liquor Stores	$82.90	
Health & Personal Care Stores		General Merchandise Stores
- Pharmacies and Drug Stores	$568.60	
- Cosmetics, Beauty Supplies and Perfume Stores	$19.90	Other Retail Stores
- Optical Goods Stores	$20.00	
- Other Health and Personal Care Stores	$54.60	
Gasoline Stations		
- Gasoline Stations with Convenience Stores	$461.10	Service Stations
- Other Gasoline Stations	$163.60	
Clothing & Clothing Accessories Stores		
- Clothing Stores	$438.50	Apparel Stores
- Men's Clothing Stores	$20.00	
- Women's Clothing Stores	$76.20	
- Children's and Infants' Clothing Stores	$21.70	
- Family Clothing Stores	$283.30	
- Clothing Accessories Stores	$8.10	
- Other Clothing Stores	$29.20	
- Shoe Stores	$60.50	
- Jewelry, Luggage, & Leather Goods Stores	$88.30	Other Retail Stores
- Jewelry Stores	$82.50	
- Luggage, & Leather Goods Stores	$5.90	
Sporting Goods, Hobby, Book, & Music Stores		
- Sporting Goods, Hobby, & Musical Instruments	$187.40	Other Retail Stores
- Sporting Goods Stores	$91.10	
- Hobby, Toys and Games Stores	$51.80	
- Sew, Needlework, Piece Goods Stores	$11.70	
- Musical Instrument and Supplies Stores	$32.80	
- Book, Periodical, & Music Stores	$61.70	
- Book Stores and News Dealers	$38.50	
- Book Stores	$37.00	
- News Dealers and Newsstands	$1.50	
- Prerecorded Tape, Compact Disc, & Records	$23.20	
General Merchandise Stores		
- Department Stores excluding Leased Dept Stores	$909.40	General Merchandise Stores
- Other General Merchandise Stores	$340.40	
- Warehouse Clubs and Super Stores	$299.50	
- All Other General Merchandise Stores	$40.90	
Miscellaneous Store Retailers		
- Florists	$20.90	Other Retail Stores
- Office Supplies, Stationery, & Gift Stores	$161.00	
- Office Supplies and Stationery Stores	$80.80	
- Gift, Novelty, and Souvenir Stores	$80.20	
- Used Merchandise Stores	$34.10	
- Other Miscellaneous Store Retailers	$103.90	
Non-store Retailers		
- Electronic Shopping and Mail-order Houses	$506.30	Other Retail Stores
- Vending Machine Operators	$8.80	
- Direct Selling Establishments	$114.20	
Foodservice & Drinking Places		
- Full-Service Restaurants	$670.90	Eating and Drinking Places
- Limited-service Eating Places	$517.40	
- Special Foodservices	$295.10	
- Drinking Places - Alcoholic Beverages	$19.50	
TOTAL RETAIL STORES	$12,101.00	

Summary by BOE Category

BOE Category	In Millions
Apparel Stores	$499.0
General Merchandise Stores	$1,818.4
Food Stores	$1,814.3
Eating & Drinking Places	$1,502.9
Home Furnishings and Appliances	$472.8
Building Materials	$1,221.7
Motor Vehicles & Parts	$2,639.8
Service Stations	$624.7
Other Retail Stores	$1,507.4
Retail Total	$12,101.0

Sources: Claritas; State of California Board of Equalization; and CBRE Consulting.

Appendix F-4
Translation of Claritas Retail Sales Categories to BOE Categories
City of South San Francisco's Portion of Candlestick Point Market Area
In 2008 Dollars (Millions)

Claritas Sales Category	Claritas Retail Sales 2008 2008 $'s	BOE Category
Motor Vehicle & Parts Dealers		
- Automotive Dealers	$40.00	Motor Vehicles & Parts
- Other Motor Vehicle Dealers	$1.20	
- Automotive Parts, Accessories, & Tire Stores	$3.20	
Furniture & Home Furnishings Stores		
- Furniture Stores	$8.70	Home Furnishings and Appliances
- Home Furnishing Stores	$3.80	
Electronics & Appliance Stores		
- Appliance, Television, and Other Electronics	$7.00	
- Household Appliances Stores	$0.90	
- Radio Television and Other Electronics	$6.10	
- Computer and Software Stores	$1.40	Other Retail Stores
- Camera & Photographic Equipment Stores	$0.00	
Building Material & Garden Equipment & Supply Dealers		
- Building Material & Supply Dealers	$18.90	Building Materials and Farm Implements
- Home Centers	$0.00	
- Paint and Wallpaper Stores	$1.00	
- Hardware Stores	$9.00	
- Other Building Materials Dealers	$9.00	
- Building Materials, Lumberyards	$3.10	
- Lawn and Garden Equipment and Supplies	$1.90	Other Retail Stores
- Outdoor Power Equipment Stores	$0.20	
- Nursery and Garden Centers	$1.70	
Food & Beverage Stores		
- Grocery Stores	$17.40	Food Stores
- Supermarkets and Other Grocery Stores	$16.60	
- Convenience Stores	$0.80	
- Specialty Food Stores	$8.10	
- Beer, Wine, & Liquor Stores	$3.70	
Health & Personal Care Stores		General Merchandise Stores
- Pharmacies and Drug Stores	$9.00	
- Cosmetics, Beauty Supplies and Perfume Stores	$0.10	Other Retail Stores
- Optical Goods Stores	$0.00	
- Other Health and Personal Care Stores	$0.20	
Gasoline Stations		
- Gasoline Stations with Convenience Stores	$17.70	Service Stations
- Other Gasoline Stations	$4.10	
Clothing & Clothing Accessories Stores		
- Clothing Stores	$1.80	Apparel Stores
- Men's Clothing Stores	$0.10	
- Women's Clothing Stores	$1.20	
- Children's and Infants' Clothing Stores	$0.00	
- Family Clothing Stores	$0.00	
- Clothing Accessories Stores	$0.00	
- Other Clothing Stores	$0.50	
- Shoe Stores	$0.00	
- Jewelry, Luggage, & Leather Goods Stores	$2.30	Other Retail Stores
- Jewelry Stores	$2.30	
- Luggage, & Leather Goods Stores	$0.00	
Sporting Goods, Hobby, Book, & Music Stores		
- Sporting Goods, Hobby, & Musical Instruments	$4.80	Other Retail Stores
- Sporting Goods Stores	$2.00	
- Hobby, Toys and Games Stores	$0.60	
- Sew, Needlework, Piece Goods Stores	$0.00	
- Musical Instrument and Supplies Stores	$2.20	
- Book, Periodical, & Music Stores	$1.00	
- Book Stores and News Dealers	$0.40	
- Book Stores	$0.10	
- News Dealers and Newsstands	$0.30	
- Prerecorded Tape, Compact Disc, & Records	$0.60	
General Merchandise Stores		
- Department Stores excluding Leased Dept Stores	$9.10	General Merchandise Stores
- Other General Merchandise Stores	$9.50	
- Warehouse Clubs and Super Stores	$7.60	
- All Other General Merchandise Stores	$1.90	
Miscellaneous Store Retailers		
- Florists	$0.30	Other Retail Stores
- Office Supplies, Stationery, & Gift Stores	$5.70	
- Office Supplies and Stationery Stores	$1.70	
- Gift, Novelty, and Souvenir Stores	$4.10	
- Used Merchandise Stores	$0.70	
- Other Miscellaneous Store Retailers	$1.70	
Non-store Retailers		
- Electronic Shopping and Mail-order Houses	$33.10	Other Retail Stores
- Vending Machine Operators	$0.30	
- Direct Selling Establishments	$6.30	
Foodservice & Drinking Places		
- Full-Service Restaurants	$21.40	Eating and Drinking Places
- Limited-service Eating Places	$14.60	
- Special Foodservices	$13.80	
- Drinking Places - Alcoholic Beverages	$0.60	
TOTAL RETAIL STORES	$273.40	

Summary by BOE Category

BOE Category	In Millions
Apparel Stores	$1.8
General Merchandise Stores	$27.6
Food Stores	$29.2
Eating & Drinking Places	$50.4
Home Furnishings and Appliances	$19.5
Building Materials	$18.9
Motor Vehicles & Parts	$44.4
Service Stations	$21.8
Other Retail Stores	$59.8
Retail Total	$273.4

Sources: Claritas; State of California Board of Equalization; and CBRE Consulting.

Appendix F-5
Translation of Claritas Retail Sales Categories to BOE Categories
City of Daly City's Portion of Candlestick Point Market Area
In 2008 Dollars (Millions)

Claritas Sales Category	Claritas Retail Sales 2008 2008 $'s	BOE Category
Motor Vehicle & Parts Dealers		
- Automotive Dealers	$0.50	Motor Vehicles & Parts
- Other Motor Vehicle Dealers	$0.00	
- Automotive Parts, Accessories, & Tire Stores	$0.00	
Furniture & Home Furnishings Stores		
- Furniture Stores	$0.00	Home Furnishings and Appliances
- Home Furnishing Stores	$0.50	
Electronics & Appliance Stores		
- Appliance, Television, and Other Electronics	$0.00	
- Household Appliances Stores	$0.00	
- Radio Television and Other Electronics	$0.00	
- Computer and Software Stores	$0.00	Other Retail Stores
- Camera & Photographic Equipment Stores	$0.00	
Building Material & Garden Equipment & Supply Dealers		
- Building Material & Supply Dealers	$2.80	Building Materials and Farm Implements
- Home Centers	$1.50	
- Paint and Wallpaper Stores	$0.00	
- Hardware Stores	$0.00	
- Other Building Materials Dealers	$1.20	
- Building Materials, Lumberyards	$0.40	
- Lawn and Garden Equipment and Supplies	$0.00	Other Retail Stores
- Outdoor Power Equipment Stores	$0.00	
- Nursery and Garden Centers	$0.00	
Food & Beverage Stores		
- Grocery Stores	$1.40	Food Stores
- Supermarkets and Other Grocery Stores	$1.40	
- Convenience Stores	$0.00	
- Specialty Food Stores	$0.00	
- Beer, Wine, & Liquor Stores	$0.00	
Health & Personal Care Stores		General Merchandise Stores
- Pharmacies and Drug Stores	$9.00	
- Cosmetics, Beauty Supplies and Perfume Stores	$0.00	Other Retail Stores
- Optical Goods Stores	$0.00	
- Other Health and Personal Care Stores	$0.00	
Gasoline Stations		
- Gasoline Stations with Convenience Stores	$0.00	Service Stations
- Other Gasoline Stations	$3.90	
Clothing & Clothing Accessories Stores		
- Clothing Stores	$0.00	Apparel Stores
- Men's Clothing Stores	$0.00	
- Women's Clothing Stores	$0.00	
- Children's and Infants' Clothing Stores	$0.00	
- Family Clothing Stores	$0.00	
- Clothing Accessories Stores	$0.00	
- Other Clothing Stores	$0.00	
- Shoe Stores	$0.00	
- Jewelry, Luggage, & Leather Goods Stores	$0.00	Other Retail Stores
- Jewelry Stores	$0.00	
- Luggage, & Leather Goods Stores	$0.00	
Sporting Goods, Hobby, Book, & Music Stores		
- Sporting Goods, Hobby, & Musical Instruments	$0.00	Other Retail Stores
- Sporting Goods Stores	$0.00	
- Hobby, Toys and Games Stores	$0.00	
- Sew, Needlework, Piece Goods Stores	$0.00	
- Musical Instrument and Supplies Stores	$0.00	
- Book, Periodical, & Music Stores	$0.00	
- Book Stores and News Dealers	$0.00	
- Book Stores	$0.00	
- News Dealers and Newsstands	$0.00	
- Prerecorded Tape, Compact Disc, & Records	$0.00	
General Merchandise Stores		
- Department Stores excluding Leased Dept Stores	$0.00	General Merchandise Stores
- Other General Merchandise Stores	$1.80	
- Warehouse Clubs and Super Stores	$1.80	
- All Other General Merchandise Stores	$0.00	
Miscellaneous Store Retailers		
- Florists	$0.00	Other Retail Stores
- Office Supplies, Stationery, & Gift Stores	$4.90	
- Office Supplies and Stationery Stores	$0.00	
- Gift, Novelty, and Souvenir Stores	$4.90	
- Used Merchandise Stores	$1.30	
- Other Miscellaneous Store Retailers	$0.00	
Non-store Retailers		
- Electronic Shopping and Mail-order Houses	$0.00	Other Retail Stores
- Vending Machine Operators	$0.00	
- Direct Selling Establishments	$0.00	
Foodservice & Drinking Places		
- Full-Service Restaurants	$0.70	Eating and Drinking Places
- Limited-service Eating Places	$2.30	
- Special Foodservices	$18.50	
- Drinking Places - Alcoholic Beverages	$0.00	
TOTAL RETAIL STORES	**$47.60**	

Summary by BOE Category

BOE Category	In Millions
Apparel Stores	$0.0
General Merchandise Stores	$10.8
Food Stores	$1.4
Eating & Drinking Places	$21.5
Home Furnishings and Appliances	$0.5
Building Materials	$2.8
Motor Vehicles & Parts	$0.5
Service Stations	$3.9
Other Retail Stores	$6.2
Retail Total	$47.6

Sources: Claritas; State of California Board of Equalization; and CBRE Consulting.

Appendix F-6
Translation of Claritas Retail Sales Categories to BOE Categories
City of Brisbane's Portion of Candlestick Point Market Area
In 2008 Dollars (Millions)

Claritas Sales Category	Claritas Retail Sales 2008 2008 $'s	BOE Category
Motor Vehicle & Parts Dealers		
- Automotive Dealers	$2.40	Motor Vehicles & Parts
- Other Motor Vehicle Dealers	$0.00	
- Automotive Parts, Accessories, & Tire Stores	$0.00	
Furniture & Home Furnishings Stores		
- Furniture Stores	$0.50	Home Furnishings and Appliances
- Home Furnishing Stores	$0.40	
Electronics & Appliance Stores		
- Appliance, Television, and Other Electronics	$0.40	
- Household Appliances Stores	$0.30	
- Radio Television and Other Electronics	$0.10	
- Computer and Software Stores	$0.10	Other Retail Stores
- Camera & Photographic Equipment Stores	$0.00	
Building Material & Garden Equipment & Supply Dealers		
- Building Material & Supply Dealers	$21.10	Building Materials and Farm Implements
- Home Centers	$0.00	
- Paint and Wallpaper Stores	$0.00	
- Hardware Stores	$13.20	
- Other Building Materials Dealers	$7.90	
- Building Materials, Lumberyards	$2.70	
- Lawn and Garden Equipment and Supplies	$1.60	Other Retail Stores
- Outdoor Power Equipment Stores	$0.00	
- Nursery and Garden Centers	$1.60	
Food & Beverage Stores		
- Grocery Stores	$2.60	Food Stores
- Supermarkets and Other Grocery Stores	$2.60	
- Convenience Stores	$0.00	
- Specialty Food Stores	$0.60	
- Beer, Wine, & Liquor Stores	$1.70	
Health & Personal Care Stores		
- Pharmacies and Drug Stores	$0.00	General Merchandise Stores
- Cosmetics, Beauty Supplies and Perfume Stores	$0.00	Other Retail Stores
- Optical Goods Stores	$0.00	
- Other Health and Personal Care Stores	$1.00	
Gasoline Stations		
- Gasoline Stations with Convenience Stores	$0.00	Service Stations
- Other Gasoline Stations	$0.00	
Clothing & Clothing Accessories Stores		
- Clothing Stores	$0.70	Apparel Stores
- Men's Clothing Stores	$0.00	
- Women's Clothing Stores	$0.00	
- Children's and Infants' Clothing Stores	$0.00	
- Family Clothing Stores	$0.00	
- Clothing Accessories Stores	$0.10	
- Other Clothing Stores	$0.60	
- Shoe Stores	$0.00	
- Jewelry, Luggage, & Leather Goods Stores	$0.10	Other Retail Stores
- Jewelry Stores	$0.10	
- Luggage, & Leather Goods Stores	$0.00	
Sporting Goods, Hobby, Book, & Music Stores		
- Sporting Goods, Hobby, & Musical Instruments	$0.20	Other Retail Stores
- Sporting Goods Stores	$0.20	
- Hobby, Toys and Games Stores	$0.00	
- Sew, Needlework, Piece Goods Stores	$0.00	
- Musical Instrument and Supplies Stores	$0.00	
- Book, Periodical, & Music Stores	$0.40	
- Book Stores and News Dealers	$0.00	
- Book Stores	$0.00	
- News Dealers and Newsstands	$0.00	
- Prerecorded Tape, Compact Disc, & Records	$0.40	
General Merchandise Stores		
- Department Stores excluding Leased Dept Stores	$0.00	General Merchandise Stores
- Other General Merchandise Stores	$3.00	
- Warehouse Clubs and Super Stores	$1.90	
- All Other General Merchandise Stores	$1.10	
Miscellaneous Store Retailers		
- Florists	$0.10	Other Retail Stores
- Office Supplies, Stationery, & Gift Stores	$1.00	
- Office Supplies and Stationery Stores	$1.00	
- Gift, Novelty, and Souvenir Stores	$0.00	
- Used Merchandise Stores	$0.00	
- Other Miscellaneous Store Retailers	$0.60	
Non-store Retailers		
- Electronic Shopping and Mail-order Houses	$32.30	Other Retail Stores
- Vending Machine Operators	$0.20	
- Direct Selling Establishments	$23.00	
Foodservice & Drinking Places		
- Full-Service Restaurants	$0.20	Eating and Drinking Places
- Limited-service Eating Places	$1.20	
- Special Foodservices	$2.00	
- Drinking Places - Alcoholic Beverages	$0.00	
TOTAL RETAIL STORES	**$97.40**	

Summary by BOE Category

BOE Category	In Millions
Apparel Stores	$0.7
General Merchandise Stores	$3.0
Food Stores	$4.9
Eating & Drinking Places	$3.4
Home Furnishings and Appliances	$1.3
Building Materials	$21.1
Motor Vehicles & Parts	$2.4
Service Stations	$0.0
Other Retail Stores	$60.6
Retail Total	**$97.4**

Sources: Claritas; State of California Board of Equalization; and CBRE Consulting.

APPENDIX G: TRANSLATION OF CLARITAS RETAIL SALES CATEGORIES TO BOE CATEGORIES, HUNTERS POINT SHIPYARD PHASE II MARKET AREA, 2008

Appendix G-1
Translation of Claritas Retail Sales Categories to BOE Categories
San Francisco's Portion of Hunters Point Shipyard Phase II Market Area
In 2008 Dollars (Millions)

Claritas Sales Category	Claritas Retail Sales 2008 2008 $'s	BOE Category
Motor Vehicle & Parts Dealers		
- Automotive Dealers	$36.60	Motor Vehicles & Parts
- Other Motor Vehicle Dealers	$0.50	
- Automotive Parts, Accessories, & Tire Stores	$8.00	
Furniture & Home Furnishings Stores		
- Furniture Stores	$9.50	Home Furnishings and Appliances
- Home Furnishing Stores	$53.10	
Electronics & Appliance Stores		
- Appliance, Television, and Other Electronics	$24.90	
- Household Appliances Stores	$4.60	
- Radio Television and Other Electronics	$20.30	
- Computer and Software Stores	$0.90	Other Retail Stores
- Camera & Photographic Equipment Stores	$2.10	
Building Material & Garden Equipment & Supply Dealers		
- Building Material & Supply Dealers	$122.90	Building Materials and Farm Implements
- Home Centers	$23.50	
- Paint and Wallpaper Stores	$1.90	
- Hardware Stores	$1.00	
- Other Building Materials Dealers	$96.60	
- Building Materials, Lumberyards	$32.90	
- Lawn and Garden Equipment and Supplies	$4.30	Other Retail Stores
- Outdoor Power Equipment Stores	$0.10	
- Nursery and Garden Centers	$4.20	
Food & Beverage Stores		
- Grocery Stores	$123.10	Food Stores
- Supermarkets and Other Grocery Stores	$122.30	
- Convenience Stores	$0.70	
- Specialty Food Stores	$14.90	
- Beer, Wine, & Liquor Stores	$8.00	
Health & Personal Care Stores		General Merchandise Stores
- Pharmacies and Drug Stores	$21.90	
- Cosmetics, Beauty Supplies and Perfume Stores	$0.10	Other Retail Stores
- Optical Goods Stores	$0.00	
- Other Health and Personal Care Stores	$0.20	
Gasoline Stations		
- Gasoline Stations with Convenience Stores	$0.00	Service Stations
- Other Gasoline Stations	$17.30	
Clothing & Clothing Accessories Stores		
- Clothing Stores	$9.30	Apparel Stores
- Men's Clothing Stores	$0.90	
- Women's Clothing Stores	$3.30	
- Children's and Infants' Clothing Stores	$0.50	
- Family Clothing Stores	$3.40	
- Clothing Accessories Stores	$0.20	
- Other Clothing Stores	$1.10	
- Shoe Stores	$0.40	
- Jewelry, Luggage, & Leather Goods Stores	$3.90	Other Retail Stores
- Jewelry Stores	$2.40	
- Luggage, & Leather Goods Stores	$1.50	
Sporting Goods, Hobby, Book, & Music Stores		
- Sporting Goods, Hobby, & Musical Instruments	$7.50	Other Retail Stores
- Sporting Goods Stores	$2.00	
- Hobby, Toys and Games Stores	$5.50	
- Sew, Needlework, Piece Goods Stores	$0.00	
- Musical Instrument and Supplies Stores	$0.00	
- Book, Periodical, & Music Stores	$4.70	
- Book Stores and News Dealers	$3.20	
- Book Stores	$3.00	
- News Dealers and Newsstands	$0.10	
- Prerecorded Tape, Compact Disc, & Records	$1.60	
General Merchandise Stores		
- Department Stores excluding Leased Dept Stores	$8.10	General Merchandise Stores
- Other General Merchandise Stores	$13.60	
- Warehouse Clubs and Super Stores	$6.40	
- All Other General Merchandise Stores	$7.10	
Miscellaneous Store Retailers		
- Florists	$2.10	Other Retail Stores
- Office Supplies, Stationery, & Gift Stores	$7.60	
- Office Supplies and Stationery Stores	$6.60	
- Gift, Novelty, and Souvenir Stores	$1.00	
- Used Merchandise Stores	$2.70	
- Other Miscellaneous Store Retailers	$18.80	
Non-store Retailers		
- Electronic Shopping and Mail-order Houses	$8.00	Other Retail Stores
- Vending Machine Operators	$2.20	
- Direct Selling Establishments	$22.20	
Foodservice & Drinking Places		
- Full-Service Restaurants	$39.00	Eating and Drinking Places
- Limited-service Eating Places	$12.50	
- Special Foodservices	$24.40	
- Drinking Places - Alcoholic Beverages	$2.70	
TOTAL RETAIL STORES	$638.00	

Summary by BOE Category

BOE Category	In Millions
Apparel Stores	$9.7
General Merchandise Stores	$43.6
Food Stores	$146.0
Eating & Drinking Places	$78.6
Home Furnishings and Appliances	$87.5
Building Materials	$122.9
Motor Vehicles & Parts	$45.1
Service Stations	$17.3
Other Retail Stores	$87.3
Retail Total	$638.0

Sources: Claritas; State of California Board of Equalization; and CBRE Consulting.

Appendix G-2
Translation of Claritas Retail Sales Categories to BOE Categories
City of Daly City's Portion of Hunters Point Shipyard Phase II Market Area
In 2008 Dollars (Millions)

Claritas Sales Category	Claritas Retail Sales 2008 2008 $'s	BOE Category
Motor Vehicle & Parts Dealers		
- Automotive Dealers	$0.00	Motor Vehicles & Parts
- Other Motor Vehicle Dealers	$0.00	
- Automotive Parts, Accessories, & Tire Stores	$0.00	
Furniture & Home Furnishings Stores		
- Furniture Stores	$0.00	Home Furnishings and Appliances
- Home Furnishing Stores	$0.00	
Electronics & Appliance Stores		
- Appliance, Television, and Other Electronics	$0.00	
- Household Appliances Stores	$0.00	
- Radio Television and Other Electronics	$0.00	
- Computer and Software Stores	$0.00	Other Retail Stores
- Camera & Photographic Equipment Stores	$0.00	
Building Material & Garden Equipment & Supply Dealers		
- Building Material & Supply Dealers	$0.30	Building Materials and Farm Implements
- Home Centers	$0.00	
- Paint and Wallpaper Stores	$0.00	
- Hardware Stores	$0.00	
- Other Building Materials Dealers	$0.30	
- Building Materials, Lumberyards	$0.10	
- Lawn and Garden Equipment and Supplies	$0.00	Other Retail Stores
- Outdoor Power Equipment Stores	$0.00	
- Nursery and Garden Centers	$0.00	
Food & Beverage Stores		
- Grocery Stores	$0.20	Food Stores
- Supermarkets and Other Grocery Stores	$0.20	
- Convenience Stores	$0.00	
- Specialty Food Stores	$0.00	
- Beer, Wine, & Liquor Stores	$0.00	
Health & Personal Care Stores		General Merchandise Stores
- Pharmacies and Drug Stores	$0.10	
- Cosmetics, Beauty Supplies and Perfume Stores	$0.00	Other Retail Stores
- Optical Goods Stores	$0.00	
- Other Health and Personal Care Stores	$0.00	
Gasoline Stations		
- Gasoline Stations with Convenience Stores	$0.00	Service Stations
- Other Gasoline Stations	$1.10	
Clothing & Clothing Accessories Stores		
- Clothing Stores	$0.00	Apparel Stores
- Men's Clothing Stores	$0.00	
- Women's Clothing Stores	$0.00	
- Children's and Infants' Clothing Stores	$0.00	
- Family Clothing Stores	$0.00	
- Clothing Accessories Stores	$0.00	
- Other Clothing Stores	$0.00	
- Shoe Stores	$0.00	
- Jewelry, Luggage, & Leather Goods Stores	$0.00	Other Retail Stores
- Jewelry Stores	$0.00	
- Luggage, & Leather Goods Stores	$0.00	
Sporting Goods, Hobby, Book, & Music Stores		
- Sporting Goods, Hobby, & Musical Instruments	$0.00	Other Retail Stores
- Sporting Goods Stores	$0.00	
- Hobby, Toys and Games Stores	$0.00	
- Sew, Needlework, Piece Goods Stores	$0.00	
- Musical Instrument and Supplies Stores	$0.00	
- Book, Periodical, & Music Stores	$0.00	
- Book Stores and News Dealers	$0.00	
- Book Stores	$0.00	
- News Dealers and Newsstands	$0.00	
- Prerecorded Tape, Compact Disc, & Records	$0.00	
General Merchandise Stores		
- Department Stores excluding Leased Dept Stores	$0.00	General Merchandise Stores
- Other General Merchandise Stores	$0.10	
- Warehouse Clubs and Super Stores	$0.10	
- All Other General Merchandise Stores	$0.00	
Miscellaneous Store Retailers		
- Florists	$0.00	Other Retail Stores
- Office Supplies, Stationery, & Gift Stores	$1.30	
- Office Supplies and Stationery Stores	$0.00	
- Gift, Novelty, and Souvenir Stores	$1.30	
- Used Merchandise Stores	$0.00	
- Other Miscellaneous Store Retailers	$0.00	
Non-store Retailers		
- Electronic Shopping and Mail-order Houses	$0.00	Other Retail Stores
- Vending Machine Operators	$0.00	
- Direct Selling Establishments	$0.00	
Foodservice & Drinking Places		
- Full-Service Restaurants	$0.00	Eating and Drinking Places
- Limited-service Eating Places	$0.00	
- Special Foodservices	$0.20	
- Drinking Places - Alcoholic Beverages	$0.00	
TOTAL RETAIL STORES	**$3.30**	

Summary by BOE Category

BOE Category	In Millions
Apparel Stores	$0.0
General Merchandise Stores	$0.2
Food Stores	$0.2
Eating & Drinking Places	$0.2
Home Furnishings and Appliances	$0.0
Building Materials	$0.3
Motor Vehicles & Parts	$0.0
Service Stations	$1.1
Other Retail Stores	$1.3
Retail Total	**$3.3**

Sources: Claritas; State of California Board of Equalization; and CBRE Consulting.

APPENDIX H: NEW HOUSEHOLD DEMAND BY TYPE OF AFFORDABLE HOUSING

Appendix H-1
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
Average Household Income for New Households in Affordable Units
2009

Unit Type	Total	Units (1) For Rent	Units (1) For Sale	Average Persons Per Household	Persons For Rent	Persons For Sale
Senior	312	312	0	1.0	312	-
1-Bedroom	535	263	272	2.0	526	544
2-Bedroom	1,023	427	595	3.0	1,282	1,786
3-Bedroom	1,376	543	833	4.0	2,170	3,334
4+Bedroom	99	99	0	5.0	493	-
Total	**3,345**	**1,644**	**1,701**		**4,784**	**5,664**
Weighted Average Persons Per Household					**3.4**	**3.5**

Maximum Income by Household Size for 2009 (2)

Maximum Income (3)	Household Size 3 Person	4 Person	Average
50% of Median (Rental)	$43,550	$48,400	$45,975
80% of Median (For Sale)	$69,700	$77,450	$73,575

Sources: "Bayview Waterfront Project Description", February 2008; "Maximum Income by Household Size: derived from the Unadjusted Area Median Income for HUD Metro Fair Market Rent Area that contains San Francisco", San Francisco Mayor's Office, March 31, 2009; and CBRE Consulting.

(1) From Table II-3 "Candlestick Point - Hunters Point Shipyard Phase II - Housing Mix" in the "Bayview Waterfront Project Description", February 2008.
(2) "Maximum Income by Household Size: derived from the Unadjusted Area Median Income for HUD Metro Fair Market Rent Area that contains San Francisco", San Francisco Mayor's Office, March 31, 2009.
(3) The Candlestick Point - Hunters Point Shipyard Phase II Development Plan sets affordable housing limits at an average of 50% of Area Median Income (AMI) for rental units and an average of 80% AMI for ownership units. See http://www.sfgov.org/site/sfra_page.asp?id=5581.

Appendix H-2
Candlestick Point - Hunters Point Shipyard Phase II Development Plan
Retail Demand Spending Analysis
Household Spending Potential for Households in Affordable Rentals (1)
Candlestick Point Market Area and Hunters Point Shipyard Phase II Market Area
2009

	Affordable Rentals		Affordable For-Sale Units	
Type of Retailer	Per Household (2) Spending	Area Total (in $ 000's) Spending	Per Household (2) Spending	Area Total (in $ 000's) Spending
Apparel Stores	$869	$84,063	$1,280	$123,771
General Merchandise Stores	$2,811	$271,880	$3,527	$341,106
Food Stores	$3,420	$330,805	$3,988	$385,658
Eating and Drinking Places	$2,212	$213,958	$3,090	$298,845
Home Furnishings and Appliances	$637	$61,609	$836	$80,862
Building Materials (3)	$1,213	$117,288	$1,901	$183,845
Auto Dealers and Auto Supplies	$4,071	$393,724	$6,194	$599,087
Service Stations	$2,012	$194,606	$2,511	$242,820
Other Retail Stores (4)	$2,203	$213,056	$3,055	$295,504
Total	$19,449	$1,880,989	$26,382	$2,551,499

Sources: Claritas 2009; and CBRE Consulting.

(1) All figures are expressed in constant 2009 dollars. Reference area defined as California.
(2) Analysis assumes the average household income of households in affordable rentals is $45,975 in 2009. See Appendix H-1
(3) Building materials group includes hardware stores, plumbing and electrical supplies, paint and wallpaper products, glass stores, farm implement dealers, and lumber.
(4) Other retail stores includes packaged liquor stores, gifts, art goods and novelties, sporting goods, florists, photographic equipment and supplies, musical instruments, stationary and books, jewelry, office and school supplies, second-hand merchandise, farm and garden supply stores, mobile homes/trailers and campers, boat and motorcycle dealers, and miscellaneous other retail stores.

APPENDIX I: BENCHMARK CALCULATION OF DEMOGRAPHICS, TRADE AREA HOUSEHOLDS OF SELECT GROCERY STORES NEAR HUNTERS POINT SHIPYARD PHASE II MARKET AREA

Appendix I-1
Benchmark Calculation of Demographics
Trade Area Households of Select Grocery Stores
Near the Hunters Point Neighborhood Shipyard Phase II Retail Market Area (1)
2009

	Claritas Data			San Francisco Data (1)	
	San Francisco County	Grocery Store 3-Mile Radius Households	Ratio of Grocery Store Radius to Entire County	City of San Francisco (1)	Estimated Households within Grocery Store Trade Area Radius
	[A]	[B]	[C = B / A]	D	[E = D * C]
19. Whole Foods Market (399 4th St., San Francisco)	332,596	192,086	57.8%	346,618	200,184
25. Foods Co. (1800 Folsom St., San Francisco)	332,596	237,731	71.5%	346,618	247,754
27. Good Life Grocery (1524 20th St., San Francisco)	332,596	189,459	57.0%	346,618	197,446
29. Delano IGA Market (1245 S. Van Ness, San Francisco)	332,596	216,132	65.0%	346,618	225,244
33. Safeway (5290 Diamond Heights Blvd., San Francisco)	332,596	197,984	59.5%	346,618	206,331
37. Safeway (4950 Mission Street)	332,596	122,983	31.5%	346,618	109,216
43. Safeway (30 Chestnut Avenue, South San Francisco)	332,596	48,599	14.6%	346,618	50,648

Sources: Claritas Inc., 2009; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting, Inc.

(1) San Francisco Urban Water Management Plan data interpolated from 2005 and 2030 estimates and projections.

Appendix I-2
Benchmark Calculation of Demographics
Overlapping Trade Area Households of Select Grocery Stores
Near the Hunters Point Shipyard Phase II Neighborhood Retail Market Area (1)
2009

	Claritas Data			San Francisco Data (1)	
	San Francisco County	Grocery Store's Overlapping Portion with the Market Area (2)	Ratio of San Francisco's Portion to Entire County	City of San Francisco	Grocery Store's Overlapping Portion with the Market Area
	[A]	[B]	[C = B / A]	D	[E = D * C]
19. Whole Foods Market (399 4th St., San Francisco)	332,596	3,248	1.0%	346,618	3,385
25. Foods Co. (1800 Folsom St., San Francisco)	332,596	12,798	3.8%	346,618	13,338
27. Good Life Grocery (1524 20th St., San Francisco)	332,596	18,461	5.6%	346,618	19,239
29. Delano IGA Market (1245 S. Van Ness, San Francisco)	332,596	21,144	6.4%	346,618	22,035
33. Safeway (5290 Diamond Heights Blvd., San Francisco)	332,596	18,548	5.6%	346,618	19,330
37. Safeway (4950 Mission Street)	332,596	18,771	5.6%	346,618	19,562
43. Safeway (30 Chestnut Avenue, South San Francisco)	332,596	0	0.0%	346,618	0

Sources: Claritas Inc., 2009; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting, Inc.

(1) San Francisco Urban Water Management Plan data interpolated from 2005 and 2030 estimates and projections.
(2) Estimates of the portion of households within each grocery store's trade area that are also within the Hunters Point Shipyard Phase II Neighborhoold Market Area.

Appendix I-3
Benchmark Calculation of Demographics
For Store 37. Safeway (4950 Mission Street)
Near the Hunters Point Shipyard Phase II Neighborhood Retail Market Area
2009

	Claritas Data			San Francisco & ABAG Data		Claritas Data			San Francisco and ABAG Data (1)	
	County or City Total	Store Total Radius	Ratio of Store Radius to Entire County or City	City or County	Store Total Radius	City or County	Grocery Store Overlapping Portion with the Market Area	Ratio of San Francisco's Portion to Entire County	City of San Francisco	Grocery Store's Overlapping Portion with the Market Area
	[A]	[B]	[C = B / A]	D	[E = D * C]	[A]	[B]	[C = B / A]	D	[E = D * C]
San Francisco	332,596	104,798	31.5%	346,618	109,216	332,596	18,771	5.6%	346,618	19,562
Brisbane	1,671	343	20.5%	1,777	365	1,671	0	0.0%	1,777	0
Colma	422	367	87.0%	472	410	422	0	0.0%	472	0
Broadmoor	1,295	527	40.7%	1,295 (1)	527 (1)	1,295	0	0.0%	1,295	0
Daly City	29,765	16,678	56.0%	31,689	17,756	29,765	150	0.5%	31,689	160
Total Households Store 37					128,274					19,722

Sources: Claritas Inc., 2009; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting, Inc.

(1) Broadmoor estimates were not available from ABAG so the analysis uses the Claritas figures as reasonable proxies for this geographic area.

APPENDIX J: BENCHMARK CALCULATION OF DEMOGRAPHICS FOR STORE 37. SAFEWAY

Appendix J
Benchmark Calculation of Demographics
For Store 37. Safeway (4950 Mission Street) Trade Area (1)
2009 and 2030

	2009 Store 37 Safeway Trade Area Households (2)	Projected Annual Household Growth Rates (3)	2030 Projected Store 37 Safeway Trade Area Households
	[A]	[B]	[C]
San Francisco	109,216	0.37%	118,024
Brisbane	365	1.74%	524
Colma	410	0.90%	495
Broadmoor	527	0.69%	609
Daly City	17,756	0.69%	20,522
Total Households Store 37	**128,274**	**0.42%**	**140,174**

Sources: Appendix I-3; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; Association of Bay Area Governments (ABAG) "Projections 2007"; and CBRE Consulting, Inc.

(1) San Francisco Urban Water Management Plan data and ABAG data interpolated from 2005 and 2030 estimates and projections.

(2) See Appendix I-3.

(3) The San Francisco estimate is based on the figures from the San Francisco Urban Water Management Plan, excluding major planned development projects at Treasure Island, Park Merced, and Hunters Point / Candlestick Point. The remaining estimates are calculated from ABAG's "Projections 2007" publication. The Daly City figure is also used as a proxy for Broadmoor, which does not have specific estimates in the ABAG publication.

APPENDIX K: BENCHMARK CALCULATION OF DEMOGRAPHICS, WESTFIELD SHOPPING CENTRE, SHOPS AT TANFORAN, AND WESTLAKE SHOPPING CENTER

Appendix K-1
Benchmark Calculations of Household Data
Relevant to the Westfield San Francisco Centre
2009

	Claritas Data			San Francisco & ABAG Data (1)		Claritas Data			San Francisco and ABAG Data (1)	
	County or City Total	Shopping Center Total Radius	Ratio of SC Radius to Entire County or City	City or County	Shopping Center Total Radius	City or County	Shopping Center's Overlapping Portion with the Market Area	Ratio of San Francisco's Portion to Entire County	City of San Francisco	Shopping Center's Overlapping Portion with the Market Area
	[A]	[B]	[C = B / A]	D	[E = D * C]	[A]	[B]	[C = B / A]	D	[E = D * C]
San Francisco	332,596	285,598	85.9%	346,618 (1)	297,639	332,596	82,898	24.9%	346,618	86,393
Brisbane	1,671	779	46.6%	1,777	829	1,671	779	46.6%	1,777	829
S. San Francisco	20,216	723	3.6%	20,601	737	20,216	723	3.6%	20,601	737
Daly City	29,765	4,171	14.0%	31,689	4,441	29,765	1,062	3.6%	31,689	1,131
Total Households Westfield Shopping Centre					303,645					89,089

Sources: Claritas Inc., 2009; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting, Inc.

(1) San Francisco Urban Water Management Plan data interpolated from 2005 and 2030 estimates and projections. ABAG data interpolated from 2005 estimates and 2010 projections.

Appendix K-2
Benchmark Calculations of Household Data
Relevant to the Shops at Tanforan
2009

	Claritas Data			San Francisco & ABAG Data (1)		Claritas Data			San Francisco and ABAG Data (1)	
	County or City Total	Shopping Center Total Radius	Ratio of SC Radius to Entire County or City	City or County	Shopping Center Total Radius	City or County	Shopping Center Overlapping Portion with the Market Area	Ratio of San Francisco's Portion to Entire County	City of San Francisco	Shopping Center's Overlapping Portion with the Market Area
	[A]	[B]	[C = B / A]	D	[E = D * C]	[A]	[B]	[C = B / A]	D	[E = D * C]
Broadmoor	1,295	1,275	98.5%	N/A	N/A	1,295	0	0.0%	N/A	0
Burlingame	12,218	12,180	99.7%	12,794	12,754	12,218	0	0.0%	12,794	0
Colma	422	422	100.0%	472	472	422	0	0.0%	472	0
Millbrae	8,006	8,006	100.0%	20,601	20,601	8,006	0	0.0%	20,601	0
San Bruno	14,743	14,697	99.7%	15,704	15,655	14,743	0	0.0%	15,704	0
Brisbane	1,671	1,671	100.0%	1,777	1,777	1,671	1,432	85.7%	1,777	1,523
S. San Francisco	83,394	46,426	55.7%	20,601	11,469	83,394	6,307	7.6%	20,601	1,558
San Francisco	332,596	46,426	14.0%	346,618 (1)	48,383	332,596	34,384	10.3%	346,618	35,834
Daly City	29,765	29,814	100.2%	31,689	31,741	29,765	1,524	5.1%	31,689	1,623
Pacifica	13,804	7,814	56.6%	14,288	8,088	13,804	0	0.0%	14,288	0
San Mateo	37,060	12,758	34.4%	39,468	13,587	37,060	0	0.0%	39,468	0
Hillsborough	3,734	2,859	76.6%	3,814	2,920	3,734	0	0.0%	3,814	0
Highlands-Baywood Park	1,546	426	27.6%	N/A	N/A	1,546	0	0.0%	N/A	0
Unincorporated (2)	21,683	763	3.5%	21,683	N/A	21,683	9	0.0%	21,683	9
Total Households, Shops at Tanforan					167,447					40,546

Sources: Claritas Inc., 2009; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting, Inc.

(1) San Francisco Urban Water Management Plan data interpolated from 2005 and 2030 estimates and projections. ABAG data interpolated from 2005 estimates and 2010 projections.
(2) Total for Unincorporated is ABAG data, Claritas does not provide unincorporated data for an entire county.

Appendix K-3
Benchmark Calculations of Household Data
Relevant to Westlake Shopping Center
2009

	Claritas Data			San Francisco & ABAG Data (1)		Claritas Data			San Francisco and ABAG Data (1)	
	County or City Total	Shopping Center Total Radius	Ratio of SC Radius to Entire County or City	City or County	Shopping Center Total Radius	City or County	Shopping Center Overlapping Portion with the Market Area	Ratio of San Francisco's Portion to Entire County	City of San Francisco	Shopping Center's Overlapping Portion with the Market Area
	[A]	[B]	[C = B / A]	D	[E = D * C]	[A]	[B]	[C = B / A]	D	[E = D * C]
Broadmoor	1,295	1,275	98.5%	N/A	N/A	1,295	0	0.0%	N/A	0
Colma	422	422	100.0%	472	472	422	0	0.0%	472	0
Millbrae	8,006	74	0.9%	20,601	190	8,006	0	0.0%	20,601	0
San Bruno	14,743	10,452	70.9%	15,704	11,133	14,743	0	0.0%	15,704	0
S. San Francisco	83,394	18,772	22.5%	20,601	4,637	83,394	4,811	5.8%	20,601	1,188
San Francisco	332,596	123,946	37.3%	346,618 (1)	129,171	332,596	54,924	16.5%	346,618	57,240
Daly City	29,765	29,938	100.6%	31,689	31,873	29,765	1,524	5.1%	31,689	1,623
Pacifica	13,804	8,264	59.9%	14,288	8,554	13,804	0	0.0%	14,288	0
Unincorporated (2)	21,683	359	1.7%	21,683	N/A	21,683	9	0.0%	21,683	9
Total Households, Westlake Shopping Center					186,031					60,060

Sources: Claritas Inc., 2009; San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; and CBRE Consulting, Inc.

(1) San Francisco Urban Water Management Plan data interpolated from 2005 and 2030 estimates and projections. ABAG data interpolated from 2005 estimates and 2010 projections.
(2) Total for Unincorporated is ABAG data, Claritas does not provide unincorporated data for an entire county.

APPENDIX L: BENCHMARK CALCULATION OF DEMOGRAPHICS FOR THE WESTFIELD SHOPPING CENTRE, WESTLAKE SHOPPING CENTER, AND THE SHOPS AT TANFORAN

Appendix L
Benchmark Calculations of Household Data and Project Growth Rates
For the Westfield Centre, Westlake Shopping Center, and The Shops at Tanforan
2005, 2009 and 2030

City (1)	2005	2030	Average Annual Growth Rate	Westfield SF Centre		Westlake Center		Shops at Tanforan	
				2009 (2)	2030 (3)	2009 (2)	2030 (3)	2009 (2)	2030 (3)
	[A]	[B]	[C]	[D]	[E]	[F]	[G]	[H]	[I]
San Francisco	82,767	109,624	0.67%	297,639	342,445	129,171	148,617	48,383	55,667
Brisbane	1,690	2,600	1.74%	829	1,190	N/A	N/A	1,777	2,552
Colma	440	550	0.90%	N/A	N/A	472	569	472	569
Daly City	31,210	37,080	0.69%	4,441	5,132	31,873	36,838	31,741	36,686
Millbrae	7,980	9,180	0.56%	N/A	N/A	190	214	20,601	23,173
Pacifica	14,160	15,450	0.35%	N/A	N/A	8,554	9,204	8,088	8,702
S. San Francisco	20,130	24,240	0.75%	737	861	4,637	5,420	11,469	13,406
Burlingame	12,610	13,790	0.36%	N/A	N/A	N/A	N/A	12,754	13,749
San Bruno	15,210	18,590	0.81%	N/A	N/A	11,133	13,177	15,655	18,529
San Mateo	38,400	46,770	0.79%	N/A	N/A	N/A	N/A	13,587	16,035
Hillsborough	3,750	4,030	0.29%	N/A	N/A	N/A	N/A	2,920	3,102
Totals				**303,645**	**349,628**	**186,031**	**214,040**	**167,447**	**192,170**
Weighted Average Annual Growth Rates by Trade Area, 2009-2030					**0.67%**		**0.67%**		**0.66%**

Sources: San Francisco Urban Water Management Plan projections from email sent by PBS&J dated July 2, 2009; Association of Bay Area Governments (ABAG) "Projections 2007"; Claritas Inc.; and CBRE Consulting Inc.

(1) San Francisco household data from the San Francisco Urban Water Management Plan, the remaining cities are from ABAG's "Projections 2007" publication.
(2) See Appendices K-1, K-2, and K-3 for details.
(3) Projections of the city level sections of the respective trade areas are based on the related growth rates in Column C.

Appendix V1 Page & Turnbull Hunters Point Shipyard Feasibility Study, Revised September 9, 2009

HUNTERS POINT SHIPYARD

San Francisco, California

FEASIBILITY STUDY

Prepared for
PBS&J

PAGE & TURNBULL
imagining change in historic environments through design, research, and technology.

JULY 1, 2009
REV'D: SEPTEMBER 9, 2009
09061

I. INTRODUCTION

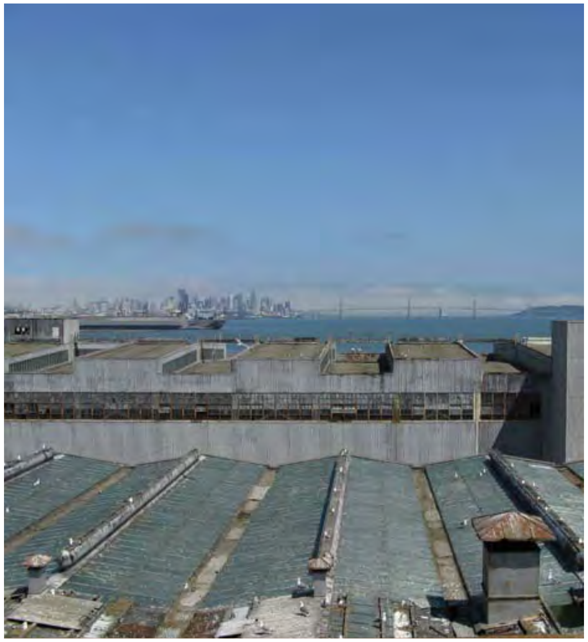


Figure 1. View from roof of Building 253, overlooking its atrium; Building 231 and Bay Bridge in the background.

1.1 Purpose

This Feasibility Study was prepared at the request of Lennar Urban for the Bayview Waterfront Project ("Project") as part of the alternatives analysis for the Bayview Waterfront Project Environmental Impact Report (EIR). This study examines the reuse of three buildings at the former Hunters Point Naval Shipyard: Buildings 211, 231 and 253. These three buildings are part of the potential Hunters Point Commercial Dry Dock and Naval Shipyard Historic District. All three buildings were constructed between 1942 and 1947, and were used as machine shops for the former shipyard. This study proposes a conceptual use for each building based on the current master plan for the project site. It examines the program/use, site and building constraints, code compliance issues, and rehabilitation requirements. Also included are structural analyses which highlight seismic concerns and/or visual deficiencies relative to the structural performance of each building. A conceptual cost estimate for each building is also provided. As potential historic resources [as identified in upcoming environmental impact report], each of the intended reuse options examines the rehabilitation of the buildings according to the Secretary of the Interior's *Standards for the Treatment of Historic Properties*.

1.2 Project Team

The rehabilitation alternatives proposed in this study were produced collaboratively by the project team consisting of:

- Page & Turnbull, Inc. (prime historic preservation/architectural consultant),
- CBRE Consulting | CB Richard Ellis, Inc. (economic consultant),
- JR Conkey & Associates (cost estimator), and
- Emergent Structures, Inc. (structural engineers).

1.3 Methodology

Page & Turnbull, along the with project team, completed the following tasks:

- Review of existing documentation, including:
  - *Circa: Historic Property Development, Hunters Point Commercial Dry Dock and Naval Shipyard Historic District DPR 523D form (draft, 31 October 2008)*
  - *Circa: Historic Property Development, DPR 523A Form, Building 211(draft, June 2008)*
  - *Circa: Historic Property Development, DPR 523A Form, Building 231 (draft, June 2008)*
  - *Circa: Historic Property Development, DPR 523A Form, Building 253 (draft, June 2008)*
  - *Selection of architectural drawings available at the Department of the Navy on Treasure Island (a complete set of architectural drawings was not available for all buildings under review)*
- Consultation with Lennar Urban regarding the intended program;
- Consultation with Project Team, including CBRE, JR Conkey and Emergent Structures. Discussions included overview of the existing conditions of the buildings, limitations associated with building operations and anticipated program of the Project;
- Site visits on May 19, 2009 and June 4, 2009 to visually assess each building, record current condition, and verify building measurements for the code and rehabilitation analysis;
- Code analysis of the three buildings based on 2007 California Building Code (CBC), California Historic Building Code (CHBC), and San Francisco Planning Code;
- Completed architectural diagrams and drawings exploring the conceptual use and layout for each building;
- A visual analysis, review of historic drawings, and basic structural calculations were part of the strategy;
- Review by JR Conkey & Associates of the project documents, including photographs, reports and proposed conceptual sketches; to assist in preparation of the Preliminary Cost Estimate.

II. BACKGROUND

II.1 Project Background

This Feasibility Study has been completed as part of the Bayview Waterfront Project ("Project"), which includes new plans for the Candlestick Point, Hunters Point Shipyard (HPS) and India Basin Shoreline areas of San Francisco. The Project encompasses an approximately 764-acre area east of U.S. 101 in the southeast area of the City and occupies the waterfront area from India Basin to the approximate western edge of Candlestick Point. The Project is comprised of two primary components: (1) the Candlestick Point – Hunters Point Shipyard Phase II Development Plan ("CP-HPS Development Plan" or "Development Plan") and (2) the India Basin Shoreline Plan ("India Basin Plan").

The CP-HPS Development Plan is a project-level development being proposed by Lennar Urban. A wide range of uses are proposed: a mixed-use community with residential, retail, office, research and development, civic and community uses, and parks and recreational open space. A major component would be a new stadium for the San Francisco 49ers, a National Football League team. Additionally, new infrastructure would be provided to support the development. In the event that the stadium is not constructed, a development plan for an additional three million square feet of research and development space on the proposed stadium site will be explored.

The Project also includes new land use controls for the India Basin Shoreline portion of the BVHP, also known as the Bayview Hunters Point (BVHP) Redevelopment Survey Area C. The San Francisco Planning Department and the San Francisco Redevelopment Agency are the Project Sponsors for the India Basin Plan. Plans for the India Basin Shoreline would allow a largely industrial zoned area to support a mix of residential, commercial, and light industrial uses and would amend the BVHP Redevelopment Plan to include Area C. Project components could include an amendment to the existing BVHP Redevelopment Plan, amendments to the General Plan, and new zoning controls and design guidelines for the area. Taken together, these components constitute the India Basin Plan. The Plan assumes that the India Basin area would be developed over time by various private parties.

In 2008, Circa: Historic Property Development conducted an historic resource survey of the Bayview Waterfront Plan, as part of the environmental review process. This survey produced a historic context statement on the entire project area, and focused upon the history and development of specific areas within the plan, including India Basin, Hunters Point Shipyard, public housing, and Candlestick Point. As part of the survey, listed and potential historic resources were identified for the purposed of the California Environmental Quality Act (CEQA). Buildings 211, 231, and 253 were among the buildings that were identified as potential historic resources. These three properties were identified as part of a potential National Register-eligible historic district, the Hunters Point Commercial Dry Dock and Naval Shipyard Historic District. The significance of this district is based upon its history associated with the San Francisco Dry Dock Company (formerly the California Dry Dock Company) and the Navy. The boundaries of this district encompass Buildings 140, 204, 205, 207, 208, 211, 224, 231, and 253, which include some of the oldest properties remaining on the project site.

The Hunters Point Shipyard was previously studied by the Department of the Navy in 1997; these findings were later updated by Circa as part of the Project. Circa's findings have not been finalized and are in the process of being reviewed by the San Francisco Planning Department (the lead agency for CEQA determinations).

Additional information may be garnered from the Project Description of the Administrative Draft Environmental Impact Report.

Figure 2. Looking down at atrium roof of Building 253 with 211 (to the right) and 231 beyond.

Figure 3. Hunters Point Shipyard Historic Resource Survey and Proposed Historic District.

Figure 4. Building 231 on right, and Building 211 on left.

II.2 Historical Overview

The following section provides a brief historical overview of the project site.

> *The Hunters Point Commercial Dry Dock and Naval Shipyard Historic District is comprised of a collection of buildings, structures and objects associated with the area's transition from early commercial dry dock operation to high tech naval repair and Radiological research and waste treatment facility. Located across the San Francisco Bay from East Bay port facilities, Hunters Point Shipyard began as the California Dry Dock Company in 1867 when the first dry dock (Drydock #1) was cut from solid rock at the northeastern tip of Hunters Point. The dry dock facilities expanded in 1901-1903, when the newly formed San Francisco Drydock Company completed Buildings 204, 204 and Dry Dock 2, at the time was the most modern dry dock on the Bay. Dry Dock 3 replaced Dry Dock 1 in 1918. Buildings 140 (Pumphouse 3), 204 (Gatehouse), 205 (Pumphouse 2), 207 (Latrine building) and 208 (Tool Room and Shop Service building) were constructed in conjunction with these two drydocks. In preparation for WWII, the Navy purchased the dry docks and adjacent support buildings and undertook construction of a high tech shipyard to assist with the construction and repair of the Naval fleet. The Historic District encompasses the early dry dock facilities, the first building built by the Navy in preparation for WWII (Building 231), the Optical, Electronics and Ordnance Building (Building 253), the original Shipfitters Shop (Building 211), and an air raid shelter (Building 224). Site features include rail spurs, crane ways, light standards, bollards, drydock pumping equipment and other built-ins, fencing and wharves.*[1]

II. 3 Setting

The Hunters Point Shipyard is located at the southeastern corner of San Francisco, and is bounded by the San Francisco Bay to the east, India Basin to the north, Bayview Hill Park to the south, and the Hunters Point/Bayview community to the west. The project site is located in close proximity to Highway 101 (Bayshore Freeway) and is approximately eight miles from Downtown San Francisco. The surrounding Bayview neighborhood is predominantly residential and industrial in character, and features a diverse ethnic population. As a former naval shipyard, the area surrounding the project site is distinctly industrial in character, and is characterized by broad expanses of concrete paving, former railways, a concrete shoreline, and other industrial buildings of varying scales and sizes. Since much of the surrounding area is undergoing renovation or clean-up, the setting around the potential historic district is quickly changing with the removal of road networks and changes to the infrastructure.

Figure 5. Aerial photograph of Hunters Point Shipyard. Source: Google Earth, 2009.

1 Circa: Historic Property Development, Hunters Point Commercial Dry Dock and Naval Shipyard Historic District DPR 523D form (draft, 31 October 2008).

II.4 Secretary of the Interior's Standards for Rehabilitation

The Secretary of the Interior's Standards for the Treatment of Historic Properties (Standards) are the benchmark by which Federal agencies and many local government bodies evaluate rehabilitative work on historic properties. The Standards are a useful analytic tool for understanding and describing the potential impacts of substantial changes to historic resources. Compliance with the Standards does not determine whether a project would cause a substantial adverse change in the significance of an historic resource. Rather, projects that comply with the Standards benefit from a regulatory presumption that they would have a less-than-significant adverse impact on an historic resource.[2] Projects that do not comply with the Standards may or may not cause a substantial adverse change in the significance of an historic resource.

The Standards provide guidelines for four types of treatment that can be applied to historic properties: Preservation, Rehabilitation, Restoration, and Reconstruction. According to the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, the treatments are defined as follows:

> **Preservation**: The *Standards for Preservation* "require retention of the greatest amount of historic fabric, along with the building's historic form, features, and detailing as they have evolved over time."
>
> **Rehabilitation**: The *Standards for Rehabilitation* "acknowledge the need to alter or add to a historic building to meet continuing new uses while retaining the building's historic character."
>
> **Restoration**: The *Standards for Restoration* "allow for the depiction of a building at a particular time in its history by preserving materials from the period of significance and removing materials from other periods."
>
> **Reconstruction**: The *Standards for Reconstruction* "establish a limited framework for re-creating a vanished or non-surviving building with new materials, primarily for interpretive purposes."[3]

2 CEQA Guidelines subsection 15064.5(b)(3).

3 Kay D. Weeks and Anne E. Grimmer, *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings* (Washington, D.C.: U.S. Department of the Interior National Park Service, 1995), 2.

The *Standards for Rehabilitation* are defined as follows:

Rehabilitation Standard 1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.
Rehabilitation Standard 2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.

Rehabilitation Standard 3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.

Rehabilitation Standard 4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.

Rehabilitation Standard 5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.

Rehabilitation Standard 6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

Rehabilitation Standard 7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

Rehabilitation Standard 8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

Rehabilitation Standard 9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.

Rehabilitation Standard 10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.[4]

4 Ibid., 62.

Character-Defining Features
To assist with the rehabilitation feasibility analysis, Page & Turnbull assessed the potential historic resources and determined the character-defining features for each building. A property's character-defining features are those physical elements that enable a property to convey its historic identity or significance. These distinctive character-defining features are the physical traits that convey significance relative to a property type and/or architectural style. A property must clearly contain enough of those characteristics to be considered a true representative of a particular type, period, or method of construction, and these features must also retain a sufficient degree of integrity. Characteristics can be expressed in terms such as form, proportion, structure, plan, style, or materials. The character-defining features for each property have been included in Section IV of this report.

III APPROACH

Figure 6. Proposed master plan for Area C; prepared by IBI Group for Lennar Urban.

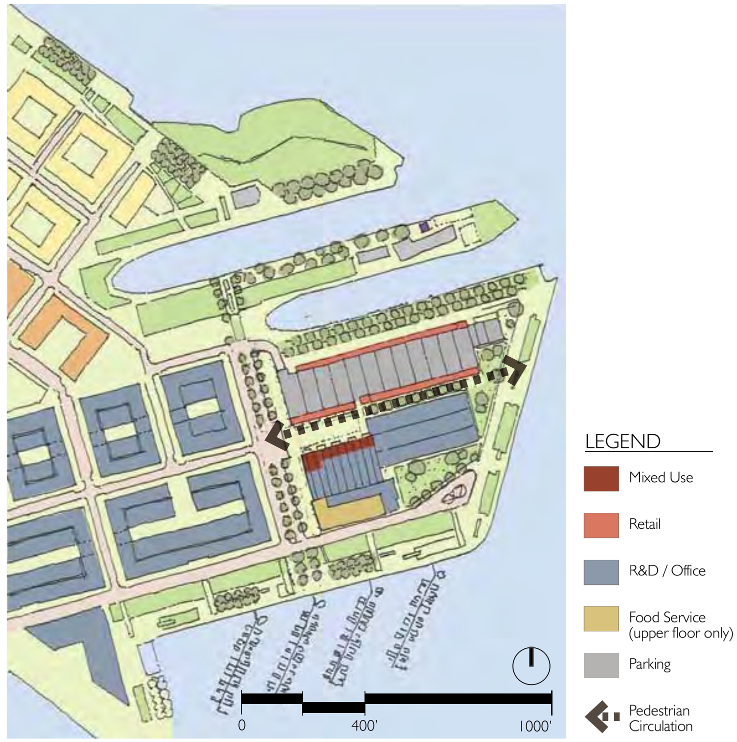


Figure 7. Proposed revised master plan, indicating rehabilitation of Buildings 211, 231 and 253; by Page & Turnbull.

III.1 Original Uses

According to available records, the three building under review were originally used as follows:

- Building 211 was used as an Electrical Machinery Repair Shop.
- Building 231 was used as a Ship and Machinery Repair Shop.
- Building 253 was used as the Optical, Electronic & Ordnance Shop.

III.2 Current Master Plan Proposal

The current master plan proposal calls for the demolition of all three buildings, and the new construction of new research and development buildings, see Figure 6.

While the adaptive reuse of the Buildings 211, 231 and 253 slightly alters the current master plan, the overall concept of Block C development is maintained, i.e., the existing buildings offer more than 250,000 square feet of research and development use (R&D). It accommodates approximately 1000 parking spaces within the footprint of Building 231, as well as offers mixed use public spaces, retail and food service. Additionally, Building 231 accommodates a solar energy generation plant that would provide green infrastructure to the entire site. The location of existing buildings on the site and their proximity to the waterfront enables to maintain vehicular and pedestrian circulation patterns similar to the ones proposed in the current master plan. Proximity of the three buildings to each other would allow access to waterfront through a pedestrian promenade. Figure 7 depicts a revised master plan scenario for this area.

While it may be possible to accommodate new structures on this site in addition to retaining historic buildings, this study was not focused on evaluating new development opportunities. A combination of retaining existing structures and a new development on this parcel should be considered to supplement this document and the EIR.

III.3 Reuse Possibilities

The simple construction and large scale of each of the three buildings allows them to be reused in a variety of ways. In order to be compatible with the proposed redevelopment plan, Page & Turnbull proposes the following uses for each of the buildings:

- Building 211 = Class B Office/Research & Development (R&D)
- Building 231 = Parking Facility with Retail Use at ground level, and Green Energy Plant at upper level*
- Building 253 = Mixed Use [Retail/Food Service] at lower level with Research & Development (R&D) at upper levels*

*Building uses were proposed taking into consideration layout and physical characteristics of the existing buildings and were determined to maximize the potential of existing building footprints, volumes and architectural character. The adaptive reuse study suggests a single new use for each of the buildings, however, alternative uses are also suggested; refer to individual building studies for more detail on alternative uses.

III.4 Structural Approach

The structural assessment was performed by Emergent Structures, Inc. in order to assist with the evaluation and feasibility of the re-use of buildings 211, 231, and 253 at Hunters Point Shipyard. An essential goal of the re-use of each building is to retain as much of the original structure as possible while allowing for its continued use. The existing structural components are character defining features that contribute to the architectural character of the buildings and thus should be preserved. These goals are achievable because the existing structural systems of all three buildings generally have capacity to accommodate new uses. Where required, the structural assessment suggested the introduction of new elements that would tie into and reinforce the existing structure by strengthening weak or inadequate members. Since the reuse proposal for all three buildings introduces new floor plates, these elements enhance the seismic performance by providing bracing and seismic connections to building walls. The new floors would be constructed of light weight steel framing and steel/concrete slabs, and would have their own support system and footings. In general, the buildings' structural systems are in great shape, requiring only minor upgrades, mostly to resist lateral forces.

III.5 Approach to Rehabilitation Cost Assessment

JR Conkey & Associates prepared the Preliminary Cost Estimates included in this Feasibility Study. The approach to rehabilitation cost evaluation is based on the assessment of major costs associated with the CSI Components listed. Project information, including photos, preliminary re-use reports and sketches were used to identify relevant cost drivers; cost estimators used historical data gathered from years of experience and input from professionals in the design and construction industries. The Preliminary Feasibility Study will compare each CSI Component Division as less than, the same as, or more than the historical cost models of the past. This study also defines the exclusions so that the project team can assess the budgets that impact soft costs such as Pre-construction, A&E, Developer and Impact Fees.

IV. REUSE STUDIES

IV.1 Building 211

Building 211 is a rectangular plan, timber-frame building with a monitor roof that is attached to the east end of Building 253. The building is set on a concrete base and is clad with wood shiplap siding. It has two large freight door openings and a smaller rolling industrial door at the east end. The interior of Building 211 and Building 253 is contiguous. Asbestos shingles have been applied as secondary siding on the south elevation. A two-story shed addition clad in wood shiplap siding and glazed with one-over-one wood double-hung windows is located on the south side of Building 211. Also on the south elevation is a sliding wood industrial door with inset personnel doors (one infilled). The monitor is glazed with multi-pane wood windows.

The character-defining features of Building 211 include, but are not limited to:
- Simple exterior façade;
- Wood shiplap siding;
- Exposed timber-frame structural system consisting of timber columns, beams, and trusses;
- Exposed interior walls;
- Interior catwalks;
- Double-height interior volume;
- Raised volume of the central structural bay;
- Multi-pane roof monitor; and
- Large freight doors and openings.

Also notable within the interior of the building is the large crane, which is located on the track that runs the length of the center structural bay.

Pros:
- Minimal impact to existing historic structure
- Building is re-used in its original location
- Structural upgrades reinforce building for longevity
- Plan layout if flexible and can be re-configured in any number of ways
- Existing exterior wood cladding is easily modified to accept new window
- Existing building height allows for insertion of an additional floor plate, providing additional rental area
- Only minor demolition and upgrades required to existing building
- Floor to ceiling height allows maintaining double height volume, with circulation paths organized around the atrium, thus keeping the historic character of the building

Cons:
- Addition of new windows takes away from historic condition of exterior walls
- Addition of a floor plate alters the original open volume of the building
- Independent structure is required for new second floor plate
- Depending on configuration, not all offices have direct natural light

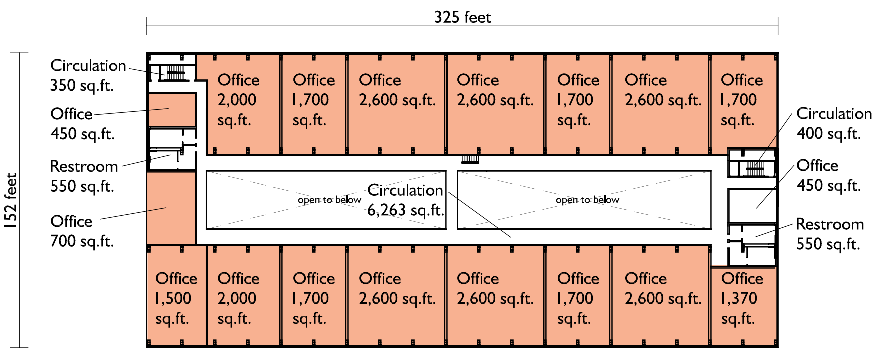
Figure 8. East elevation of Building 211.

Figure 9. Inside lower portion of 211. A second floor plate will be added in this area.

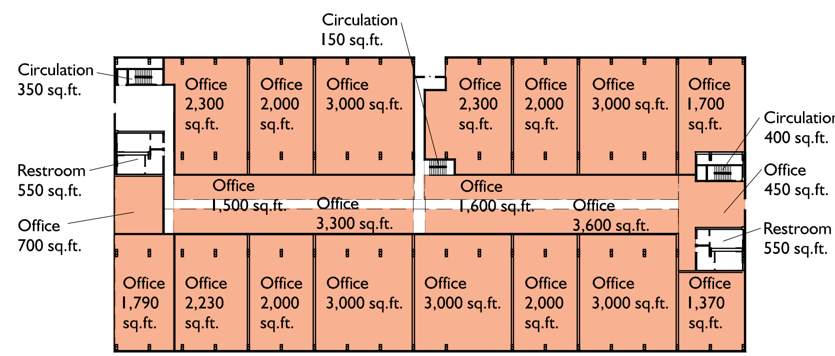
Figure 10. South elevation of Building 211. The lean-to will be demolished. Building 253 in background.

IV.1 Building 211: Reuse Approach

Building 211 is a wood-frame warehouse with a rectangular plan, which consists of three structural bays roughly 50 feet each in width. Existing height (27'-9" to the bottom of the lower truss cord) allows for insertion of a second floor plate, which maximizes square footage of the building. The proposed use for this building is B (offices/R&D). Both first and second floors will contain office spaces, support areas, and circulation (corridors and hallways). New windows will be provided on both the north and south side of the building to provide offices on the two lower floors with natural light. The second floor plate will have two large openings that will allow natural light from the roof monitors to reach the ground floor level, and allow the building to retain some of its large double-height volume. As part of this proposal, an existing deteriorated wooden addition on the south side will be removed, and existing siding and roofing will be replaced with compatible materials.



2nd Floor

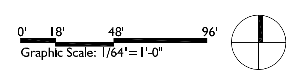


Ground Floor

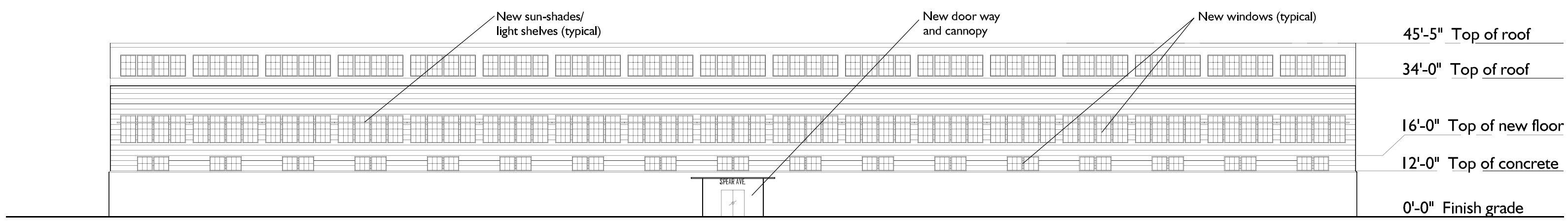
LEGEND

Office [80,520 sq.ft.]

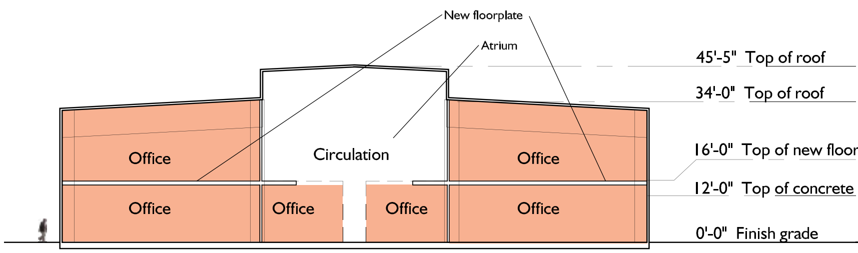
Circulation, Support [10,663 sq.ft.]



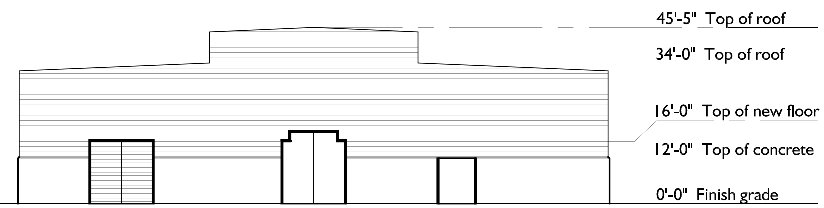
IV.1 **Building 211: Reuse Approach** continued



South Elevation



North-South Section



East Elevation

LEGEND

Office [80,520 sq.ft.]

Circulation, Support [10,663 sq.ft.]

0' 9' 24' 48'
Graphic Scale: 1/32"=1'-0"

IV.1 Building 211: Code Requirements

With a few accommodations, Building 211 can easily conform to the requirements of the California Building code. The change in occupancy and the addition of a second floor will require a sprinkler system. As a heavy timber frame construction, the floor plate is limited to 49,000 square feet. With the addition of sprinklers and the retention of wide open areas that surround the building (with the exception where it adjoins building 253) the allowable floor area can be increased and still meet regular code. The California Historic Building code allows some flexibility on building size, however, it too requires that the building be sprinklered when the occupancy type changes.

The length of the existing floor plate (325 feet) creates a need for additional exits (three in total), and three new stairs from the second floor. New restroom fixtures will be needed in order to meet code and occupancy requirements.

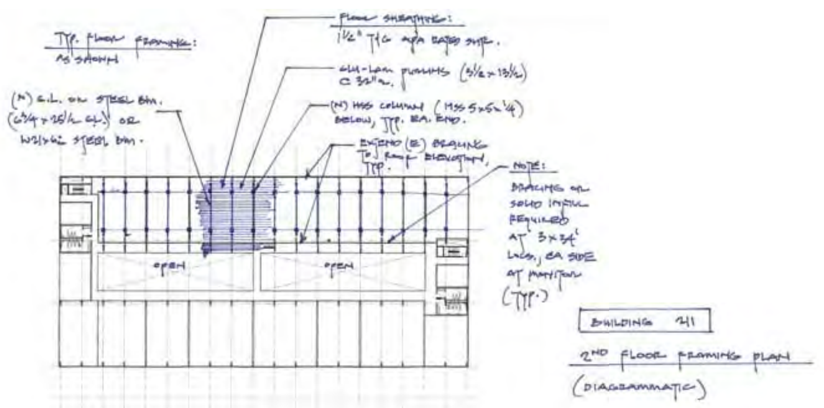
The width of spaces that surround the building also allow for un-protected and un-limited openings. The only exception is where Building 211 adjoins building 253. For the first 30 feet, the openings must be protected and limited in size. Any existing openings in this area are allowed to be sprinklered to meet this requirement per California Historic Building Code.

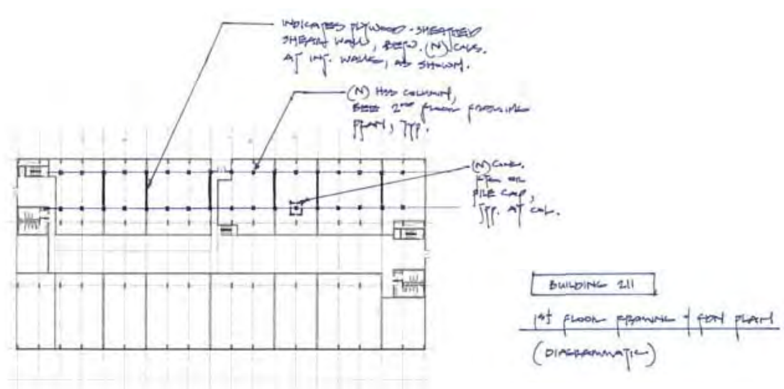
		Code Section (CBC 2007)	Notes
Address	211 Hunters Point Shipyard, Parcel C, San Francisco, 94124		
APN	4591A001		
Construction Date	1942		
Construction Type	Heavy Timber, Type IV	602.4	
Proposed Use	Core and shell for offices and research labs		
Occupancy type	Group B, Laboratories: testing/research	302.1	
Building Height	73 feet		
Maximum allowable height	65 feet	504.1	Can use existing building code to make compliant since no addition in height is proposed.
Current number of stories	1		
Proposed number of stories	2		
Maximum allowable stories	5	504.1	
Sprinklers	Yes	903.2	Not currently present, not required by code for occupancy type. Used for allowable area and story increase.
Current Area	49,336 square feet		Gross
Proposed Area	91,183 square feet		Gross
Maximum allowable area per story	36,000 square feet	504.1	
Area increase required	Yes		
Allowable area per story with increase	187,200 square feet	504.2	
Occupant load	774 occupants	1004.1	100 square feet per occupant
Percent of unprotected openings allowed	Unlimited, no building within 30 feet	704.8	North exterior wall
	Unlimited, no building within 30 feet	704.8	East exterior wall
	Unlimited, no building within 30 feet	704.8	South exterior wall, portions of existing opening may need to be protected
	None, attached to B253, must have 1 hr. separation	704.8	West exterior wall, portions of opening may need to be protected
Interior travel distance limitations	300'	1016.1	
Minimum number of exits	3 at first floor, 2 at second floor	1019.1	
Minimum number of toilet fixtures required	33	CPC, 412.1	table 4-1, total
Women's W/C	13		
Men's W/C	12		
Urinals	8		
Minimum number of lavatories required	20	CPC, 412.1	table 4-1, total
Women's	10		
Men's	10		
Minimum number of drinking fountains	0	CPC, 412.1	Table 4-1
Atrium considerations	1 hour separation from occupied spaces to atrium	404.5	

Existing Building Code		CBC Chapter 34	
Additions alterations or repairs to existing building	New work needs to comply with regular code for new construction	3403.1	Existing building code, CBC Chapter 34
Additions alterations or repairs to existing building impact to structure	Additions and alterations cannot increase the force by more than 5% unless new forces are still in compliance with the regular code. New elements need to meet regular code for structures.	3403.2	Existing building code, CBC Chapter 34
Fire escapes	This section does not apply since building exiting is served by stairs	3404.1	Existing building code, CBC Chapter 34
Change of Occupancy	No change is allowed that places the building in a different use/occupancy type, unless that new type can be made to meet with the regular code.	3406.1	Existing building code, CBC Chapter 34 Building meets regular code for requirements of new occupancy.
Change of Occupancy impact to structure	Structure must comply with the new occupancy's requirement for structure under the regular building code.	3406.4	Existing building code, CBC Chapter 34
Compliance	Use this section if building cannot be made compliant under regular code or historic building code	3410.0	Not required since re-use of buildings can be made compliant under the regular code and a few elements from the historic building code.
Historic Building Code		CBC Title 24 Part 8	(CHBC)
Application	This building is a qualified historic structure and can use the Historic Building Code	8-301.2	Based on contribution to historic district
Change in occupancy	Change in occupancy is permitted,	8-302.2	Change in occupancy does not necessarily require total conformance with regular code, per provisions in CHBC
Required separations	One hour maximum separations required where regular code specifies greater if a sprinkler system is installed	8-302.2	Sprinkler utilized in regular code for area increase
Maximum Floor Area	Multi story buildings must meet regular code requirement, except when a sprinkler is provided, there is no limit on floor area in the historic structure	8-302.4	Floor area made to work under regular code with the use of sprinklers.
Maximum Height	Historic building height is not limited provided it does not exceed that of the historical design	8-302.5	
Exterior wall protection	sprinklers may be used to satisfy requirement for existing openings	8-402.1	Portions of west and south walls will need separation where building 253 and 211 are connected.
Non-conformance with regular code	Where the building cannot meet the requirements of the regular code, sprinklers may be used	8-410.1	applies to occupancy, fire separation, exiting distances.
High-rise (buildings greater than 75 feet)	Building must meet all regular codes unless amended by CHBC	8-412	
Exiting width	Existing openings are permitted to be used even if they are less than the required minimum	8-502.2	
Exit stairs	Existing stairs that do not meet regular code are permitted to be used for exiting provided that they do not pose a hazard	8-502.3	
Accessibility	Regular code applies to accessibility, unless there is a threat to significant character defining features.	8-602.1	
Structural engineer review of historic structure	A qualified structural engineer should evaluate the building and assess condition	8-703.1	
New additions and alterations	Structures must conform to regular code	8-704.1	
Evaluation of structure	Structural Engineer should evaluate the building and propose upgrades as required. Consideration should be given to minimize loss and impact to historic fabric	8-705	
Lateral loads	Forces in the historic building need not exceed 0.75 times the seismic forces prescribed by 1995 CBC	8-706.1	
Mechanical, electrical, and plumbing systems	Systems shall comply with the regular code, unless amended by CHBC, existing system can be used if deemed safe	8-902	No existing systems in the building can be used. Will need all new mechanical, electrical and plumbing systems.

IV.1 Building 211: Structural Assessment

Building 211 is easily adaptable from a manufacturing/warehouse building into an office building. The large spans and open areas can be configured in a number of different ways, allowing for total flexibility in dividing space to create offices. Overall, the building as it stands today is in fairly good condition structurally. Some structural repairs are required to the roof diaphragm, and some additional lateral strengthening is needed to support the new use. Lateral strengthening can be in the form of 4 cross braces or sheer walls below the monitor windows for two bays each. New columns and beams will have to be added to support the second floor as well as the existing structure. These new columns will require new foundations since the integrity of the existing foundation's condition cannot be evaluated at this time.





emergent *structures, inc.*

Paul B. Hofland, SE
Principal

Bldg. 211 – Exterior, East Elevation

Building 211

Existing Building – Bldg. 211

General

Building 211 at Hunter's Point Shipyards is a wood-framed building, rectangular in plan, with overall dimensions of approximately 323 feet x 150 feet. The main portion of the building comprises a high, nominally flat-roofed center bay measuring approximately 50 feet wide x 323 feet in length. This center bay is flanked by a pair of lower bays, each of which also measure 50 feet x 323 feet. A continuous clerestory, or monitor, window occurs along the length of the building at each side of the center bay, between the lower flanking roofs and the high bay roof. The continuous monitor is glazed with multi-pane wood windows. There is a low shed roof structure addition on the southwest side of the building, measuring approximately 25 feet wide x 187 feet long. This long rectangular addition is in relatively poor condition.

The exterior walls are of reinforced concrete to approximately 10 to 12 feet above the first floor. Above this height, exterior walls are wood framed and diagonally board-sheathed. The building adjoins the east end of Building 253.

Gravity System

Exterior and interior columns occur on a 17 foot grid (one exterior each side of the building, and two interior, each side of the center high-bay), throughout the entire length of the building. Each of the bays is otherwise column free for 50 feet. Built-up wood roof trusses spanning 50 feet occur on each of the column grids at 17 foot o.c. , typically at both of the low flanking bays, and also at the high-bay space. A series of regularly spaced 2x roof rafters span longitudinally between the roof trusses. The wood roof rafters are sheathed with what appears to be 1x diagonal board sheathing.

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IV.1 Building 211: Structural Assessment continued

Building 211 (cont.)

Existing Building – Bldg. 211 (cont.)

Lateral System

The existing lateral system, supporting the existing walls and roof only, appears to be a wood braced-frame system in the East-West direction, and a vertically offset three-bay truss-frame in the North-South direction. Both of these systems appear to be somewhat incomplete, irregular or both. In the East-West direction at the exterior North and South walls, for example, there are double-diagonal braces in alternate bays, which extend only to the bottom plane of the roof trusses. Since the bracing does not extend to the roof plane, the columns must act in bending above the bottom of the trusses to deliver seismic loads from the roof diaphragm.

Foundations

Existing structural foundation plans for Building 211 were not provided, and were not reviewed. Thus we have not determined conclusively either what the existing foundation system is, or what it's allowable capacity may be at this time. We would recommend that further efforts be made to obtain these drawings, so that a determination of foundation type and capacity can be made. We would also recommend that any significant new loads (either gravity or seismic) be supported on new foundation elements, so as not to overload the existing ones. The choice of new column arrangement or of vertical lateral load resisting element locations can and should be made to facilitate the installation of new foundation elements for their support, and to minimize the introduction of new loads onto existing foundations. It should be noted that we did not observe any evidence of building damage that we could attribute directly to foundation movement. Existing foundations appear to be performing satisfactorily in supporting the loads they have been subjected to.

Visual Condition Assessment

Based on our cursory visual assessment, Building 211 appears to be in relatively good overall condition. The long rectangular low-roofed addition is in relatively poor condition, with evidence of water damage and moisture intrusion.

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Building 211 (cont.)

Planned Additions / Revisions

Building 211 comprises approximately 53,300 square feet on a single main floor slab. A proposed addition would add a structured second floor of approximately 42,000 square feet, bringing the total building square footage to approximately 95,300. The new second floor would comprise approximately 32,500 square feet of new office space, approximately 6,300 square feet of circulation space, and approximately 4,300 square feet for toilets, mechanical space and miscellaneous walls. The office space would be located primarily in the two flanking side bays, while the circulation would be principally around the perimeter of the central high-bay space. With this arrangement, natural light from the center bay monitor roof can reach the ground floor through the open-to-below areas left at the high bay.

The proposed redevelopment of Building 211 also anticipates the removal of the long, low rectangular shed-roofed addition mentioned above. As this element was determined to be in a deteriorated state, this will preclude the need to invest significant monies in its refurbishment.

Based on our field observations and some limited study, we believe that it is structurally feasible to create the planned additions and revisions, provided existing structural systems are not overloaded, and new ones are employed to handle any significant new loads, whether seismic or gravity.

Gravity Systems for Proposed Addition

The existing column grid spacing in the longitudinal direction is 17 feet on center. We would suggest that the second floor be framed of either wood framing or a combination of wood and structural steel beam framing. To accomplish this framing system, either glu-lam or steel beams could be placed on the the column grids, with at least a single interior column at the mid-span of the side bay. Assuming a nominal office unit live loading of 100 psf, purlins spanning 17 feet could be 3 1/8 x 13½ glu-lams spaced at 32" o.c. Plywood sheathing could be 1-1/8" APA rated sheathing, T&G, Exposure 1. Beams on the column lines could be approximately 6 ¾ x 25½ glu-lams, with AITC (American Institute of Timber Construction) combination symbol 24F-V8, if wood, or W21x68, ASTM 992 (Gr. 50), continuous. The beam sizes given assume the introduction of two new column lines, located 10 feet inside each end of the beams. New columns would be on the order of HSS5x5x1/4. New footings for the new columns may be assumed to be 5'-0 x 5'-0 x 1'-8, typical. All of the above information is preliminary and to be used for estimating purposes only; actual required sheathing, member and foundation sizes may vary.

Lateral Systems for Proposed Addition

We believe the new 2nd floor structure can be supported laterally in the East-West direction by the existing exterior concrete walls which extend to this level. Attachment details between the new 2nd floor framing and the exterior concrete wall would need to be developed, but might include wood ledgers with expansion bolts or steel plates, expansion bolts and thru bolts. For lateral loads in this same direction, new plywood-sheathed shear walls or steel diagonal bracing extending to the 2nd floor will be required along grid lines B and C, flanking the central high-bay. For estimating purposes, four 34-foot bays should be assumed to be required for this purpose along each of the primary interior longitudinal grid lines, B and C.

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IV.1 Building 211: Structural Assessment continued

Building 211 (cont.)

In the North-South direction, the new second floor system will require lateral bracing in the form of either new plywood-sheathed shear walls or steel diagonal braced frames located at walls oriented in the north-south direction. For estimating purposes, assume that each side bay will require four interior shear walls (or braces) x 30 feet long, between new columns. This should occur at each side of the high center bay.

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IV.1 Building 211: Cost Estimate

The Preliminary Cost Estimate (below) is provided to predict rehabilitation and reuse of Building 211 based on the conceptual reuse diagrams, pages 10-11.

ESTIMATE WORKSHEET

HUNTER'S POINT REHABILITATION BUILDING: 211

PROJECT: **HUNTER'S POINT SHIPYARD, PARCEL C, SAN FRANCISCO, CA 94124** (E) BUILDING GSF: 49,336

PHASE: **FEASIBILITY STUDY (PRELIMINARY)** TOTAL BUILDING GSF: 91,183

ESTIMATE DATE **AUGUST 28, 2009** 2 of 4 8/28/2009 5:20 PM

BID DATE: **UNKNOWN** Copy of Hunters Point Concept 08_28_09

PREPARED BY: J.R. CONKEY & ASSOCIATES

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
1000	ABATEMENT ALLOWANCE	49,336	SF	$10.00	$493,360
2000	DEMOLITION	49,336	SF	$3.75	$185,010
3000	NEW SECOND FLOOR STRUCTURE	41,847	SF	$35.00	$1,464,645
3000	FULL SEISMIC UPGRADE	91,183	SF	$12.50	$1,139,788
5000	STAIRS/HANDRAILS	2	FLTS	$25,000.00	$50,000
6000	MISC FINISH CARPENTRY	91,183	SF	$0.50	$45,592
7000	ROOF REPLACEMENT	49,336	SF	$12.00	$592,032
7000	WATERPROOFING (ALLOWANCE)	49,336	SF	$0.50	$24,668
8000	EXTERIOR SKIN / WINDOW REPLACEMENT (ALLOWANCE)	47,300	SF	$75.00	$3,547,500
9000	CORE FINISHES (RESTROOMS, CORRIDORS)	10,675	SF	$175.00	$1,868,125
9000	TENANT IMPROVEMENT FINISHES	80,508	SF	$125.00	$10,063,500
10000	SPECIALTIES	91,183	SF	$0.50	$45,592
14000	ELEVATORS	4	STOPS	$50,000.00	$200,000
15000	FIRE PROTECTION SYSTEM	91,183	SF	$6.00	$547,098
15000	HVAC	91,183	SF	$25.00	$2,279,575
15000	PLUMBING (CORE)	28	FIXT	$4,000.00	$112,000
15000	LAB PLUMBING (TENANT IMPROVEMENT)	91,183	SF	$8.00	$729,464
16000	ELECTRICAL - POWER	91,183	SF	$25.00	$2,279,575
16000	LIGHTING (CORE)	10,675	SF	$6.50	$69,388
16000	LIGHTING (TENANT IMPROVEMENT)	80,508	SF	$7.50	$603,810
16000	FIRE ALARM	91,183	SF	$6.00	$547,098
	EXCLUDES: SITEWORK, SITE UTILITIES, UTILITY COMPANY CHARGES, DEVELOPMENT FEES,				
	DEVELOPER FEES, FF&E COSTS, DESIGN FEES, CONSTRUCTION MANAGEMENT FEES,				
	HAZARDOUS MATERIALS ABATEMENT (EXCEPT FOR ALLOWANCE NOTED) AND CHANGE ORDER CONTINGENCY				
	SUBTOTAL HARD COSTS				**$26,887,818**
	CONTINGENCY				
	ESTIMATING CONTINGENCY	20.00%			**$5,377,564**
	SUBTOTAL CONSTRUCTION COSTS				**$32,265,382**
	MARK-UPS				
	GENERAL CONDITIONS	10.00%			$3,226,538
	OVERHEAD & PROFIT	10.00%			$3,549,192
	INSURANCE & BONDS	2.25%			$878,425
	SUBTOTAL MARK-UPS				**$7,654,155**
	SUBTOTAL CONSTRUCTION COSTS & MARK-UPS				**$39,919,537**
	ESCALATION				
	ESCALATION (FIGURED BY OTHERS)	0.00%			**$0**
	TOTAL CONSTRUCTION ESTIMATE:				**$39,919,537**

IV.2 Building 231

Building 231 is a steel-frame industrial building, located just south of Dry Dock #2 in the Ship Repair area of the former shipyard. The eastern half of the building was constructed in 1942, while the remainder was constructed between 1944 and 1945. The original building and addition are indistinguishable from one another. The basic building has a rectangular plan (over 193,000 sq.ft.) and is capped by a flat roof with roof monitors running the width of the building. Freight elevator shafts are located at the east and west ends of the north elevation, as well as at the center of the south elevation. The freight elevator columns and the spandrel areas of the side walls are clad in thick corrugated sheet iron siding. Elsewhere the curtain wall is enclosed with operable corrugated safety glass panels, reinforced with chicken wire. A band of industrial steel windows with central awning sash wraps around the upper level of the building. Two-story shed additions project from both the north and south elevations and two rolling metal freight doors with concrete door surrounds are located at the building's west end. The interior is characterized by a long, unobstructed three-story space.

The character-defining features of Building 231 include, but are not limited to:
- Rectilinear massing;
- Large and unobstructed interior volume;
- Exposed steel-frame structural system consisting of steel trusses, columns, and bracing;
- Corrugated metal siding;
- Corrugated safety glass siding;
- Monitor windows at the upper level;
- Industrial steel sash windows at the upper level;
- Enlarged ground floor freight openings; and
- External stair and elevator shafts.

Pros
- Existing building is re-used in its original location
- New program makes relatively minor impact on the original structure
- Minor upgrades and demolition required to existing structure to accommodate program
- Additional floor plates help brace the existing structure
- Parking levels and/or Mechanical floor can be exchanged for office space if desired (building as configured would still meet code)
- Retail use at lower level "activates" long edges of building, engaging pedestrians and creating a lively streetscape
- Large number of cars can be accommodated without any addition of height or density
- Large roof area conducive to alternative energy production, i.e. solar.
- Excellent views from upper floor

Cons
- Addition of a floor plate alters original open plan and volume
- Independent structure is required for new floor plates
- Cost per parking spot is relatively high
- Much of the glass at the upper level would need to be replaced due to breakage
- If alternative (office) use is preferred, not all offices would have direct access to natural light (based on the wide floor plate)

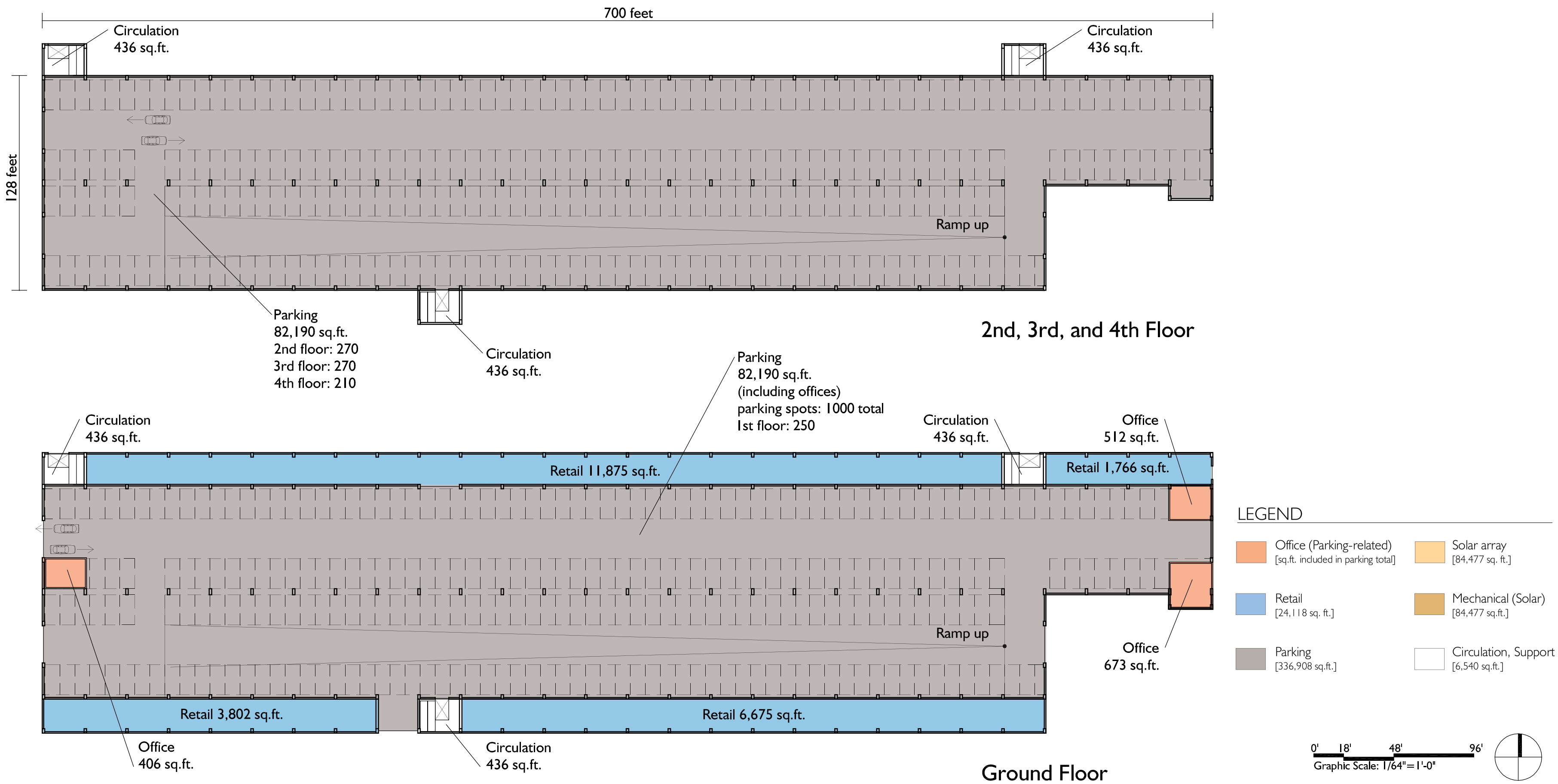
Figure 11. South elevation of Building 231.

Figure 12. Interior view of parking area; half of the width is hidden behind the columns.

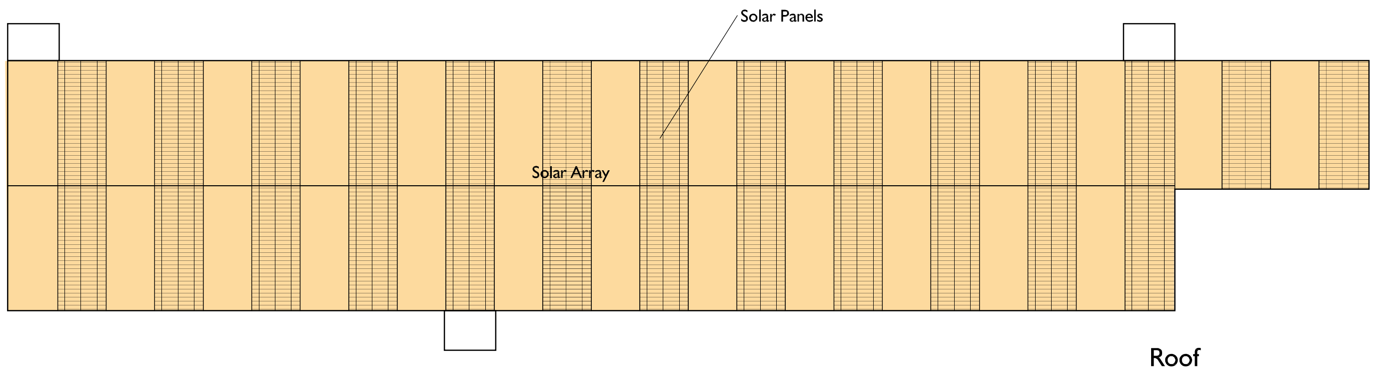
Figure 13. East elevation of Building 231.

IV.2 Building 231: Reuse Approach

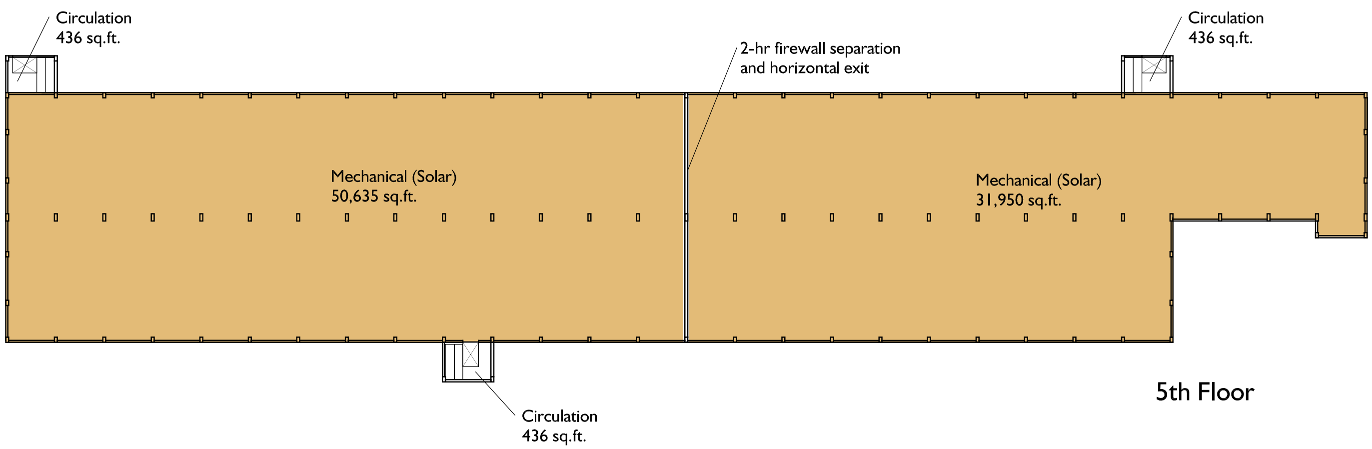
The existing configuration of the building and its oversized volume makes it a good candidate for use as a parking structure. The height of the main building volume (45 feet to the bottom of structure) allows for the insertion of up to three new floor plates. We have proposed that a total of four floors be used to accommodate parking, and the existing upper floor be used as a mechanical facility or an energy plant. The existing roof volume will be clad in new solar panels to provide power to several buildings on the site. To accommodate additional a new steel framed structure be inserted to support it. Existing glazing will remain where in good condition, while deteriorated sections will be removed. The existing siding will be replaced with new siding material to imitate the character of the original material. Additionally, two-story shed additions along the north and south sides of the main building volume are proposed to be used as retail spaces.



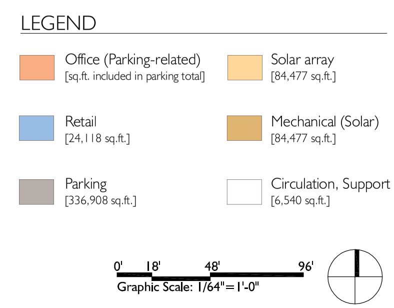
IV.2 Building 231: Reuse Approach continued



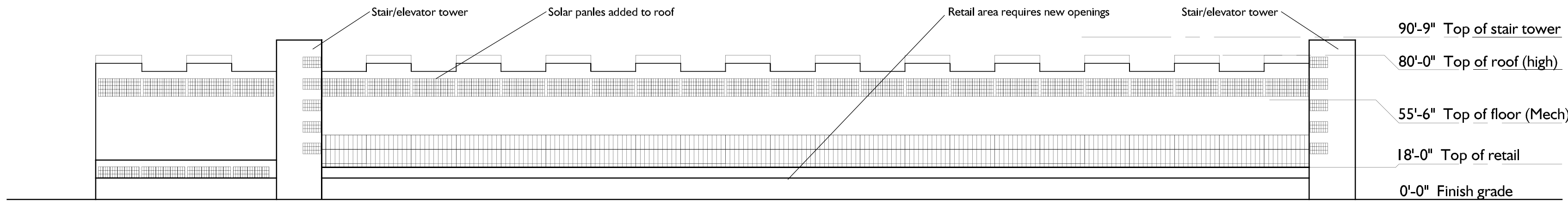
Roof



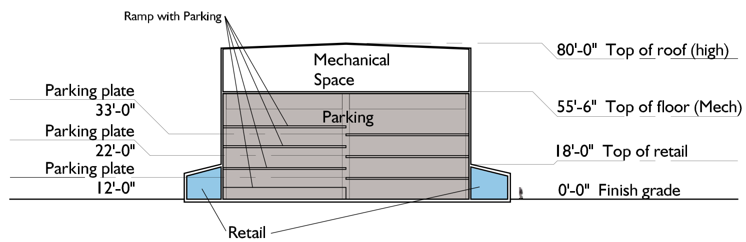
5th Floor



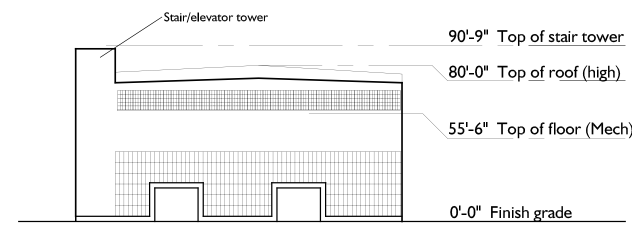
IV.2 Building 231: Reuse Approach continued



South Elevation



North-South Section



East Elevation

LEGEND

- Office (Parking-related) [sq.ft. included in parking total]
- Retail [24,118 sq.ft.]
- Parking [336,908 sq.ft.]
- Solar array [84,477 sq.ft.]
- Mechanical (Solar) [84,477 sq.ft.]
- Circulation, Support [6,540 sq.ft.]

0' 18' 48' 96'
Graphic Scale: 1/64"=1'-0"

IV.2 Building 231: Code Requirements

Converting building 231 into a parking garage, solar electrical plant, and ground level retail requires a few accommodations to be made. The change in occupancy type generally requires the addition of sprinklers where none were present before. In this case sprinklers are required to make the building's story count work with regular code. Historic code cannot be employed here since the additional stories are new. As it currently stands, there are two stories. The parking garage adds an additional three stories for a total of five, however in type IIB construction only four are allowed. Sprinklers allow for one additional story to be added above the four-floor allowance. Restrooms are not required for electrical/mechanical rooms (on the fifth floor) and parking. The retail occupancy will require these facilities; numbers depend on type of business (restaurant, food service, mercantile, etc). An assumption of mercantile is utilized for the code review.

Under the regular code, the building is too tall at 80 feet; a maximum height of 50 feet is allowed. To address this situation, the California Historical Building Code can be utilized, since there is no new increase in height proposed; the building can remain at its originally designed height. However, this building qualifies as a high-rise under the historic code (buildings greater than 75 feet), and therefore needs to meet all the requirements of such buildings under the regular code. This has the greatest impact on exits, sprinklers, paths of travel, and fire ratings of stair shafts, to name a few.

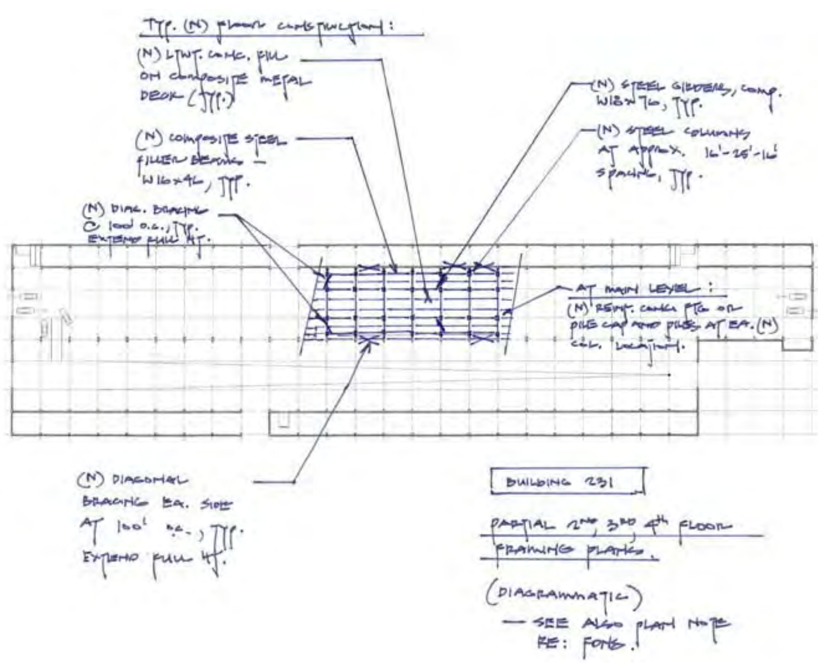
Existing openings pose no problem and do not need to be protected. The open space around Building 231 is clear of other buildings by at least 30 feet, and in some cases more than 80 feet. There are currently three exits, which works with the new proposed occupancy. A fire wall with a two hour rating will need to be installed on the top floor where the solar electric facility is located, because the occupancy type requires a shorter distance to an exit than that of the parking structure.

		Code Section (CBC 2007)	Notes
Address	231 Hunters Point Shipyard, Parcel C, San Francisco, 94124		
APN	4591A001		
Construction Date	1945		
Construction Type	Steel Frame, Type IIB	602.2	
Proposed Use	Parking structure, solar electrical plant, retail at perimeter		
Occupancy type	Parking: Group S-2,	302.1	
	Electrical plant: Group S-2,	302.1	
	Retail: Group M	302.1	
Building Height	80 feet		
Maximum allowable height	55 feet	504.1	Can use existing building code to make compliant since no addition in height is proposed.
Current number of stories	2		
Proposed number of stories	5		4 stories of parking, 1 story of mechanical
Maximum allowable stories	4	504.1	
Sprinklers	Yes	903.2	Not currently present, not required by code for occupancy type. Used for allowable area and story increase.
Current Area	195,370 square feet		Gross
Proposed Area	452,050 square feet		Gross
Maximum allowable area per story	26,000 square feet	504.1	
Area increase required	Yes		
Allowable area per story with increase	122,850 square feet	504.2, 506.1	Largest floor plate is 109,810 square feet (first floor)
Occupant load	Parking: 1623 occupants	1004.1	Square foot per occupant: Parking: 200; 324,452 square feet
	Electrical: 824 occupants	1004.1	Square foot per occupant: Mechanical: 100; 82,390 square feet.
	Retail: 804 occupants	1004.1	Square foot per occupant: Retail: 30; 24,118 square feet
Percent of unprotected openings allowed	Unlimited, no building within 30 feet	704.8	North exterior wall
	Unlimited, no building within 30 feet	704.8	East exterior wall
	Unlimited, no building within 30 feet	704.8	South exterior wall
	Unlimited, no building within 30 feet	704.8	West exterior wall
Interior travel distance limitations	300'	1016.1	Mechanical floor requires a horizontal exit to achieve 300 foot requirement
Minimum number of exits	3	1019.1	2 required per code, 3 provided because of travel distance limitations
Minimum number of toilet fixtures required	17	CPC, 412.1	Total. Retail only, none required for parking
Women's W/C	9		
Men's W/C	4		
Urinals	4		
Minimum number of lavatories required	9	CPC, 412.1	Total. Retail only, none required for parking
Women's	5		
Men's	4		
Minimum number of drinking fountains	None	CPC, 412.1	Retail

Existing Building Code		CBC Chapter 34	
Additions alterations or repairs to existing building	New work needs to comply with regular code for new construction	3403.1	Existing building code, CBC Chapter 34
Additions alterations or repairs to existing building impact to structure	Additions and alterations cannot increase the force by more than 5% unless new forces are still in compliance with the regular code. New elements need to meet regular code for structures.	3403.2	Existing building code, CBC Chapter 34
Fire escapes	This section does not apply since building exiting is served by stairs	3404.1	Existing building code, CBC Chapter 34
Change of Occupancy	No change is allowed that places the building in a different use/occupancy type, unless that new type can be made to meet with the regular code.	3406.1	Existing building code, CBC Chapter 34 Building meets regular code for requirements of new occupancy.
Change of Occupancy impact to structure	Structure must comply with the new occupancy's requirement for structure under the regular building code.	3406.4	Existing building code, CBC Chapter 34
Compliance	Use this section if building cannot be made compliant under regular code or historic building code	3410.0	Not required since re-use of buildings can be made compliant under the regular code and a few elements from the historic building code.
Historic Building Code		CBC Title 24 Part 8	(CHBC)
Application	This building is a qualified historic structure and can use the Historic Building Code	8-301.2	Based on contribution to historic district
Change in occupancy	Change in occupancy is permitted	8-302.2	Change in occupancy does not necessarily require total conformance with regular code, per provisions in CHBC
Required separations	One hour maximum separations required where regular code specifies greater if a sprinkler system is installed	8-302.2	Sprinkler utilized in regular code for area increase
Maximum Floor Area	Multi story buildings must meet regular code requirement, except when a sprinkler is provided, there is no limit on floor area in the historic structure	8-302.4	Floor area made to work under regular code with the use of sprinklers.
Maximum Height	Historic building height is not limited provided it does not exceed that of the historical design	8-302.5	
Exterior wall protection	sprinklers may be used to satisfy requirement for existing openings	8-402.1	Not required for this building
Non-conformance with regular code	Where the building cannot meet the requirements of the regular code, sprinklers may be used	8-410.1	applies to occupancy, fire separation, exiting distances.
High-rise (buildings greater than 75 feet)	Building must meet all regular codes unless amended by CHBC	8-412	
Exiting width	Existing openings are permitted to be used even if they are less than the required minimum	8-502.2	
Exit stairs	Existing stairs that do not meet regular code are permitted to be used for exiting provided that they do not pose a hazard	8-502.3	
Accessibility	Regular code applies to accessibility, unless there is a threat to significant character defining features.	8-602.1	
Structural engineer review of historic structure	A qualified structural engineer should evaluate the building and assess condition	8-703.1	
New additions and alterations	Structures must conform to regular code	8-704.1	
Evaluation of structure	Structural Engineer should evaluate the building and propose upgrades as required. Consideration should be given to minimize loss and impact to historic fabric	8-705	
Lateral loads	Forces in the historic building need not exceed 0.75 times the seismic forces prescribed by 1995 CBC	8-706.1	
Mechanical, electrical, and plumbing systems	Systems shall comply with the regular code, unless amended by CHBC, existing system can be used if	8-902	No existing systems in the building can be used. Will need all new mechanical, electrical and plumbing

IV.2 Building 231: Structural Assessment

Converting building 231 into a parking structure requires the addition of three floors to accommodate 1000 spaces. The existing structure, although visually in good condition, will not support the extra floors on its own. A new system of columns, shear walls, bracing, and metal decking will need to be introduced to take the additional load of the new floor plates. There was not enough information to review the foundations, but most likely new footings will be required for the added columns.



emergent
structures, inc.

Paul B. Hofland, SE
Principal

Building 231 – Exterior View Looking SE

Building 231

Existing Building – Bldg. 231

General

Building 231 at Hunter's Point Shipyards is a long, narrow steel-framed structure, rectangular in plan, with overall dimensions of approximately 700 feet x 165 feet at the main floor level. An end notch measuring approximately 100 feet x 82 ½ feet at the southeast end of the building occurs in what would otherwise be a regular rectangular plan. The building is comprised of two levels at present: a very tall main floor level industrial-type space, and a structured upper level with a unique alternating high-low roof framing system which admits plenty of natural light. The building has a pair of 20 foot wide continuous longitudinal low-roofed spaces at the main floor, which flank the main portion of the building.

Gravity System

The main portion of the building comprises a high-bay main floor space, flanked by columns and with a single row of columns running down the center of the 125 foot wide space. Steel Rolled steel columns occur on a 25 foot grid spacing along the length of the building. At the top of this main floor space is a concrete floor/ceiling, supported on steel framing. The upper level concrete floor slab appears to be supported on concrete-encased steel beams spanning between steel trusses located typically on the 25 foot column grid. The trusses have a classical web arrangement, with 9 interior panel points over a 56 ½ foot span.

The roof framing above the upper level floor is remarkable in that it has been designed to create alternating low and high roof planes, with clerestories at 25 foot centers to admit natural light. Transverse open-web steel roof trusses span across the space on 25 foot centers. At the high roof areas, steel beams span between the top chords of the trusses to support the high roof. At alternating low roof areas, steel beams

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IV.2 Building 231: Structural Assessment continued

Building 231 (cont.)

Existing Building – Bldg. 231(cont.)

Gravity System (cont.)

span between the roof truss bottom chords to support the lower roof areas. Roof truss vertical and diagonal webs run between the roof truss top and bottom chords.

The longitudinal exterior walls appear to be constructed of reinforced concrete to approximately 10 feet to 12 feet above the first finished floor. Above this height, exterior walls are clad in a steel-supported system of glazing and industrial metal panels.

Lateral System

Double diagonal steel lattice bracing occurs between alternate pairs of building columns both above and below the existing upper level floor. At the main floor level there are typically three tiers of diagonal lattice bracing occurring between the main floor and the underside of the upper floor. Above the upper floor, a single tier is provided between the upper floor and the intermittent plane of the lower portion of the roof.

There is a system of horizontal bracing which occurs at the bottom chord of the trusses; this effectively braces the bottom chords at roughly ¼ points from each end. The horizontal bracing is continuous along the end bays of the trusses, and is continuous over the interior portion at every 4^{th} bay. This bracing essentially creates a lightweight diaphragm in the plane of the bottom chord of the trusses.

Foundations

Existing structural foundation plans for Building 231 were not provided, and were not reviewed. Thus we have not determined conclusively either what the existing foundation system is, or what it's allowable capacity may be at this time. We would recommend that further efforts be made to obtain these drawings, so that a determination of foundation type and capacity can be made. We would also recommend that any significant new loads (either gravity or seismic) be supported on new foundation elements, so as not to overload the existing ones. The choice of new column arrangement or of vertical lateral load resisting element locations can and should be made to facilitate the installation of new foundation elements for their support, and to minimize the introduction of new loads onto existing foundations. It should be noted that we did not observe any evidence of structural damage in Building 231 that we could attribute directly to foundation movement. Existing foundations appear to be performing satisfactorily in supporting the loads that they have been subjected to.

Visual Condition Assessment

Based on our cursory visual assessment, Building 231 appears to be in relatively good overall condition.

Planned Additions / Revisions

The proposed additions to Building 231 consist of three new floors of elevated framing inside the main floor high-bay space. The interior main floor slab and the new elevated floor slabs are programmed for parking, with approximately 1200 spaces provided in a double-loaded arrangement with a two-way central drive aisle and single corkscrew ramp.

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Building 231 (cont.)

Planned Additions / Revisions (cont.)

We understand that the current proposal is to use the existing low bay spaces flanking the main building volume for retail and/or miscellaneous coffee/food service. The existing upper floor is envisioned as mechanical / support space for clean energy production.

Gravity System for Proposed Addition

We recommend that the new elevated floors be constructed as composite concrete-filled metal deck on composite steel beams supported on new steel columns. New columns should be located to respect the drive aisles and parking layout. We recommend that new columns be provided not only along the drive aisle, but also near the exterior walls and existing central column line, to effectively support the new floors without increasing loads on the existing structure or foundations. To facilitate this, we suggest that columns could be placed at approximately 50 feet o.c. in the longitudinal direction, and perhaps at a spacing of approximately 16' – 25' – 16' in the transverse direction, centered on the drive aisle. With an assumed design live load of 50 psf for passenger car parking, and with filler beams spaced at approximately 8 foot on center, spanning 25 feet, a typical filler beam could be a W16x46, and typical girders could be W18x76. Column gravity loads would be on the order of 415 kips for interior columns, and 225 kips for exterior columns. A typical exterior column would be on the order of a W10x49, and a typical interior column would be on the order of a W10x76. New spread footing sizes might be on the order of 12 foot square x 3 foot thick for interior columns, and 8 foot square x 2.5 foot thick for exterior columns. All sizes noted above are preliminary, are provided for preliminary estimating purposes only, and are subject to change.

Lateral System for Proposed Addition

For Building 231 and its proposed addition, we would recommend the introduction of a new steel braced frame or concrete shear wall lateral system, extending at least to the existing upper level floor, integrating the planned new floor levels with the existing upper floor. It will likely be most efficient to plan for relatively few, well-dispersed locations for the new braced frames or shear walls, rather than to replace the existing system of lattice diagonal bracing with new lateral load resisting elements on a one-for-one basis. Once this is done, the braced frames or shear walls should be extended to the roof above the upper level floor. New steel collectors will be required to effectively deliver seismic loads generated at the roof into the new vertical lateral elements.

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IV.2 Building 231: Cost Estimate

The Preliminary Cost Estimate (below) is provided to predict rehabilitation and reuse of Building 231 based on the conceptual reuse diagrams, pages 17-19.

ESTIMATE WORKSHEET

HUNTER'S POINT REHABILITATION

PROJECT: **HUNTER'S POINT SHIPYARD, PARCEL C, SAN FRANCISCO, CA 94124**
PHASE: **FEASIBILITY STUDY (PRELIMINARY)**
ESTIMATE DATE **JUNE 26, 2009**
BID DATE: **UNKNOWN**
PREPARED BY: J.R. CONKEY & ASSOCIATES

BUILDING: 231
(E) BUILDING GSF: 195,370
TOTAL BUILDING GSF: 452,050

3 of 4
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Hunters Point Concept 6_26_09

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
1000	ABATEMENT ALLOWANCE	195,370	SF	$10.00	$1,953,700
2000	DEMOLITION	195,370	SF	$3.75	$732,638
3000	NEW PARKING STRUCTURE	337,152	SF	$55.00	$18,543,360
3000	FULL SEISMIC UPGRADE	452,050	SF	$7.50	$3,390,375
5000	STAIRS/HANDRAILS	12	FLTS	$25,000.00	$300,000
6000	MISC FINISH CARPENTRY	452,050	SF	$0.50	$226,025
7000	ROOF REPLACEMENT	116,000	SF	$12.00	$1,392,000
7000	WATERPROOFING (ALLOWANCE)	452,050	SF	$0.50	$226,025
8000	EXTERIOR SKIN / WINDOW REPLACEMENT (ALLOWANCE)	112,450	SF	$85.00	$9,558,250
9000	CORE FINISHES (RESTROOMS, CORRIDORS)	26,390	SF	$175.00	$4,618,250
9000	TENANT IMPROVEMENT FINISHES	2,948	SF	$120.00	$353,760
10000	SPECIALTIES	452,050	SF	$0.50	$226,025
14000	ELEVATORS	12	STOPS	$50,000.00	$600,000
15000	FIRE PROTECTION SYSTEM	452,050	SF	$6.00	$2,712,300
15000	HVAC	29,338	SF	$35.00	$1,026,830
15000	PLUMBING	50	FIXT	$4,000.00	$200,000
16000	ELECTRICAL - POWER	452,050	SF	$17.50	$7,910,875
16000	LIGHTING	452,050	SF	$5.50	$2,486,275
16000	FIRE ALARM	452,050	SF	$6.00	$2,712,300
16000	PHOTOVOLTAIC	1,302,467	WATTS	$5.90	$7,684,553
	EXCLUDES: SITEWORK, SITE UTILITIES, UTILITY COMPANY CHARGES, DEVELOPMENT FEES,				
	DEVELOPER FEES, FF&E COSTS, DESIGN FEES, CONSTRUCTION MANAGEMENT FEES,				
	HAZARDOUS MATERIALS ABATEMENT (EXCEPT FOR ALLOWANCE NOTED,)				
	SUBTOTAL HARD COSTS				**$66,853,541**
	CONTINGENCY				
	ESTIMATING CONTINGENCY	20.00%			**$13,370,708**
	SUBTOTAL CONSTRUCTION COSTS				**$80,224,249**
	MARK-UPS				
	GENERAL CONDITIONS	10.00%			$8,022,425
	OVERHEAD & PROFIT	10.00%			$8,824,667
	INSURANCE & BONDS	2.25%			$2,184,105
	SUBTOTAL MARK-UPS				**$19,031,197**
	SUBTOTAL CONSTRUCTION COSTS & MARK-UPS				**$99,255,446**
	ESCALATION				
	ESCALATION (FIGURED BY OTHERS)	0.00%			**$0**
	TOTAL CONSTRUCTION ESTIMATE:				**$99,255,446**

IV.3 Building 253

Building 253 is a concrete-frame, glass curtain wall industrial building with two distinct segments: a six-story tall factory/office area, and a three-story tall industrial plant. Building 253 is connected to the west end of Building 211, and the two buildings are contiguous with one another. The six-story portion of Building 253 features a reinforced concrete-frame and floors, with bands of metal, fixed and awning sash windows at each level. Full height, concrete stairwell/freight elevator towers are located at the northwest and southeast corners and a gantry attaches to the south elevation for external hoisting. This gantry appears to be mounted on a track that wraps around the top of the building. The three-story portion of Building 253 also features a concrete frame and is almost entirely glazed with operable, steel frame, corrugated wire glass panels (awning windows). The roof of this segment is also covered with corrugated glass. Two, concrete frame, rolling metal industrial doors punctuate the west facade of the three-story building.

The character-defining features of Building 253 include, but are not limited to:
- Rectilinear massing;
- Open plan;
- Unobstructed interior volume;
- Corrugated safety glass siding panels;
- Corrugated safety glass roofing panels;
- Transparency of the exterior siding and roof monitors;
- Exposed concrete structural system;
- Glazed tower; and
- Wide structural bays.

Pros
- Existing building is re-used in its original location
- Rehabilitated building would offer Class A office and lab spaces based on the available floor to ceiling heights, sun exposure and views, vibration-proof floor plates, layout flexibility and new infrastructure.
- Minor upgrades and demolition required to existing structure to accommodate program (see cons as well)
- Large volumes allow for additional rental space by inserting three new floor plates
- Current structure is very adaptable to almost any configuration (see cons as well)
- Several different types of programs can be accommodated in the same building on different levels
- Existing stairs and elevator locations work with proposed occupancy
- Glazed exterior walls provide plenty of natural light
- Upper floors have great views
- Top floor is capable of accommodating alternative uses (office, fitness facility, etc.), not only food service

Cons
- Addition of floor plates alters large atrium space, affecting the industrial character of the building
- Requires additional sheer walls, may have an impact on how space can be configured
- Much of the exterior glass is damaged and will require replacement in-kind.

Figure 14. West elevation of Building 253. Tower portion on right and Atrium portion on left.

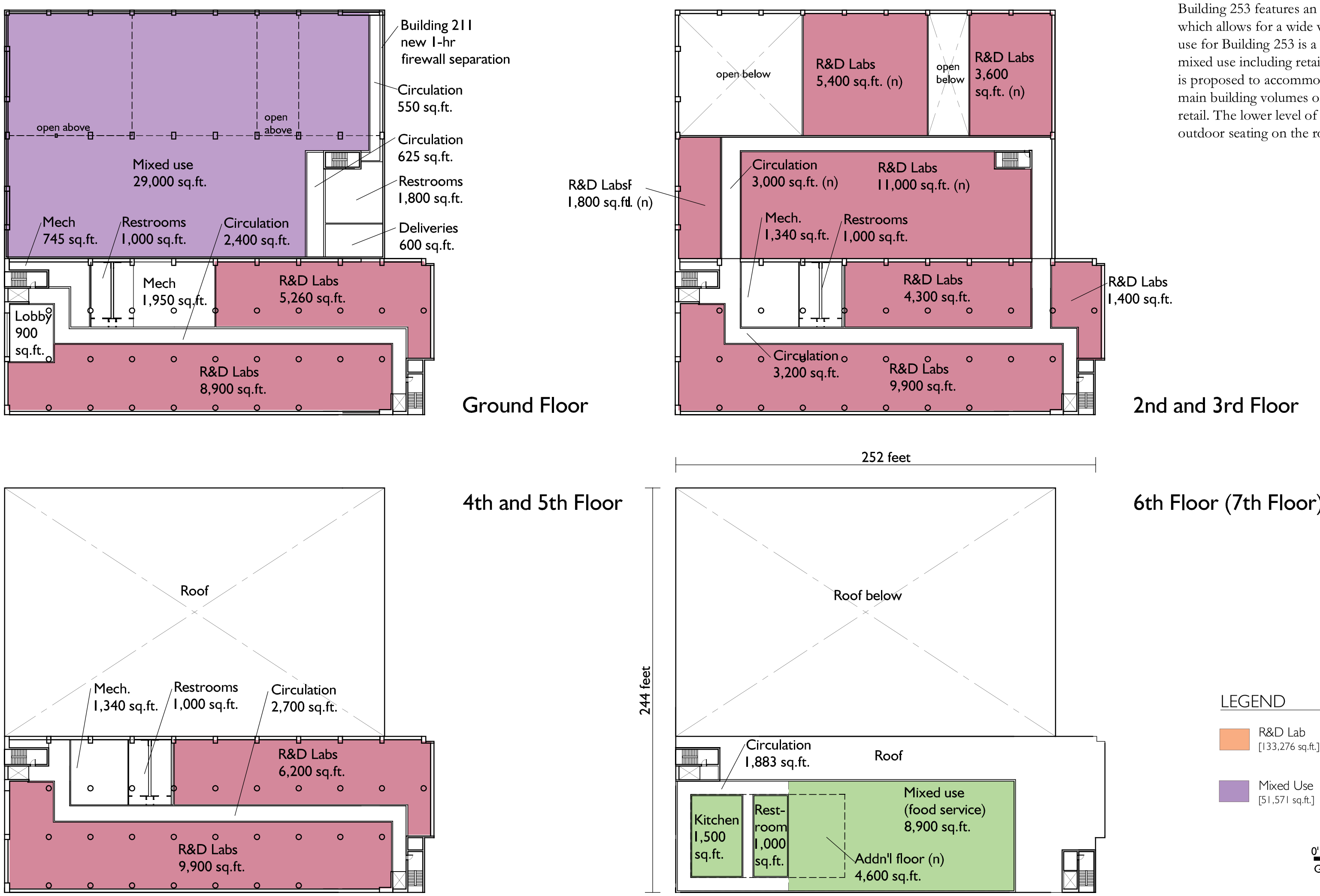
Figure 15. South and west elevations of Building 253. Windows are in poor condition.

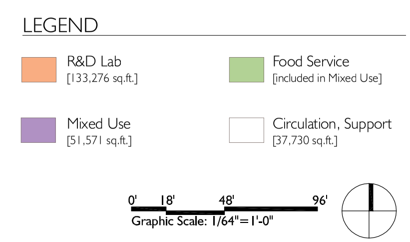
Figure 16. Interior view of 6th floor.

Figure 17. Overall view of atrium.

IV.3 Building 253: Reuse Approach

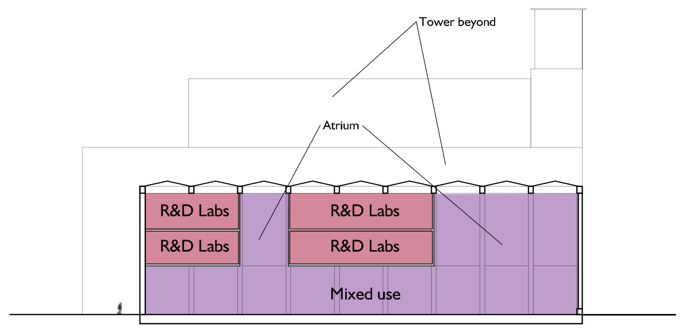
Building 253 features an unobstructed, multi-level floor plate, which allows for a wide variety of new uses. The proposed use for Building 253 is a combination of offices, R&D, and mixed use including retail and restaurant. The six-story tower is proposed to accommodate R&D and office spaces, while the main building volumes on the lower level will accommodate retail. The lower level of the tower will have a restaurant with outdoor seating on the roof deck.



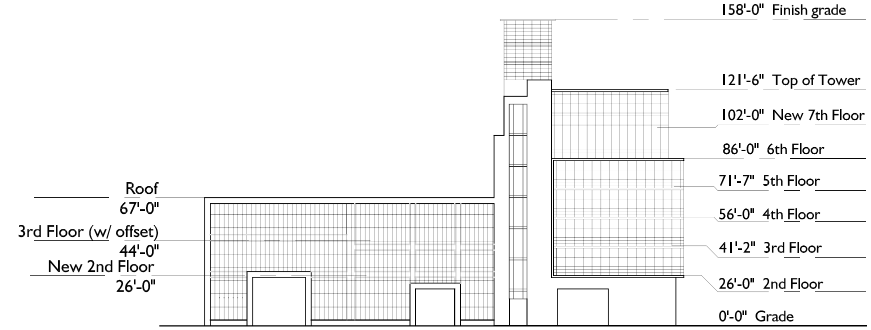


REUSE STUDIES

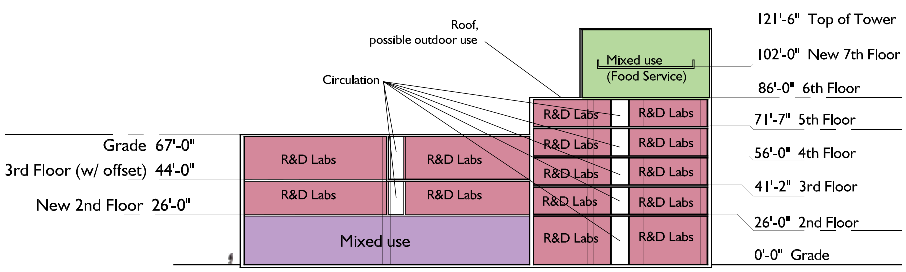
IV.3 Building 253: Reuse Approach continued



East West Section
(not through tower)



West Elevation



North South Section

LEGEND

- R&D Lab [133,276 sq.ft.]
- Mixed Use [51,571 sq.ft.]
- Food Service [included in Mixed Use
- Circulation, Support [37,730 sq.ft.]

0' 18' 48' 96'
Graphic Scale: 1/64"=1'-0"

IV.3 Building 253: Code Requirements

Building 253 most easily accommodates a new occupancy type. As a type IA construction (non combustible, concrete) there are no limits on height or area. The size of the floor plates is such that no additional exits are required in the tower. Egress can be served by the current stair shafts, and the current stair configuration. A third exit is required where new floor plates are introduced in the former assembly area because of the long travel distances. The California Historical Building Code allows for the use of existing exiting paths, provided that they are not a danger to occupants. The current stairs are a little steep, but seem safe enough.

The actual occupancy type has the largest code impact. Any building used for laboratories needs to have a fire wall with exits and elevators on either side. Fortunately, Building 253 is already served by two freight elevators at the opposing corners, therefore, introducing a fire separation provides the required safety level and meets the code. Sprinklers will be installed for laboratory uses as part of fire and life safety requirement.

The existing openings do not need to be protected and are not limited (with the exception of the area adjacent to building 211). There are no buildings within 30 feet, and in many cases there is greater than 80 feet clear. With no requirement for opening protection, the tower's spaces can maintain their character with three glazed walls (the fifth floor has four glazed walls); and the lower assembly area, now proposed as labs and mixed use, can remain as an all glazed space, thus preserving these important character defining features of the building.

Regular accommodation will have to be made for restroom facilities; however existing facilities seem adequate to meet the needs of occupants in the laboratory portions of the building. Extra facilities are required for the mixed use space at the first floor.

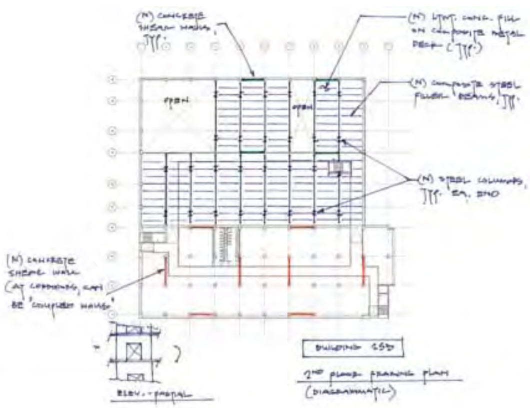
		Code Section (CBC 2007)	Notes
Address	253 Hunters Point Shipyard, Parcel C, San Francisco, 94124		
APN	4591A001		
Construction Date	--		
Construction Type	Concrete, Type 1A	602.2	General
	Steel Frame, Type IIA	602.2	6th floor
Proposed Use	Mixed use at lower portion of building, offices and research labs in tower portion, mixed use food service at top of building		
Occupancy type	Research Laboratories, Group L (Treat as Group B)	302.1, 443	Section 443 details more specific requirements for the division of space, treatment of floors, walls, and exiting from labs, ventilation, sprinklers. Per section 443, other than specifics, this occupancy should be treated as Group B
	Mixed use: Group M	302.1	
	Assembly use, food service: A-2	302.1	6th floor
Building Height	150 feet		
Maximum allowable height	Unlimited	504.1	
Current number of stories	6		Does not include small tower
Proposed number of stories	7		High ceiling in 6th floor allows for extra story within existing volume
Maximum allowable stories	Unlimited	504.1	
Sprinklers	Yes	903.2	Good idea for occupancy and insurance type
Current Area	177,800 square feet		
Proposed Area	222,577 square feet		
Maximum allowable area per story	Unlimited	504.1	
Area increase required	No		
Allowable area per story with increase	N/A		
Occupant load			
Labs/offices	1,212 occupants	1004.1	Square foot per occupant: 100; 121,160 square feet
Mixed use	967 occupants	1004.1	Square foot per occupant: 30; 29,000 square feet
Assembly use, food service:	900 occupants	1004.1	Square foot per occupant: 15; 13,500 square feet
Commercial kitchen:	8 occupants	1004.1	Square foot per occupant: 200; 1,500 square feet, kitchen associated with food service
Percent of unprotected openings allowed	Unlimited, no building within 30 feet	704.8	North exterior wall, portions of existing windows may need protection
	None at building 211, unlimited at tower	704.8	East exterior wall, 1 hour separation required at B 211, portions of existing windows may need protection
	Unlimited, no building within 30 feet	704.8	South exterior wall
	Unlimited, no building within 30 feet	704.8	West exterior wall
Interior travel distance limitations	300'	1016.1	
Minimum number of exits	2	1019.1	2 required per code, 3 provided because of travel distance limitations on floors 1, 2, 3.
Minimum number of toilet fixtures required	82	CPC, 412.1	table 4-1, total
Labs/offices: Women's W/C	18		
Labs/offices: Men's W/C	17		
Labs/offices: Urinals	13		
Mixed use: Women's W/C	9		
Mixed use: Men's W/C	4		
Mixed use: Urinals	4		
Food Service: Women's W/C	5		
Food Service: Men's W/C	4		
Food Service: Urinals	3		
Minimum number of lavatories required	49	CPC, 412.1	table 4-1, total
Labs/offices: Women's	16		
Labs/offices: Men's	16		
Mixed use: Women's	5		
Mixed use: Men's	4		
Food Service: Women's	4		
Food Service: Men's	4		
Minimum number of drinking fountains	3	CPC, 412.1	table 4-1, total
Labs/offices	0		
Mixed Use	3		
Food Service	0		

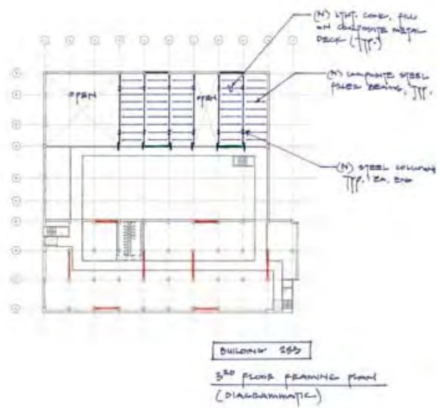
IV.3 Building 253: Code Requirements continued

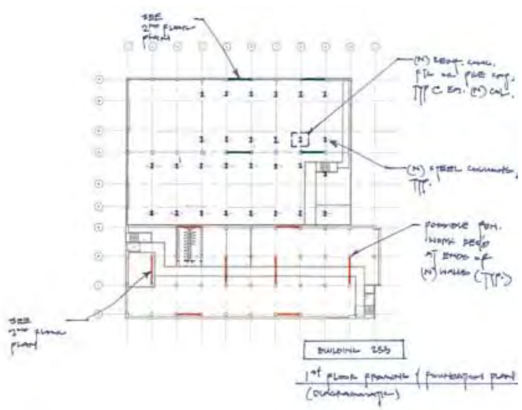
Minimum number of drinking fountains	3	CPC, 412.1	table 4-1, total
Labs/offices	0		
Mixed Use	3		
Food Service	0		
Atrium considerations	1 hour separation from occupied spaces to atrium	404.5	
Laboratory considerations: Emergency power	Emergency power system is required	443.2.4	
Laboratory considerations: Construction type	Must be type I or IIA	443.2.5	Type is acceptable for use
Laboratory considerations: Fire separations	1 hour separation is required to corridors	443.2.7	
Laboratory considerations: Spill response	Building requires an area for emergency spill response	443.2.9	Would be handled by each tenant in build-out
Laboratory considerations: Hazardous materials	Restrictions vary on materials that are acceptable depending on the floor	443.3	Tennant should review with CBC for compliance
Laboratory considerations: Ventilation	Exhaust fumes cannot mix with supply air	443.4	A separate system is required for supply air, and lab exhaust from vent hoods, etc.
Laboratory considerations: Means of egress	Portions that have a floor area of 200 square feet or more, require two separate exits	443.6.1	Each large room will require 2 exits when used as a lab
Laboratory considerations: Means of egress	Any portion of the room must be within 100 feet of an exit	443.6.2	Exit includes rated corridor.
Laboratory considerations: Means of egress	Buildings greater than 4 floors require at least one 2 hour horizontal exit per floor. Each side needs to be provided with an elevator and exit stair	443.6.5	Identified on plans.
Existing Building Code		CBC Chapter 34	
Additions alterations or repairs to existing building	New work needs to comply with regular code for new construction	3403.1	Existing building code, CBC Chapter 34
Additions alterations or repairs to existing building impact to structure	Additions and alterations cannot increase the force by more than 5% unless new forces are still in compliance with the regular code. New elements need to meet regular code for structures.	3403.2	Existing building code, CBC Chapter 34
Fire escapes	This section does not apply since building exiting is served by stairs	3404.1	Existing building code, CBC Chapter 34
Change of Occupancy	No change is allowed that places the building in a different use/occupancy type, unless that new type can be made to meet with the regular code.	3406.1	Existing building code, CBC Chapter 34 Building meets regular code for requirements of new occupancy.
Change of Occupancy impact to structure	Structure must comply with the new occupancy's requirement for structure under the regular building code.	3406.4	Existing building code, CBC Chapter 34
Compliance	Use this section if building cannot be made compliant under regular code or historic building code	3410.0	Not required since re-use of buildings can be made compliant under the regular code and a few elements from the historic building code.
Historic Building Code		CBC Title 24 Part 8	(CHBC)
Application	This building is a qualified historic structure and can use the Historic Building Code	8-301.2	Based on contribution to historic district
Change in occupancy	Change in occupancy is permitted.	8-302.2	Change in occupancy does not necessarily require total conformance with regular code, per provisions in CHBC
Required separations	One hour maximum separations required where regular code specifies greater if a sprinkler system is installed	8-302.2	Sprinkler utilized in regular code for area increase
Maximum Floor Area	Multi story buildings must meet regular code requirement, except when a sprinkler is provided, there is no limit on floor area in the historic structure	8-302.4	Floor area made to work under regular code with the use of sprinklers.
Maximum Height	Historic building height is not limited provided it does not exceed that of the historical design	8-302.5	
Exterior wall protection	sprinklers may be used to satisfy requirement for existing openings	8-402.1	Portions of east wall will need separation where building 253 and 211 are connected.
Non-conformance with regular code	Where the building cannot meet the requirements of the regular code, sprinklers may be used	8-410.1	applies to occupancy, fire separation, exiting distances.
High-rise (buildings greater than 75 feet)	Building must meet all regular codes unless amended by CHBC	8-412	
Exiting width	Existing openings are permitted to be used even if they are less than the required minimum	8-502.2	
Exit stairs	Existing stairs that do not meet regular code are permitted to be used for exiting provided that they do not pose a hazard	8-502.3	
Accessibility	Regular code applies to accessibility, unless there is a threat to significant character defining features.	8-602.1	
Structural engineer review of historic structure	A qualified structural engineer should evaluate the building and assess condition	8-703.1	
New additions and alterations	Structures must conform to regular code	8-704.1	
Evaluation of structure	Structural Engineer should evaluate the building and propose upgrades as required. Consideration should be given to minimize loss and impact to historic fabric	8-705	
Lateral loads	Forces in the historic building need not exceed 0.75 times the seismic forces prescribed by 1995 CBC	8-706.1	
Mechanical, electrical, and plumbing systems	Systems shall comply with the regular code, unless amended by CHBC, existing system can be used if deemed safe	8-902	No existing systems in the building can be used. Will need all new mechanical, electrical and plumbing systems.

IV.3 Building 253: Structural Assessment

As a type IA construction (non-combustable) the building lends itself naturally for use as a research lab. It also has a structural system that can take a vertical load of 250 pounds per square foot, far in excess of what would be required for such a use. On the other hand, there are a number of upgrades required to the structure to cope with lateral forces. The significant weight of the concrete structure places a great deal of horizontal force on the inadequate shear walls; which currently include the stair towers alone. Additional sheer walls running the height of the building will have to be places at various locations on the floor plate. In the "atrium" type space, additional reinforcement will be required at the connections of concrete beams to columns. Most likely, the overlap of re-bar is inadequate.







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Paul B. Hofland, SE
Principal

Building 253 - North Atrium in Foreground, South Concrete-Framed Column/Slab Building in Background, w/ Penthouse and Observation Tower – view looking SE

Building 253

Existing Building – Bldg. 253

General

Building 253 at Hunter's Point Shipyards is comprised of two rectangular volumes, one alongside the other, framed in reinforced concrete. The shorter volume is approximately 150 feet wide x 200 feet long. The northernmost bay, approximately 75 feet wide, is open from the main floor to the fully glazed roof. The adjacent 75 foot wide bay has an upper floor framed below the roof level. The upper floor framing appears to be a formed concrete slab supported by concrete-encased filler beams, which are in turn supported by steel girders located on column lines at 25 feet on center, which span the clear width of the space.

The second of the two rectangular volumes which make up Building 253 is approximately 87½ feet wide x 250 feet long. This portion of the building is comprised of 3 bays across, each measuring 29'-2". Column bay spacing in the longitudinal direction is 25 feet, thus the tributary area to each interior column is approximately 730 square feet per floor, while tributary area per floor at exterior columns is 365 square feet. Elevated floor slabs are of conventional reinforced concrete with a slab-beam system supported by round concrete columns tapering conical capitals. The floors are believed to have been designed to support a superimposed live load of 250 psf, typically, as indicated by the signage evident throughout this part of the building.

integrative structural solutions

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IV.3 Building 253: Structural Assessment continued

Building 253 (cont.)

General (cont.)

The main roof framing is again of reinforced concrete construction, with a slab-beam system supported on round concrete columns with tapering conical capitals.

A large steel-framed penthouse, measuring 60 feet x 200 feet, extends above the main high roof. The penthouse is framed with steel columns at 25 foot centers joined by deep steel girders. The penthouse is connected by a concrete "bridge" link at the level of the penthouse roof to the southeast stair tower which extends above the roof. At the northwest end, the penthouse is connected to a concrete framed stair tower which also has an observation tower element which extends above the roof and is the highest part of the structure.

Gravity Systems

The gravity systems for this building are as described in the above section.

Lateral Systems

Lateral systems for this building appear to be of four main types, depending on the location within the building. The north Atrium portion appears to be a concrete moment frame structure, with multiple beams and columns apparent in each elevation. The south concrete slab-beam structure appears to be supported laterally primarily by the concrete stair towers acting as shear walls or cores in the diagonally opposite NW and SE corners of the building. There is diagonal steel bracing which evidently provides both vertical and lateral support for the roof over the portion of elevated 3rd level floor between grids D and G. Finally, the penthouse structure is comprised of a series of single-bay portal frames, and appears to be additionally braced by the extension of the NW stair core, and a bridge connection from the roof slab to the SE stair core.

At the penthouse, the connection of the bridge slab to the stair core appears tenuous at best, and as there does not appear to be an alternative east-west bracing system at the north and south sides of the penthouse, the lateral system for this element should be thoroughly studied and remedial work completed as necessary.

The concrete moment frame which comprises the lateral system for the north Atrium component of the building will almost certainly have non-complying confinement reinforcing for beams and columns, as well as inadequate longitudinal reinforcing lap splice lengths. This will need to be addressed; it is possible that the provision of FRP or steel or reinforced concrete jacketing would sufficiently address this issue. Access to these elements is quite good inside the vaulted Atrium space. Alternatively, a new concrete shear wall system could be employed in select bays.

It is likely that the NW and SE stair cores are not adequate to brace the relatively heavy column and beam-slab system alone. We believe that additional interior or exterior shear walls are likely to be required. One should assume that at least two walls x 25 feet in each direction will be required, full height of the building, with new foundations.

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Building 253 (cont.)

Foundations

We were not provided with structural foundation drawings for the existing Building 253, and therefore did not have an opportunity to determine their type or allowable capacity.

Visual Condition Assessment

There is significant concrete cracking and spalling that has occurred around the Observation Tower element, probably as a result of its extreme exposure. This deterioration will need to be assessed and repaired.

Planned Additions / Revisions – Bldg. 253

It is our understanding that the proposal to repurpose Building 253 involves the addition of approximately 36,000 square feet total, on two levels. The second level would see the addition of 26,400 square feet, with 9,000 of that to be added at the north atrium, and the balance to be added between grids D and G. The third level would have an additional 9,000 square feet added at the north atrium space. Otherwise, the proposed redevelopment doesn't involve the addition of any substantial square footage to the building.

Existing floor posted live load capacities of 250 lbs/sf are well in excess of what we would normally anticipate would be required for the proposed R&D / office uses. The existing floor of the penthouse is intended to be employed as Mixed Use, with a Kitchen, Restrooms and a Dining Area. The normally required live load capacity for these activities is no more than 100 lbs/sf; the existing steel columns in this area are posted with a floor load capacity of 230 lbs/sf. Thus the building's existing gravity system appears to be quite substantial with respect to its allowable live load capacity.

Based on our field observations and some limited study, again we believe that it is structurally feasible to create the planned additions and revisions, provided existing structural systems are not overloaded, and new ones are employed to handle any significant new loads, whether seismic or gravity.

Gravity Systems for Proposed Additions

We recommend that the floor framing for the new additions be constructed of lightweight concrete fill on composite metal deck, supported on composite steel filler beams. The beams, in turn, would be supported by composite steel girders on new steel columns. At the north atrium space, at both the 2nd and 3rd levels, as well as between grids D and G, we believe new floors could be created by spanning filler beams at approximately 8 foot spacing between girders spanning north-south, located on the existing column grids. New steel columns supporting the girders could be introduced at approximately 10 feet from each girder end, allowing the new floor loads to be supported independently of the existing columns and foundations. New foundations would then be provided at each of these columns.

Lateral Systems for Proposed Additions

See discussion above for remarks on the lateral system for this building.

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The Preliminary Cost Estimate (below) is provided to predict rehabilitation and reuse of Building 253 based on the conceptual reuse diagrams, pages 25-26.

ESTIMATE WORKSHEET

HUNTER'S POINT REHABILITATION BUILDING: 253

PROJECT: **HUNTER'S POINT SHIPYARD, PARCEL C, SAN FRANCISCO, CA 94124** (E) BUILDING GSF: 177,800

PHASE: **FEASIBILITY STUDY (PRELIMINARY)** TOTAL BUILDING GSF: 222,577

ESTIMATE DATE **UNKNOWN**

BID DATE: **AUGUST 28, 2009**

PREPARED BY: J.R. CONKEY & ASSOCIATES

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8/28/2009
5:20 PM
Copy of Hunters Point Concept 08_28_09

ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL COST
1000	ABATEMENT ALLOWANCE	177,800	SF	$10.00	$1,778,000
2000	DEMOLITION	177,800	SF	$3.75	$666,750
3000	FULL SEISMIC UPGRADE	177,800	SF	$12.50	$2,222,500
3000	NEW BUILDING STRUCTURE	44,777	SF	$200.00	$8,955,400
5000	STAIRS/HANDRAILS (REFURBISH)	18	FLTS	$15,000.00	$270,000
6000	MISC FINISH CARPENTRY	194,670	SF	$0.50	$97,335
7000	ROOF REPLACEMENT	57,971	SF	$12.00	$695,652
7000	WATERPROOFING (ALLOWANCE)	194,970	SF	$0.50	$97,485
8000	EXTERIOR SKIN / WINDOW REPLACEMENT (ALLOWANCE)	79,536	SF	$85.00	$6,760,560
9000	CORE FINISHES (RESTROOMS, CORRIDORS)	18,855	SF	$175.00	$3,299,625
9000	TENANT IMPROVEMENT FINISHES	203,722	SF	$95.00	$19,353,590
10000	SPECIALTIES	222,577	SF	$0.50	$111,289
14000	ELEVATORS	12	STOPS	$50,000.00	$600,000
15000	FIRE PROTECTION SYSTEM	222,577	SF	$6.00	$1,335,462
15000	HVAC	222,577	SF	$35.00	$7,790,195
15000	PLUMBING	180	FIXT	$4,000.00	$720,000
16000	ELECTRICAL - POWER	222,577	SF	$17.50	$3,895,098
16000	LIGHTING	222,577	SF	$5.50	$1,224,174
16000	FIRE ALARM	222,577	SF	$6.00	$1,335,462
	EXCLUDES: SITEWORK, SITE UTILITIES, UTILITY COMPANY CHARGES, DEVELOPMENT FEES,				
	DEVELOPER FEES, FF&E COSTS, DESIGN FEES, CONSTRUCTION MANAGEMENT FEES,				
	HAZARDOUS MATERIALS ABATEMENT (EXCEPT FOR ALLOWANCE NOTED,)				
	SUBTOTAL HARD COSTS				**$61,208,576**
	CONTINGENCY				
	ESTIMATING CONTINGENCY	20.00%			**$12,241,715**
	SUBTOTAL CONSTRUCTION COSTS				**$73,450,291**
	MARK-UPS				
	GENERAL CONDITIONS	10.00%			$7,345,029
	OVERHEAD & PROFIT	10.00%			$8,079,532
	INSURANCE & BONDS	2.25%			$1,999,684
	SUBTOTAL MARK-UPS				**$17,424,245**
	SUBTOTAL CONSTRUCTION COSTS & MARK-UPS				**$90,874,536**
	ESCALATION				
	ESCALATION (FIGURED BY OTHERS)	0.00%			**$0**
	TOTAL CONSTRUCTION ESTIMATE:				**$90,874,536**

Appendix V2 CBRE Proposed Hunters Point Shipyard Phase II Redevelopment—Parcel C Financial Feasibility Analysis of Historic Reuse Options, October 30, 2009

CBRE CONSULTING

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MEMORANDUM

To: Wells Lawson, City of San Francisco

From: Mary Smitheram-Sheldon and Courtney Pash, CBRE Consulting

Date: October 30, 2009

Subject: Proposed Hunters Point Shipyard Phase II Redevelopment - Parcel C
Financial Feasibility Analysis of Historic Reuse Options

INTRODUCTION

As requested, CBRE Consulting has analyzed the financial feasibility of two potential Historic Reuse Options for a portion of Parcel C of the Hunters Point Shipyard Phase II Redevelopment Project. Parcel C is planned as an employment center with 2.0 million square feet of research and development (R&D) and office space in eight distinct blocks to accommodate a variety of technology, biotechnology, and/or clean technology companies.[1]

The proposed plan includes the demolition of three buildings that have been identified as potential Historic District Contributors: Buildings 211, 231, and 253. These three buildings were constructed between 1942 and 1947 and used as machine shops for the former shipyard. If these three buildings are retained, the two planned R&D/office buildings at Blocks 5 and 6 within Parcel C will not be constructed. As part of the environmental impact report, CBRE Consulting has been asked to assess the financial feasibility of retaining these three buildings. CBRE Consulting's analysis compares the baseline project, comprising the planned Blocks 5 and 6, with two Historic Reuse Options: A) retain all three buildings, with a modest amount of new construction; and B) retain Building 253 only, with two new large R&D/office buildings.

As discussed in this memorandum, CBRE Consulting finds that retaining these three buildings as part of the Hunters Point Shipyard Phase II - Parcel C project is not financially feasible. The rehabilitation costs under the Historic Reuse Option A significantly exceed the estimated stabilized value. As a result, if this option were adopted without a significant amount of additional public subsidy, these three buildings would not be reused and would remain in their vacant, dilapidated states. This conclusion of infeasibility is partially informed by physical constraints that make the retention of these three buildings more difficult and expensive, as more fully described later in this memorandum.

Additionally, the option wherein only Building 253 is retained and two new buildings are constructed is not financially feasible. Again, the issue is that the rehabilitation cost for Building 253 is so significant that it more than offsets the combined positive residual land value associated with the new-construction buildings.

[1] Some of the blocks adjacent to the Hunters Point Shipyard Village Center include mixed use buildings – ground floor retail with residential above. These blocks, or portions of blocks, are specifically excluded from this analysis.

BACKGROUND

Methodology

CBRE Consulting prepared three static financial pro formas for this analysis: the Baseline Analysis; Historic Reuse Option A (all three buildings); and Historic Reuse Option B (only Building 253). All three pro formas compare anticipated project value upon completion to total project development cost. The Baseline Analysis examines Blocks 5 and 6 as those would be the only two blocks affected should the potential historic district contributor buildings be retained. The proposed development of this portion of Parcel C includes Block 5, with 643,000 square feet of office space and a 1,403-space parking garage, and Block 6, with 239,000 square feet of R&D space. The total new development in this portion of Parcel C is 882,000 gross square feet. On a net rentable basis, there is an estimated total of 837,900 square feet of space.

Historic Reuse Option A analyzes a hypothetical development program assuming that the three potential historic district contributor buildings are retained. These buildings could be rehabilitated to include 262,000 square feet of R&D/office space, 76,000 square feet of mixed-use/retail/restaurant space, and 1,000 off-street parking spaces. Based on a site planning study performed by IBI Group, there could be sufficient land area in two locations, west of Building 253 and south of Building 211, that each could accommodate a small office building. These buildings would have relatively small floor plates (23,000 and 17, 000 square feet), be seven stories high, with a total of 280,000 gross square feet of space. In addition, a small surface parking area for 55 autos could be placed west of Building 231.

Historic Reuse Option B studies a potential development program that includes the retention of only Building 253, plus the new development of two R&D/office buildings totaling 416,000 square feet of space. For purposes of the analysis, CBRE Consulting assumed that the larger building (230,000 square feet) would be predominantly office and the smaller building (186,000 square feet) would be predominantly R&D. A total of 1,029 parking spaces would be provided in these two buildings in above-grade structures. It should be noted that in this option, IBI Group indicates that the two proposed new buildings exceed the maximum height for overall Parcel C as presented in the EIR, but are the same height as Building 253. Therefore, this option may also have some view corridor impacts on surrounding areas.

Presentation

Exhibit 1 presents the Baseline Analysis, Exhibit 2 presents Historic Reuse Option A, and Exhibit 3 presents Historic Reuse Option B. The first page of each exhibit presents general assumptions, such as uses, building areas, and parking spaces. Page two of each exhibit presents inputs related to the operations of the project – rents, vacancy rates, and capitalization rates. Pages three and four of each exhibit outline development costs. Page five of each exhibit presents the static pro forma analysis, whereby net operating income is calculated (revenues less vacancy) and a capitalization rate is used to convert the estimated net operating income into indicated value at stabilization. From the indicated value, development costs are deducted to arrive at an estimated residual land value.

Data Sources

Information for the Baseline Analysis including project details such as use, net square feet, efficiency, market rents, development costs, and parking ratios, was provided by Lennar and its design firm, IBI Group. Certain market-based inputs were adjusted for reasonableness by CBRE Consulting based on available market data.

The main source of data pertaining to the Historic Reuse Option A is a report titled Hunters Point Shipyard Feasibility Study prepared by Page & Turnbull, an architecture firm that specializes in historic preservation. The Page & Turnbull report, prepared in conjunction with JR Conkey and Associates and Emergent Structures, Inc., provides a number of key inputs such as gross and net building areas, building uses (in collaboration with CBRE Consulting), and rehabilitation costs. CBRE Consulting, Lennar, and MacTec provided refinements related to certain inputs. Treadwell & Rollo also provided information on remediation issues. The information developed by Page & Turnbull for Building 253 was also used in the Historic Reuse Option B analysis. IBI Group provided locations, sizes, heights, and number of parking spaces for the potential new construction in both Historic Reuse Options A and B.

FEASIBILITY ANALYSIS

Assumptions

From a financial standpoint, there are a number of key differences between the Baseline Analysis and Historic Reuse Options, as detailed in the attached exhibits.

Amount of R&D/Office Development

The amount of R&D/office space developed is one of the key drivers in supporting residual land value. The following table compares the amount of R&D/office space in the three analyses. As shown, the net square feet of R&D/office space in Blocks 5 and 6 would be reduced from 837,900 net square feet in the Baseline Analysis to 500,915 net square feet in the Historic Reuse Option A. In Historic Reuse Option B, there is 549,595 net square feet of R&D/office space.

Proposed Parcel C Project – Blocks 5 and 6
Office/R&D Summary

	Baseline Analysis	Historic Reuse Option A	Historic Reuse Option B
R&D Net Square Feet	227,050	154,395	331,095
Office Net Square Feet	610,850	346,520	218,500
Total R&D/Office Net Square Feet	837,900	500,915	549,595

Source: Exhibits 1, 2, and 3.

Given this significant reduction in R&D/office space in the two Historic Reuse Options, the development program for the entirety of Parcel C would result in less than the currently proposed (baseline) 2.0 million square feet of R&D/office space. This would limit the City's ability to attain a community goal of turning Hunters Point into an employment center for local residents. It would also reduce the direct and indirect local and regional economic benefits resulting from fewer jobs created.

Amount of Retail Space

Historic Reuse Option A would include 75,689 square feet of retail space (there is no retail space in the Baseline Analysis). This would be split between a restaurant on the top floor of Building 253, large open space on the ground floor of Building 253 (assumed to be leased as a fitness center), and retail wrapping the parking on the ground floor of Building 231. Historic Reuse Option B similarly includes 51,571 square feet of retail space in Building 253 (the aforementioned rooftop restaurant and ground floor space).

Market Rent

For Building 253, Page & Turnbull concludes that the existing structure can be rehabilitated to provide space that is competitive with new R&D buildings. Therefore, CBRE Consulting has included in its analysis a market rent for this building that is consistent with the assumption used for the new

R&D building in the Baseline Analysis. However, the rehabilitated space in Building 211 would not be competitive with new Class A office space; rather this space would be considered Class B at best, with a lower average achievable rent as a result of the following factors:

- Space inefficiencies – often in rehabilitated buildings, incorporating modern access and life safety components is not as efficient as when built new;

- Less desirable/functional space – these buildings have functional issues that cannot be corrected through rehabilitation and as a result would not be suitable for biotech related R&D in the case of Building 211 (or Building 231 if it were not devoted to a parking garage);

- Different tenant types – these rehabilitated buildings would likely attract smaller non-corporate users and more eclectic users that enjoy open trusswork and exposed systems. These users typically pay rent at the lower end of the market rate range.

Additionally, market rent for the retail space in the rehabilitated structures is lower due to the more remote location of the retail space (including the rooftop restaurant) with limited visibility and the shallow retail bays in Building 231 (20 feet or less).

Hard Development Costs
Hard development costs under the Historic Reuse Option are significantly higher than those in the Baseline Analysis, due to the fact that the existing systems will have to be removed and new systems installed. New floors need to be installed with new and updated ingress/egress, including both elevators and stairwells. The buildings will also need to be seismically strengthened and brought up to current building code. Additionally, in order to address the potential for sea level increase, MacTec has estimated costs needed to raise the foundations of the buildings; these costs have been included in the analysis. The hard costs for rehabilitation are over $705 per net square foot, compared to hard costs of $270 per net square foot for new construction in the Baseline Analysis.

In addition, for Historic Reuse Option B, parking to accommodate the users of building 253 needs to be incorporated into the development of the new buildings, thus increasing the hard construction costs of the new buildings to nearly $300 per net square foot. The hard costs for building 253 are $450 per net square foot. This results in average hard development costs across all buildings of $350 per square foot, significantly higher than that of the Baseline Analysis.

Parking
The parking ratio for the entirety of parcel C in the Baseline Analysis is 1.3 structured parking spaces per 1,000 gross square feet of building area. Since Block 5 contains a large parking garage, which serves Block 6 as well as other nearby blocks, the parking ratio for those two blocks alone is 1.59 spaces per 1,000 gross square feet of building area. Historic Reuse Options A and B provide parking ratios of 1.71 and 1.61 spaces per 1,000 gross square feet, respectively. For the entirety of Parcel C, the overall ratios are 1.30 and 1.27 spaces per 1,000 gross square feet. Given the relatively minor change in parking ratios between the three different development scenarios CBRE Consulting concludes that, with respect to parking, the analyses represent even comparisons.

CBRE Consulting also prepared a sensitivity analysis for Historic Reuse Option B addressing the possibility of building underground parking, which would allow an increase in the amount of R&D/office space that could be developed. The high cost of building underground parking in this location results in significant negative residual land values for the new-construction buildings, despite the additional rentable area. Thus, current market rents do not support underground parking;

however, this situation could change in the future whereby market rents increase to the point that justifies the added cost of underground parking.

Conclusions

The summary presented below illustrates that the Baseline Analysis is feasible, with an indicated project value greater than total project development cost. Historic Reuse Option A is infeasible, with estimated total project development costs exceeding indicated project value by nearly $200 million, while the estimated deficit for Historic Reuse Option B is under $50 million.

Proposed Parcel C Project – Blocks 5 and 6
Pro Forma Analyses

	Baseline Analysis		Historic Reuse Option A		Historic Reuse Option B	
	Total	Per GSF	Total	Per GSF	Total	Per GSF
Indicated Value	$398,779,536	$476	$245,426,813	$426	$291,413,372	$485
Development Costs	$366,295,841	$437	$429,603,134	$745	$333,266,863	$554
Difference	$32,483,694	$39	-$184,176,321	-$319	-$41,853,491	-$70
Result	Feasible		Infeasible		Infeasible	

Sources: Exhibits 1, 2, and 3.

Therefore, if the Historic Reuse Option A was required, it is highly likely that the rehabilitation would not occur and these buildings would remain in their current vacant and dilapidated condition, which could negatively impact the desirability, absorption, and value potential of the remainder of Parcel C. Both vertical developers and lenders or other financial partners would not pursue this project, but instead would invest in other feasible development projects. A similar conclusion would be reached with regard to Historic Reuse Option B. The modest positive residual land value associated with the new construction would more than be offset by the deficit associated with rehabilitation of Building 253.

Physical Constraints

CBRE Consulting's conclusions of infeasibility are also informed by physical constraints that increase the difficulty and cost of retaining these three buildings. The first constraint relates to the contamination of the site. According to the U.S. Navy's proposed plan for cleanup of Parcel C, there is significant soil and groundwater contamination under and around all three buildings, as well as radiological contamination in Building 253 (and, to a lesser extent, Building 211). The proposed remediation plan calls for a variety of techniques to address the contamination, including soil removal, soil vapor extraction, installation of soil covers, injection of chemicals or biological nutrients, and decontamination of Buildings 253 and 211. A discussion with Treadwell & Rollo indicates that the proposed soil and groundwater remediation activities can still take place if the buildings remain; however the remediation will be more complicated and costly as the existing foundations will have to be drilled and/or excavated for installation of vapor walls, ventilation ducts, monitoring equipment, etc.

It should be noted that the proposed remediation alternative associated with radiological issues in the U.S. Navy plan includes the possibility of building demolition, if deemed necessary by the U.S. Navy. Therefore, it is possible that the final result of the U.S. Navy's more detailed radiological study of Building 253 may conclude that demolition of this building is the best approach to remediate the radiological contamination.

While the U.S. Navy is tasked with the remediation of the Hunters Point area, it is unclear if it will pay for the incremental costs associated with retaining the three buildings. Thus, if the buildings are retained, the additional remediation costs will need to be negotiated with the U.S. Navy. One possible outcome is that the incremental remediation cost could be added to the rehabilitation cost, thus increasing the financial deficit of Historic Reuse Option A, in particular. This cannot be quantified until the U.S. Navy conducts additional investigations and characterizations.

The second constraint is associated with the anticipated rise in sea level due to global warming. The overall project site will need to be raised by 2.5 to 3 feet to account for projected sea level change. For the rest of the project, the costs associated with raising the site are considered infrastructure (i.e., horizontal development costs). However, if the three potentially historic district contributor buildings are retained, their foundations will need to be raised, the costs for which are considered building costs (i.e., vertical development costs). These costs have been estimated by MacTec and are included in the financial analysis presented in this memorandum. Addressing this issue increases direct construction costs by 3 to 6 percent.

The contents of this memorandum are subject to the attached Assumptions and General Limiting Conditions.

ASSUMPTIONS AND GENERAL LIMITING CONDITIONS

CBRE Consulting has made extensive efforts to confirm the accuracy and timeliness of the information contained in this study. Such information was compiled from a variety of sources, including interviews with government officials, review of City and County documents, and other third parties deemed to be reliable. Although CBRE Consulting believes all information in this study is correct, it does not warrant the accuracy of such information and assumes no responsibility for inaccuracies in the information by third parties. We have no responsibility to update this report for events and circumstances occurring after the date of this report. Further, no guarantee is made as to the possible effect on development of present or future federal, state or local legislation, including any regarding environmental or ecological matters.

The accompanying projections and analyses are based on estimates and assumptions developed in connection with the study. In turn, these assumptions, and their relation to the projections, were developed using currently available economic data and other relevant information. It is the nature of forecasting, however, that some assumptions may not materialize, and unanticipated events and circumstances may occur. Therefore, actual results achieved during the projection period will likely vary from the projections, and some of the variations may be material to the conclusions of the analysis.

Contractual obligations do not include access to or ownership transfer of any electronic data processing files, programs or models completed directly for or as by-products of this research effort, unless explicitly so agreed as part of the contract.

This report may not be used for any purpose other than that for which it is prepared. Neither all nor any part of the contents of this study shall be disseminated to the public through publication advertising media, public relations, news media, sales media, or any other public means of communication without prior written consent and approval of CBRE Consulting.

EXHIBIT 1
GENERAL ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II BLOCKS 5 AND 6 OF PARCEL C
BASELINE ANALYSIS (PROPOSED PROJECT)
OCTOBER 2009

	BLOCK 5	BLOCK 6	SUBTOTAL/ AVERAGE
Site Assumptions			
Site Area (Square Feet)	312,323	101,644	413,967
Site Area (Net Acres)	7.17	2.33	9.50
Existing Structure (Square Feet) (1)	373,170	49,336	422,506
Building Assumptions			
Predominant Use	Office	R&D	
Gross Square Feet	643,000	239,000	882,000
Estimated Efficiency	95%	95%	95%
Net Square Feet	610,850	227,050	837,900
FAR	2.06	2.35	2.13
Parking Assumptions			
Parking Ratio (per Gross 1,000 sf)	2.18	0.00	1.59
Total Garage Parking Spaces	1,403	0	1,403

Sources: Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) The existing structures include only those buildings that are being considered for rehabilitation under the historic resources option and have been divided between Block 5 and 6 based on approximate location. This does not impact the residual land value before demolition and infrastructure.

OCTOBER 2009

EXHIBIT 1
INCOME / EXPENSE ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II BLOCKS 5 AND 6 OF PARCEL C
BASELINE ANALYSIS (PROPOSED PROJECT)
OCTOBER 2009

	BLOCK 5	BLOCK 6
GENERAL ASSUMPTIONS		
Vacancy Percent	7.50%	7.50%
CFD Percent	0.75%	0.75%
Capitalization Rate	6.50%	6.50%
INCOME ASSUMPTIONS		
NOI Per Square Foot	$35.00	$42.00
Expenses (1)	NNN	NNN
Annual CFD Payment	$3.39	$4.07

Sources: Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) Triple net rent covers all landlord expenses, thus Effective Gross Rent is equal to Net Operating Income (NOI).

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EXHIBIT 1
DEVELOPMENT COST ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II BLOCKS 5 AND 6 OF PARCEL C
BASELINE ANALYSIS (PROPOSED PROJECT)
OCTOBER 2009

	BLOCK 5	BLOCK 6
Hard Development Costs		
Shell Construction Costs per Gross Square Foot	$165	$165
TI Costs per Net Square Foot	$50	$100
Parking Garage Cost per Space	$20,000	$20,000
Soft Development Costs		
Soft Costs as percentage of Hard Costs	20%	20%
Financing Costs as percentage of Hard Costs	8%	8%
Leasing Costs as percentage of NOI	7.5%	7.5%
Time for Leasing Subsidy (Months)	9	9
Closing Costs as percentage of Value	1%	1%
Developer profit as percentage of Hard and Soft Costs	15%	15%
Demolition Costs		
Demolition Costs per Gross Square Foot (old buildings)	$15	$15

Sources: Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

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EXHIBIT 1
DEVELOPMENT COST SUMMARY (2009 $s)
HUNTERS POINT SHIPYARD PHASE II BLOCKS 5 AND 6 OF PARCEL C
BASELINE ANALYSIS (PROPOSED PROJECT)
OCTOBER 2009

	BLOCK 5	BLOCK 6	SUBTOTAL/ AVERAGE
Hard Development Costs			
Shell Construction Costs	$106,095,000	$39,435,000	$145,530,000
TI Costs	30,542,500	22,705,000	53,247,500
Parking	28,060,000	0	28,060,000
Total Hard Costs	$164,697,500	$62,140,000	$226,837,500
Total Hard Costs per Net Square Foot	$270	$274	*$271*
Soft Development Costs			
Soft Costs	$32,939,500	$12,428,000	$45,367,500
Financing Costs	13,175,800	4,971,200	18,147,000
Leasing Costs	1,603,481	715,208	2,318,689
Lease Subsidy (1)	14,832,202	6,615,669	21,447,871
Closing Costs	3,042,503	1,357,060	4,399,563
Developer Profit	34,543,648	13,234,071	47,777,718
Total Soft Costs	$100,137,134	$39,321,208	$139,458,341
Soft Costs as Percentage of Hard Costs (Exc. Profit)	*40%*	*42%*	*40%*
TOTAL DEVELOPMENT COSTS	$264,834,634	$101,461,208	$366,295,841
TOTAL DEVELOPMENT COSTS PER SQUARE FOOT	*$434*	*$447*	*$437*
Demolition Costs	$5,597,550	$740,040	$6,337,590
Total Development Costs including Demolition	$270,432,184	$102,201,248	$372,633,431

Sources: Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) Assumes nine months NOI loss to absorption/concessions.

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EXHIBIT 1
STATIC PRO FORMA
HUNTERS POINT SHIPYARD PHASE II BLOCKS 5 AND 6 OF PARCEL C
BASELINE ANALYSIS (PROPOSED PROJECT)
ASSUMES STABILIZED OCCUPANCY
OCTOBER 2009

	BLOCK 5	BLOCK 6	SUBTOTAL/ AVERAGE
Stabilized Operating Statement (2009 $s)			
Net Operating Income (NOI)	$21,379,750	$9,536,100	$30,915,850
Vacancy	($1,603,481)	($715,208)	($2,318,689)
NOI Adjusted for Vacancy	$19,776,269	$8,820,893	$28,597,161
Capitalized Value	$304,250,288	$135,706,038	$439,956,327
Value per Net Square Foot of Building Area	*$498*	*$598*	*$525*
Less: CFD Bond Payoff	($28,472,427)	($12,704,364)	($41,176,791)
Net Proceeds	$275,777,862	$123,001,674	$398,779,536
Less: Development Costs	$264,834,634	$101,461,208	$366,295,841
Residual Land Value	$10,943,228	$21,540,466	$32,483,694
Residual Land Value per FAR Square Foot	*$18*	*$95*	*$39*
Less: Estimated Demolition Costs	$5,597,550	$740,040	$6,337,590
Residual Land Value less Demolition Costs	$5,345,678	$20,800,426	$26,146,104
Residual Land Value less Demolition Costs per FAR Square Foot	*$9*	*$92*	*$31*

Sources: Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

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EXHIBIT 2
GENERAL ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION A
OCTOBER 2009

	BUILDING 211	BUILDING 231	BUILDING 253	NEW BUILDINGS	SUBTOTAL/ AVERAGE
EXISTING BUILDING SIZES					
Gross Building Area (Square Feet)	49,336	195,370	177,800		422,506
NEW USE					
Office					
Gross Building Square Feet (1)	91,183			280,000	371,183
Net Building Square Feet	80,520			266,000	346,520
Estimated Efficiency	88%			95%	93%
R&D					
Gross Building Square Feet (1)			171,006		171,006
Net Building Square Feet			154,395		154,395
Estimated Efficiency			90%		90%
Retail / Restaurant					
Net Building Square Feet		24,118	17,883		42,001
Mixed Use (Fitness Center)					
Net Building Square Feet			33,688		33,688
Parking Assumptions					
Gross Square Feet (2)		427,925		18,975 (3)	446,900
Parking Spaces		1,000		55	1,055
Parking Ratio (per Gross 1,000 sf)					1.71
Square Feet per Parking Space		345		345	345
TOTAL					
Gross	91,183	452,043	222,577	280,000	1,045,803
Net Rentable	80,520	24,118	205,966	266,000	576,604
Efficiency	*88%*	*N/A*	*93%*	*95%*	*N/A*

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) Gross Office/R&D space includes total rentable building area and circulation.
(2) Includes space dedicated to parking related office space
(3) Separate, surface parking lot.

OCTOBER 2009

EXHIBIT 2
INCOME / EXPENSE ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION A
OCTOBER 2009

	Office - New	Office - Rehab	R&D	Retail / Restaurant	Mixed Use (Fitness Center)
GENERAL ASSUMPTIONS					
Vacancy Percent	7.50%	7.50%	7.50%	10.00%	5.00%
CFD Percent	0.75%	0.75%	0.75%	0.75%	0.75%
Capitalization Rate	6.50%	6.50%	6.50%	6.50%	6.50%
INCOME ASSUMPTIONS					
NOI Per Square Foot	$35.00	$22.00	$42.00	$18.00	$21.00
Expenses (1)	NNN	NNN	NNN	NNN	NNN
Annual CFD Payment	$3.39	$2.13	$4.07	$1.70	$2.09

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) Triple net rent covers all landlord expenses, thus Effective Gross Rent is equal to Net Operating Income (NOI).

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EXHIBIT 2
DEVELOPMENT COST ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION A
OCTOBER 2009

	BUILDING 211	BUILDING 231	BUILDING 253	NEW BUILDINGS
Hard Development Costs				
Shell Construction Costs per Gross Square Foot	$308		$330	$165
TI Costs per Net Square Foot	$71	$15	$94	$50
Parking Garage Cost per Space (1)		$92,389		$2,100
Soft Development Costs				
Soft Costs as percentage of Hard Costs	20%	20%	20%	20%
Financing Costs as percentage of Hard Costs	8%	8%	8%	8%
Leasing Costs as percentage of NOI	7.5%	7.5%	7.5%	7.5%
Time for Leasing Subsidy (Months)	9	9	9	9
Closing Costs as percentage of Value	1%	1%	1%	1%
Developer profit as percentage of Hard and Soft costs	15%	15%	15%	15%

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) New parking west of Building 231 represents a surface parking lot.

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EXHIBIT 2
DEVELOPMENT COST SUMMARY (2009 $s)
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION A
OCTOBER 2009

	BUILDING 211	BUILDING 231	BUILDING 253	NEW BUILDINGS	SUBTOTAL/ AVERAGE
Hard Development Costs					
Shell Construction Costs	28,101,494		73,390,283	$46,200,000	147,691,777
TI Costs	5,698,387	$353,760	19,353,590	14,000,000	39,405,737
Parking		92,388,932		115,500	92,504,432
Total Hard Costs	$33,799,881	$92,742,692	$92,743,873	$60,315,500	$279,601,946
Total Hard Costs per Net Square Foot	*$420*	*$3,845*	*$450*	*$227*	*$485*
Soft Development Costs					
Soft Costs	$6,759,976	$18,548,538	$18,548,775	$12,063,100	$55,920,389
Financing Costs	2,703,991	7,419,415	7,419,510	4,825,240	$22,368,156
Leasing Costs	132,858	32,559	563,545	438,900	$1,167,862
Lease Subsidy (1)	1,228,937	293,034	5,220,019	4,059,825	$10,801,815
Closing Costs	228,482	54,482	970,542	2,454,268	$3,707,775
Developer Profit	6,728,119	17,863,608	18,819,940	12,623,525	$56,035,191
Total Soft Costs	$17,782,362	$44,211,638	$51,542,331	$36,464,858	$150,001,188
Soft Costs as Percentage of Hard Costs (Exc. Profit)	*33%*	*28%*	*35%*	*40%*	*34%*
TOTAL DEVELOPMENT COSTS	$51,582,243	$136,954,330	$144,286,203	$96,780,358	$429,603,134
TOTAL DEVELOPMENT COSTS PER NET SQUARE FOOT	$641	$5,679	$701	$364	$745

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) Assumes nine months NOI loss to absorption/concessions.

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EXHIBIT 2
STATIC PRO FORMA
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION A
ASSUMES STABILIZED OCCUPANCY
OCTOBER 2009

	BUILDING 211	BUILDING 231	BUILDING 253	NEW BUILDINGS	SUBTOTAL/ AVERAGE
Stabilized Operating Statement (2009 $s)					
Office - Rehab					
Net Operating Income (NOI)	$1,771,440			$9,310,000	$11,081,440
Vacancy	($132,858)			($698,250)	($831,108)
NOI Adjusted for Vacancy	$1,638,582			$8,611,750	$10,250,332
Capitalized Value	$25,208,954			$132,488,462	$157,697,415
Capitalized Value per Net Square Foot of Building Area	*$313*			*$498*	*$455*
Less: CFD Bond Payoff	($2,360,773)			($12,412,299)	($14,773,072)
Net Proceeds	$22,848,181			$120,076,163	$142,924,343
R&D					
Net Operating Income (NOI)			$6,484,590		$6,484,590
Vacancy			($486,344)		($486,344)
NOI Adjusted for Vacancy			$5,998,246		$5,998,246
Capitalized Value			$92,280,704		$92,280,704
Capitalized Value per Net Square Foot of Building Area			*$598*		$598
Less: CFD Bond Payoff			($8,639,024)		($8,639,024)
Net Proceeds			$83,641,680		$83,641,680
Retail / Restaurant					
Net Operating Income (NOI)		$434,124	$321,894		$756,018
Vacancy		($43,412)	($32,189)		($75,602)
NOI Adjusted for Vacancy		$390,712	$289,705		$680,416
Capitalized Value		$6,010,948	$4,456,994		$10,467,942
Capitalized Value per Net Square Foot of Building Area		*$249*	*$249*		*$249*
Less: CFD Bond Payoff		($562,706)	($417,235)		($979,942)
Net Proceeds		$5,448,241	$4,039,759		$9,488,000
Mixed Use (Fitness Center)					
Net Operating Income (NOI)			$707,448		$707,448
Vacancy			($35,372)		($35,372)
NOI Adjusted for Vacancy			$672,076		$672,076
Capitalized Value			$10,339,625		$10,339,625
Capitalized Value per Net Square Foot of Building Area			*$307*		*$307*
Less: CFD Bond Payoff			($966,835)		($966,835)
Net Proceeds			$9,372,790		$9,372,790
TOTAL CAPITALIZED VALUE	$22,848,181	$5,448,241	$97,054,229	$120,076,163	$245,426,813
CAPITALIZED VALUE PER SQUARE FOOT OF BUILDING AREA	$284	$226	$471	$451	$426
Less: Development Costs	$51,582,243	$136,954,330	$144,286,203	$96,780,358	$429,603,134
Residual Land Value	**($28,734,063)**	**($131,506,089)**	**($47,231,974)**	**$23,295,805**	**($184,176,321)**
Residual Land Value per FAR Square Foot	**($357)**	**($5,453)**	**($229)**	**$88**	**($319)**

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

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EXHIBIT 3
GENERAL ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION B
OCTOBER 2009

	NEW OFFICE	NEW R&D	BUILDING 253	SUBTOTAL/ AVERAGE
EXISTING BUILDING SIZES				
Gross Building Area (Square Feet)	244,706		177,800	422,506
NEW USE				
Office				
Gross Building Square Feet (1)	230,000			230,000
Net Building Square Feet	218,500			218,500
Estimated Efficiency	95%			95%
R&D				
Gross Building Square Feet (1)		186,000	171,006	357,006
Net Building Square Feet		176,700	154,395	331,095
Estimated Efficiency		95%	90%	93%
Restaurant				
Net Building Square Feet			17,883	17,883
Mixed Use (Fitness Center)				
Net Building Square Feet			33,688	33,688
Parking Assumptions				
Gross Square Feet	230,805	124,200	0	355,005
Parking Spaces	669	360	0	1,029
Parking Ratio (per Gross 1,000 sf)	2.91	1.94	0	1.61
Square Feet per Parking Space	345	345		345
TOTAL				
Gross	**230,000**	**186,000**	**222,577**	**638,577**
Net Rentable	**218,500**	**176,700**	**205,966**	**601,166**
Efficiency	***95%***	***95%***	***93%***	***94%***

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) Gross Office/R&D space includes total rentable building area and circulation.

OCTOBER 2009

EXHIBIT 3
INCOME / EXPENSE ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION B
OCTOBER 2009

	Office	R&D	Restaurant	Mixed Use (Fitness Center)
GENERAL ASSUMPTIONS				
Vacancy Percent	7.50%	7.50%	10.00%	5.00%
CFD Percent	0.75%	0.75%	0.75%	0.75%
Capitalization Rate	6.50%	6.50%	6.50%	6.50%
INCOME ASSUMPTIONS				
NOI Per Square Foot	$35.00	$42.00	$18.00	$21.00
Expenses (1)	NNN	NNN	NNN	NNN
Annual CFD Payment	$3.39	$4.07	$1.70	$2.09

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) Triple net rent covers all landlord expenses, thus Effective Gross Rent is equal to Net Operating Income (NOI).

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EXHIBIT 3
DEVELOPMENT COST ASSUMPTIONS
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION B
OCTOBER 2009

	NEW OFFICE	NEW R&D	BUILDING 253
Hard Development Costs			
Shell Construction Costs per Gross Square Foot	$165	$165	$330
TI Costs per Net Square Foot	$50	$100	$94
Parking Garage Cost per Space	$20,000	$20,000	
Soft Development Costs			
Soft Costs as percentage of Hard Costs	20%	20%	20%
Financing Costs as percentage of Hard Costs	8%	8%	8%
Leasing Costs as percentage of NOI	7.5%	7.5%	7.5%
Time for Leasing Subsidy (Months)	9	9	9
Closing Costs as percentage of Value	1%	1%	1%
Developer profit as percentage of Hard and Soft costs	15%	15%	15%
Demolition Costs			
Demolition Costs per Gross Square Foot (old Buildings	$15	$15	N/A

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

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EXHIBIT 3
DEVELOPMENT COST SUMMARY (2009 $s)
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION B
OCTOBER 2009

	NEW OFFICE	NEW R&D	BUILDING 253	SUBTOTAL/ AVERAGE
Hard Development Costs				
Shell Construction Costs	37,950,000	$30,690,000	73,390,283	142,030,283
TI Costs	10,925,000	$17,670,000	19,353,590	47,948,590
Parking	13,380,000	7,200,000		20,580,000
Total Hard Costs	62,255,000	$55,560,000	$92,743,873	$210,558,873
Total Hard Costs per Net Square Foot	*$285*	*$314*	*$450*	*$350*
Soft Development Costs				
Soft Costs	$12,451,000	$11,112,000	$18,548,775	$42,111,775
Financing Costs	4,980,400	4,444,800	7,419,510	$16,844,710
Leasing Costs	573,563	556,605	563,545	$1,693,712
Lease Subsidy (1)	5,305,453	5,148,596	5,220,019	$15,674,069
Closing Costs	986,340	957,252	970,542	$2,914,134
Developer Profit	12,982,763	11,666,888	18,819,940	$43,469,591
Total Soft Costs	$37,279,519	$33,886,141	$51,542,331	$122,707,990
Soft Costs as Percentage of Hard Costs (Exc. Profit)	*39%*	*40%*	*35%*	*38%*
TOTAL DEVELOPMENT COSTS	**$99,534,519**	**$89,446,141**	**$144,286,203**	**$333,266,863**
TOTAL DEVELOPMENT COSTS PER NET SQUARE FOOT	**$456**	**$506**	**$701**	**$554**
Demolition Costs	$3,670,590		$0	$3,670,590
Total Development Costs including Demolition	**$192,651,250**		**$144,286,203**	**$336,937,453**

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

(1) Assumes nine months NOI loss to absorption/concessions.

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EXHIBIT 3
STATIC PRO FORMA
HUNTERS POINT SHIPYARD PHASE II, BLOCKS 5 & 6 OF PARCEL C
HISTORIC REUSE OPTION B
ASSUMES STABILIZED OCCUPANCY
OCTOBER 2009

	NEW OFFICE	NEW R&D	BUILDING 253	SUBTOTAL/ AVERAGE
Stabilized Operating Statement (2009 $s)				
Office				
Net Operating Income (NOI)	$7,647,500			$7,647,500
Vacancy	($573,563)			($1,059,907)
NOI Adjusted for Vacancy	$7,073,938			$7,073,938
Capitalized Value	$108,829,808			$108,829,808
Capitalized Value per Net Square Foot of Building Area	*$498*			*$498*
Less: CFD Bond Payoff	($10,195,817)			($10,195,817)
Net Proceeds	$98,633,991			$98,633,991
R&D				
Net Operating Income (NOI)		$7,421,400	$6,484,590	$13,905,990
Vacancy		($556,605)	($486,344)	($1,042,949)
NOI Adjusted for Vacancy		$6,864,795	$5,998,246	$12,863,041
Capitalized Value		$105,612,231	$92,280,704	$197,892,935
Capitalized Value per Net Square Foot of Building Area		*$598*	*$598*	$598
Less: CFD Bond Payoff		*($9,887,079)*	($8,639,024)	($18,526,102)
Net Proceeds		*$95,725,152*	$83,641,680	$179,366,832
Restaurant				
Net Operating Income (NOI)			$321,894	$321,894
Vacancy			($32,189)	($32,189)
NOI Adjusted for Vacancy			$289,705	$289,705
Capitalized Value			$4,456,994	$4,456,994
Capitalized Value per Net Square Foot of Building Area			*$249*	*$249*
Less: CFD Bond Payoff			($417,235)	($417,235)
Net Proceeds			$4,039,759	$4,039,759
Mixed Use (Fitness Center)				
Net Operating Income (NOI)			$707,448	$707,448
Vacancy			($35,372)	($35,372)
NOI Adjusted for Vacancy			$672,076	$672,076
Capitalized Value			$10,339,625	$10,339,625
Capitalized Value per Net Square Foot of Building Area			*$307*	*$307*
Less: CFD Bond Payoff			($966,835)	($966,835)
Net Proceeds			$9,372,790	$9,372,790
TOTAL CAPITALIZED VALUE	$98,633,991	$95,725,152	$97,054,229	$291,413,372
CAPITALIZED VALUE PER SQUARE FOOT OF BUILDING AREA	$451	$542	$471	$485
Less: Development Costs	$99,534,519	$89,446,141	$144,286,203	$333,266,863
Residual Land Value	**($900,528)**	**$6,279,011**	**($47,231,974)**	**($41,853,491)**
Residual Land Value per FAR Square Foot	**($4)**	**$36**	**($229)**	**($70)**
Less: Estimated Demolition Costs	$3,670,590		$0	$3,670,590
Residual Land Value less Demolition Costs	$1,707,893		($47,231,974)	($45,524,081)
Residual Land Value less Demolitions Costs per FAR Square Foot	$4		($229)	($76)

Sources: Page & Turnbull; Lennar; IBI Group; MacTec.; City of San Francisco; and CBRE Consulting.

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Attachment C&R-1 Biological Consultant Curriculum Vitae

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

STEPHEN C. ROTTENBORN

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Los Gatos, CA 95032
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PROFESSIONAL EXPERIENCE

2004-present, 1997-2000 — Principal (2007-present), Senior Wildlife Ecologist, H. T. Harvey & Associates, Los Gatos, California. Supervised, managed, and contributed to hundreds of projects for public and private clients involving NEPA/CEQA impact assessment and mitigation, biological constraints analysis, environmental permitting, state and federal Endangered Species Act consultation, habitat restoration, and resource assessments and surveys. Conducted surveys for a variety of wildlife taxa, including threatened and endangered species. Researched specific anthropogenic impacts on wildlife to improve management techniques and mitigation of impacts. Provided expert testimony on avian ecology and riparian ecosystems. Supervised project staff, including project coordination and QA/QC, project scheduling, proposal preparation, and client/agency coordination.

2000-2004 — Ecology Section Chief/Senior Environmental Scientist, Wetland Studies and Solutions, Inc., Chantilly, Virginia. Managed and contributed to hundreds of projects involving a variety of wetlands and natural resources issues, such as wetland delineation, Section 404/401 and Virginia Water Protection permitting, mitigation monitoring, Chesapeake Bay Act studies, NEPA evaluations, Environmental Quality Corridor analyses, forest stand evaluations, and endangered species studies. Supervised 14 environmental scientists, including project coordination and QA/QC, project scheduling, proposal preparation, and client/agency coordination.

1989-1997 — Independent Ecological Consultant, Virginia and California. Assessed ecological risks and impacts, monitored populations of rare species. Conducted surveys for birds, butterflies, plants, and amphibians.

EDUCATION

1992-1997 — Ph.D., Department of Biological Sciences, Stanford University, Stanford, California. National Science Foundation Graduate Fellow. Dissertation research emphasized riparian ecology and impacts of urbanization on biodiversity.

1988-1992 — B.S., Department of Biology, College of William and Mary, Williamsburg, Virginia. Graduated *summa cum laude*, Phi Beta Kappa, with Highest Honors for senior thesis on flocking and foraging behavior of shorebirds.

RESEARCH EXPERIENCE

2004-present, 1997-2000 — H. T. Harvey & Associates, San Jose, California. Designed and conducted a study of the value of gabion revegetation to breeding birds. Helped design and study effects of various dredging regimes on wetland bird communities. Assisted in a study of the effects of dredge spoil disposal on seabirds and marine mammals.

1992-1997 — Doctoral Research, Department of Biology, Stanford University. Research Advisor: Prof. Paul R. Ehrlich.
- Effects of urbanization, land use, and habitat alteration on riparian bird and plant communities.
- Contribution of riparian systems to landscape-level biodiversity.
- Nest site selection and reproductive success of urban-nesting Red-shouldered Hawks.
- Social, economic, and environmental implications of floodplain development.

1990-1992 — Senior Honors Research, Department of Biology, College of William and Mary.
- Foraging and flocking strategies of shorebirds in agricultural fields.
- Shorebird and wetland conservation.

1989-1992 — Research Assistant, Department of Biology, College of William and Mary.
- Distribution, habitat associations, and breeding phenology of breeding birds on Virginia's barrier islands.

PUBLICATIONS AND PRESENTATIONS

Rottenborn, S. C. and E. S. Brinkley. 2007. Virginia's Birdlife: An Annotated Checklist (Fourth Edition). Virginia Society of Ornithology.

Henkel, L., S. Rottenborn, and R. Duke. 2007. Surveys for California clapper rails: some methodological considerations. Poster presentation at 2007 State of the San Francisco Estuary Conference.

Rottenborn, S. C. 2000. Nest-site selection and reproductive success of Red-shouldered Hawks in central California. *Journal of Raptor Research* 34:18-25.

Rottenborn, S. C. and J. Morlan. 2000. Report of the California Bird Records Committee: 1997 Records. *Western Birds* 31:1-37.

Rottenborn, S. C. 2000. Birds and Urbanization: Conservation Challenges and Opportunities. Banquet speaker at 2000 annual meeting of the Virginia Society of Ornithology.

Rottenborn, S. C. 1999. Predicting the impacts of urbanization on riparian bird communities. *Biological Conservation* 88:289-299.

Rottenborn, S. C. 1996. The use of coastal agricultural fields in Virginia as foraging habitat by shorebirds. *Wilson Bulletin* 108:783-796.

Also authored species accounts for the *Breeding Bird Atlas of Santa Clara County, California* (32 accounts) and *The Virginia Breeding Bird Atlas* (eight accounts; atlas in preparation) and wrote six articles on bird occurrences for the Virginia Society of Ornithology's publication *Raven*.

SAMPLE H. T. HARVEY & ASSOCIATES PROJECT EXPERIENCE

- **Candlestick Point – Hunters Point Shipyard**, 2008-present. Serves as principal-in-charge for H. T. Harvey's performance of a wetland delineation and tree survey, and provision of biological resources-related planning and permitting assistance for the Candlestick Point-Hunters Point Shipyard project in San Francisco. Client: Lennar/CP Development Co., LP.
- **South Bay Salt Ponds Restoration Project**, 2004-present. For this 15,000-acre restoration project in San Mateo, Santa Clara, and Alameda counties, managed H. T. Harvey's preparation of the biological resources section of the EIR/EIS and the programmatic and Phase I Biological Assessments for Federal Endangered Species Act consultation; participated in numerous public meetings and meetings of the Science Team to discuss potential project effects on biological resources; and contributed to project planning and design. Client: Philip Williams & Associates, Ltd. for the California Coastal Conservancy, U.S. Fish and Wildlife Service, and California Department of Fish and Game.
- **Antioch Bridge Nesting Bird Management**, 2009-present. Serves as principal-in-charge for H. T. Harvey's preparation and implementation of a nesting bird management plan to avoid impacts to nesting birds during a seismic retrofit project on the 1.8-mile long Antioch Bridge across the San Joaquin River (Contra Costa and Sacramento counties). Client: CH2M HILL.
- **Concord Naval Weapons Station/Marine Ocean Terminal Concord Rail Surveys**, 1997-1998 and 2010-present. Coordinated and conducted surveys for California clapper rails and California black rails at Concord Naval Weapons Station/Marine Ocean Terminal Concord (Contra Costa County) to inform planning for contaminant remediation (1997-1998) and to inform the Master Planning process (2010). Clients: TetraTech (1997-1998) and TEC, Inc. (2010).
- **Oyster Point Business Park**, 2009-present. Serves as principal-in-charge for H. T. Harvey's preparation of the biological resources section of an EIR for a proposed business park on Oyster Point in San Mateo County. Client: Lamphier-Gregory.
- **Concord Community Reuse Project**, 2008-present. Serves as principal-in-charge for H. T. Harvey's performance of a wetland delineation, preparation of the biological resources section of an EIR, contribution to a stream/wetland restoration plan, and regulatory permitting assistance for this 5200-acre project site in Contra Costa County. Clients: Arup, Ltd. and City of Concord.
- **East Contra Costa County Habitat Conservancy Special-Status Species Analysis**, 2008-present. Serves as principal-in-charge for H. T. Harvey's analysis of the potential effects of the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan on "non-covered" special-status species. Client: East Contra Costa County Habitat Conservancy.
- **Newark Areas 3 and 4 Specific Plan**, 2005-present. Serves as project manager and senior wildlife ecologist for H. T. Harvey's preparation of the biological resources chapter of an EIR on proposed residential and golf course development on Newark Specific Plan Areas 3 and 4 in Alameda County; coordinated California tiger salamander and vernal pool branchiopod surveys. Client: David J. Powers & Associates.
- **Newby Island Sanitary Landfill Expansion**, 2007-present. Serves as principal-in-charge for H. T. Harvey's preparation of the biological resources chapter of an EIR and nuisance species abatement plan for the expansion of the Newby Island Sanitary Landfill in Santa Clara County. Client: David J. Powers & Associates.
- **Salinas River Lagoon Fisheries Enhancement**, 2008-present. Serves as principal-in-charge for H. T. Harvey's preparation of a biological resources report in support of an Initial Study/Mitigated Negative Declaration, preparation of a Biological Assessment for Federal Endangered Species Act consultation, and preparation of regulatory permits for a fish screen and

channel improvement project designed to enhance fish habitat in Salinas River Lagoon (Monterey County). Client: Schaaf & Wheeler.

- **Union City San Francisco Bay Trail**, 2006-2009. Coordinated wildlife surveys and compiled the wildlife sections of a Natural Environment Study and a Biological Assessment (for Federal Endangered Species Act consultation) for a 2.5-mile segment of the San Francisco Bay Trail adjacent to the California Department of Fish and Game's Eden Landing Ecological Preserve in Alameda County. Client: EIP Associates.
- **Delta Fish Agreement Consultation Assistance**, 2009. In support of the California Department of Water Resources' Delta Fish Agreement with the California Department of Fish and Game, conducted database and literature reviews and examined aerial photos to identify all federally listed species that could potentially be affected by the Agreement's conservation measures; prepared species accounts for nine listed plants and 11 listed animals that could potentially occur in or near the areas where conservation activities would be performed; and prepared effects analyses for each species and activity. Client: California Department of Water Resources.
- **U.S. Army Corps of Engineers South San Francisco Bay Shoreline Study**, 2007-2008. Assisted in planning and preparation of a biological resources existing conditions report for portions of the South San Francisco Bay in San Mateo, Santa Clara, and Alameda Counties on which the Corps may pursue a flood protection levee construction and tidal marsh habitat restoration project. Client: U.S. Army Corps of Engineers and California Coastal Conservancy.
- **South Bay Marshes California Clapper Rail Survey**, 2006**.** Coordinated and participated in conducting surveys for California clapper rails in a number of tidal marshes in South San Francisco Bay (Santa Clara and Alameda counties) as part of H. T. Harvey's long-term monitoring of the potential effects of freshwater discharges from the San Francisco-Santa Clara Water Pollution Control Plant on tidal marsh species. Client: City of San Jose.
- **Tri-Cities Landfill Closure**, 2006. Served as project manager for H. T. Harvey's preparation of the biological resources chapter of an EIR on the closure of the Tri-Cities Landfill in Alameda County. Client: David J. Powers & Associates.
- **South Bayside System Authority Nesting Bird Monitoring**, 2005-2006. Served as project manager for H. T. Harvey's monitoring of nesting herons, terns, and other birds at the South Bayside System Authority's plant in San Mateo County during construction of its Disinfection, Storage, and Pumping project. Client: South Bayside System Authority.
- **Greenbrae Boardwalk California Clapper Rail Survey**, 2005. Served as project manager for California clapper rail surveys conducted to document clapper rail use of the Greenbrae Shoreline Protection Project and Larkspur Ferry Terminal Marsh Mitigation Project (in Marin County) 15 years after construction.
- **Albany Landfill Reclamation**, 2005. Served as senior wildlife ecologist for H. T. Harvey's preparation of a biological resources report in support of an Initial Study/Mitigated Negative Declaration for tidal restoration and improved public access of a landfill along the Albany (Alameda County) shoreline. Client: Streamborn.
- **Alameda Creek Dredging Project**, 1998-2000. Assisted in the design of and conducted bird surveys for a study to determine the effects of different sediment dredging regimes on habitat conditions and wildlife along lower Alameda Creek in Alameda County. Client: Alameda County Public Works Agency.
- **Newark Magnesium Transmission Line Reconductoring**, 1997. Conducted field surveys for H. T. Harvey's preparation of a biological resources report and conducted wildlife construction monitoring for reconductoring of a 19-mile electrical transmission line running from Newark (Alameda County) to Cupertino (Santa Clara County). Client: David J. Powers & Associates.

Steve has contributed to more than 400 projects for H. T. Harvey & Associates involving wildlife impact assessment, NEPA/CEQA documentation, biological constraints analysis, endangered species issues, permitting, and restoration. Steve has conducted surveys for a variety of wildlife taxa, including threatened and endangered species, and contributes to the design of habitat restoration and monitoring plans. In his role as project manager and principal-in-charge for numerous projects, he has supervised data collection and analysis, report preparation, and agency and client coordination.

ADVISORY AND EDITORIAL POSITIONS

- Member, Scientific Advisory Board, San Francisco Bay Bird Observatory, 1999-2004, 2009-present.
- Regional Editor, American Birding Association's *North American Birds*, 1999-2000, 2008-present.
- Member, Riparian Mercury Biosentinel Science Advisory Group, San Francisco Estuary Institute, 2010.
- Member, San Francisco Bay Area Upland Habitat Goals Birds Focus Team, 2008.
- Contributing Scientist, *Ecological Connections between Baylands and Uplands: Examples from Marin County* (white paper workshop sponsored by San Francisco Estuary Institute), 2007.
- Member, Virginia Avian Records Committee, 2000-2005 (Vice Chair, 2004-2005).
- Member, Board of Directors, Virginia Society of Ornithology, 2000-2004.
- Member, California Bird Records Committee, 1997-2000.
- Regional Editor, American Birding Association's *Field Notes*, 1998-1999.
- Member, Board of Directors, Coyote Creek Riparian Station, 1994-1999.
- Chairman, Avian Research Committee, Coyote Creek Riparian Station, 1994-1995.

CONTINUING EDUCATION, WORKSHOPS, CONFERENCES

- Urbanization and Riparian Systems, University of California, Davis Extension Program, 1998.
- Wetlands Regulation, University of California, Davis Extension Program, 1999.
- Endangered Species Regulation, University of California, Davis Extension Program, 1999.
- Wetland Delineation, Wetland Training Institute, 2000.
- 2000 Nationwide Permits, Wetland Training Institute, 2000.
- Identification of Grasses, U.S. Department of Agriculture Graduate School, 2000.
- National Hydric Soils Workshop, Wetlands Regulatory Workgroup, Mid-Atlantic Hydric Soils Committee, 2001.
- Nationwide Permits Update, Wetland Training Institute, 2002.
- Soil Taxonomy and Classification, J.W. Teaford & Co., 2002.
- AutoCad 2000, CADD Microsystems, Inc., 2002.
- Virginia State Program General Permit (SPGP) Workshop, U.S. Army Corps of Engineers, 2002.
- Plant Identification, Bill Sipple, EPA (multiple in-house courses), 2001-2003.
- Conservation Design, Engineers & Surveyors Institute, 2003.
- Stream Classification and Mapping Workshop, Fairfax County Dept. of Public Works & Environmental Services, 2003.
- Intermittent and Perennial Stream Identification for Riparian Buffer Rule Applications, N. Carolina State University, 2003.
- Low Impact Development Workshop, U.S. Army Corps of Engineers, 2003.
- State of the San Francisco Estuary Conference, 2007.
- Habitat Conservation Planning from Tahoe to the Bay, 2009.

PERMITS HELD

- H. T. Harvey & Associates' U.S. Fish and Wildlife Service 10(a)(1)(A) recovery permit TE797267-10; authorized to conduct surveys for western snowy plover and California clapper rail
- California Department of Fish and Game Scientific Collecting Permit SC-010564.
- California Department of Fish and Game Memorandum of Understanding to conduct broadcast surveys for California clapper rail and California black rail

CURRENT MEMBERSHIPS

- American Ornithologists' Union
- Cooper Ornithological Society
- Wilson Ornithological Society
- The Waterbird Society
- Raptor Research Foundation
- Western Field Ornithologists
- Santa Clara Valley Audubon Society
- San Francisco Bay Bird Observatory
- Society for Conservation Biology
- Central California Coast Chapter, Society for Conservation Biology
- Virginia Society of Ornithology
- Augusta Bird Club