WILD Equity INSTITUTE

Building a healthy and sustainable global community for people and the plants and animals that accompany us on Earth

February 21, 2014

Angela Calvillo
Clerk of the Board
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, CA 94102-4689

RE: APPEAL OF THE FINAL MITIGATED NEGATIVE DECLARATION AND PROJECT APPROVAL FOR THE SAN FRANCISCO RECREATION AND PARK DEPARTMENT'S PROPOSED "SHARP PARK PUMPHOUSE SAFETY AND INFRASTRUCTURE IMPROVEMENT PROJECT" (Case No. 2012.1427E)

Dear Ms. Calvillo:

The Wild Equity Institute and the Sierra Club's San Francisco Bay Chapter, the Center for Biological Diversity, the National Parks Conservation Association, Nature in the City, Save the Frogs!, Golden Gate Audubon, and other interested individuals and organizations submit this appeal of the Final Mitigated Negative Declaration ("FMND") adopted by the Planning Department for the Sharp Park Pumphouse Safety and Infrastructure Improvement Project ("Pumphouse Project"), Case No. 2012.14727E.

Preeminent herpetologists, coastal ecologists, and hydrologists have reviewed the revisions and mitigation measures announced in the FMND. Below you will find facts, reasonable assumptions predicated upon those facts, and expert opinions that explain how, even as revised and mitigated, the Pumphouse Project will cause significant adverse effects to (1) Sharp Park's hydrology and water quality, (2) the Laguna Salada wetland complex found there, and (3) the threatened California red-legged frog (*Rana draytonii*) & endangered San Francisco gartersnake (*Thamnophis sirtalis tetrataenia*), both of which depend upon this wetland complex for their survival.

The evidence makes clear that there is, at the very least, a fair argument that the Pumphouse Project may have a significant effect on the environment—which in turn requires San Francisco to prepare an Environmental Impact Report ("EIR") before approving the project. Cal. Pub. Res. Code § 21151; *Sierra Club v. County of Sonoma*, 6 Cal. App. 4th 1307, 1316 (1992) ("Section 21151 creates a low threshold requirement for initial preparation of an EIR and reflects a preference for resolving doubts in favor of environmental review when the question is whether any such review is warranted. [citations] For example, if there is a disagreement among experts over the significance of an effect, the agency is to treat the effect as significant and prepare an EIR.").

An EIR is particularly important here, because there are feasible alternatives to the proposed project that would reduce or avoid the Pumphouse Project's environmental effects. Specifically, allowing the Laguna Salada wetland complex's water level to rise slightly above the level tules and

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cattails can tolerate would reduce the amount of aquatic vegetation in the system, without any of the impacts to water quality, hydrology, and endangered species that the proposed project imposes. But this alternative has been ignored because only EIRs must consider feasible alternatives, and to date the City has refused to even acknowledge that alternatives to the project exist.

I. BY EXCLUDING PUMPHOUSE OPERATIONS FROM THE PROJECT DESCRIPTION THE DEPARTMENT HAS FAILED TO CONSIDER AND MITIGATE SIGNIFICANT ENVIRONMENTAL EFFECTS OF THE PUMPHOUSE PROJECT.

An accurate project description is an indispensible element of informed and legally sufficient environmental review processes under CEQA. Cnty. of Inyo v. City of Los Angeles, 71 Cal. App. 3d 185, 193, (Ct. App. 1977) (Calling an accurate project description the "*sine qua non*" of CEQA review). The FMND's project description, however, has failed to include the Pumphouse Project's key objective: to operate the pumphouse more extensively than it has ever been operated before. This increase in pumphouse operations is likely to have significant, adverse consequences on Sharp Park's threatened and endangered species, its water quality, and its hydrology. Because these significant effects exist, the Department must conduct an EIR to make an informed decision about the Pumphouse Project.

A. THE PUMPHOUSE PROJECT'S PRIMARY PURPOSE IS TO INCREASE PUMPHOUSE OPERATIONS, YET THE EFFECTS OF PUMPHOUSE OPERATIONS HAVE BEEN EXCLUDED FROM ENVIRONMENTAL REVIEW.

The Pumphouse Project's record reveals that expanding pumping operations is the very purpose of the project. For example, the project description explains, "*operation* of the flood control pump system is necessary to manage floodwaters both on Sharp Park and adjacent properties." FMND, p. 4 (emphasis added). It then explains, "[t]wo factors *adversely affect the operation of the pumps.* First, *pump operation is impaired* by sediment buildup and vegetation growth around the pump intake structure and along the connecting channel between [Horse Stable Pond and Laguna Salada]. Second, *pump operation is impaired* by the buildup of vegetation on the pump intake screens." *Id.* (emphasis added). The FMND then describes what the Pumphouse Project will do to expand pump operations: "[s]ediment and emergent vegetation, including cattails (*Typha angustifolia*) and bulrush (*Scirpus americanus*), near the existing pumphouse *would be removed in order to reduce obstructions to water flow into the pump intake structure....*" FMND, p. 6 (emphasis added); *see also id.* (A primary purpose of the Pumphouse Project is to "remove impediments to water flow within the wetland complex.").

A logical consequence of accelerating water flow to the pumphouse is that pumphouse operations will expand. But the FMND does not consider the effects of expanded pumphouse operations, because the Department expressly excludes all pumphouse operations from the project description:

> Although ongoing golf course operations, such as pump management and operation, mowing, and golf cart use, are discussed in the Biological Opinion, *these ongoing operations and maintenance activities are not considered part of the proposed project for purposes of this CEQA analysis, but rather are considered part of the existing, or baseline, conditions. No*

changes to golf course operations and maintenance, including operations of the pumps, are proposed as part of this project.

FMND, pp. 8-9 (emphasis added). Yet the project sponsor, San Francisco's Recreation and Park Department ("SFRPD"), has consistently acknowledged that the Pumphouse Project will in fact result in enhanced pumphouse operations. Specifically, SFRPD has acknowledged that (1) the wetland complex's aquatic vegetation moderates the flow of water from Laguna Salada to the pumphouse,[1, 2] and (2) if the aquatic vegetation was removed the pumphouse would drain more of the wetland complex, and at faster rates. For example, in a recent deposition John Ascariz, the Recreation and Park Department's Station Engineer for the pumphouse, explained that the Laguna Salada wetland complex moderates pumphouse operations at Sharp Park, and that pumphouse operations would increase if aquatic vegetation were removed from the system:

> Q. So I guess one thing I'm still trying to understand, if we can, is how the growth of the tules over time is impacting that number?
>
> A. To not let the water come into the pump station.
>
> Q. It's keeping the water out of the pump station?
>
> A. Keeping it way up above. All those tules is keeping like a dam and keeping all that water all up in the golf course instead of letting it flow down. You were saying through that channel creek is all grown where it's stopping the water from draining to our pump station.
>
> Q. It's your understanding that at some point the pump is no longer draining the golf course; is that right?

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[1] Letter from Sean Sweeney, Recreation and Park Department Golf Program Director, to Chris Nagano,

[2] The project description in the Pumphouse Project's Biological Opinion—which "was provided by SFPRD in the *Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project Biological Assessment*" and upon which the FMND heavily relies—also recognizes that the Laguna Salada wetland complex moderates pumphouse operations:

> California red-legged frog breeding and deposition of egg masses coincide with winter storm events (Storer 1925, Service 2002) which cause water levels to rise in Horse Stable Pond, Laguna Salada, and surrounding wetlands (SFRPD 2012). Although water levels may be lowered in advance of winter storms to provide additional water storage capacity, the pumps are not able to *instantaneously lower water levels throughout the site as storm water runoff accumulates from the surrounding watershed* (Geomatrix 1987; Kamman Hydrology and Engineering, Inc. 2009; Hayes 2012).

U.S. Fish and Wildlife Service (USFWS). Formal Endangered Species Consultation on the Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project in San Mateo County, California. 08ESMF00-2012-F-0082-2. October 2, 2012. p. 33 (emphasis added).

A. Very slow.

. . .

Q. Do you recall seeing the golf course flooded last winter?

A. Yes.

Q. And why did it flood if you had the pump set at this low level?

A. Because all the tules.

MR. CLEMENTS: Objection. It's an incomplete hypothetical. It's vague. You can answer.

THE WITNESS: Because the tules are growing and stopping our water from coming to the pumps. Then it floods all out. It's holding the water all out at the golf course instead of letting it come to our pumps for we can pump it out.

. . .

Q. Again, as best you understand from your experience, if the tules were removed, then the pumps would be able to get the water out more efficiently; is that right?

A. Yes.

Q. And do you think that you would be able to keep the course from flooding if the tules weren't there?

A. Yes.

Q. Even in a winter like last winter where there was a lot of rain?

MR. CLEMENTS: Objection. Calls for speculation.

MR. CRYSTAL: Q. Based on your experience.

A. Yes. It would do good with the pumps running. It would pump that water out.

Ascariz Dep. pp. 62, 80-81 Dec. 14, 2011. (Exhibit B). Mr. Ascariz's testimony explains how baseline conditions in the Laguna Salada complex moderate the rate and extent of pumphouse operations, and also explains how the activities called for in the Pumphouse Project—dredging sediment and aquatic vegetation from Horse Stable Pond and the connecting channel—will expand pumphouse operations. Thus, the FMND's assumption that the Pumphouse Project will have no effect on the rate and extent of baseline pumping operations is unsupported by the record: indeed, the assumption is flatly contradicted by the project sponsor itself.

The Planning Department claims that because "no changes to the pump infrastructure" are proposed and because "none of [the] operation protocols will be changed by this project," this project will not change the amount of water pumped out of the Laguna Salada wetland complex. But this argument is disingenuous for three reasons.

First, in 2008 the Recreation and Park Department did change pump infrastructure at Sharp Park by installing a new, larger pump with a rated pumping capacity of 10,000 gallons of water *per minute*. The Recreation and Park Department did not, however, conduct any CEQA review to determine whether *operating* this new, large pump would have significant environmental affects on the wetland complex and/or the species found at Sharp Park. It limited its environmental review to the *installation* of the pump—just as the Department proposes to do with the Pumphouse Project. To this day—and despite the annual operation of this pump during winter rains—the Department has failed to consider the environmental consequences of pumping such large volumes of water out of the wetland system in such a short period of time. It is disingenuous of the Department to state that it proposes no changes to pump infrastructure when in fact the Department greatly expanded its pump infrastructure in the recent past, without any CEQA analysis of that expansion.

Second, it is clear from the project description as well as the sworn testimony of the engineer who operates the pumphouse that currently the pump is not able to operate at its rated capacity, and that that Pumphouse Project's purpose is to eliminate structures that constrain the pumping rate at Sharp Park. The record is replete with references explaining that the project's primary purpose is to increase water flow to the pumphouse so the new pump may operate closer to its rated capacity. *See, e.g.,* FMND p. 6 ("The primary purposes of the proposed construction of a pond, golf cart path realignment, and sediment and vegetation removal are to . . . remove impediments to water flow within the wetland complex. . . . Sediment and emergent vegetation, including cattails (*Typha angushfolia*) and bulrush (*Scirpus ainericanus*), near the existing pumphouse would be removed in order to reduce obstructions to water flow into the pump intake structure. . . ."). These changes necessarily mean that the pumps will be operating at a faster rate, either because (a) they pump water out at a faster rate, or (b) they are able to operate on a more consistent basis because the pumphouse intake structure remains free of debris for longer periods of time. In either case, more water will be removed from the wetland complex at a faster rate than occurs presently: and the Department has never considered this environmental effect through any CEQA document.

Third, the operating protocols that constrain pumping only apply once California red-legged frog egg masses are observed at Sharp Park, and even then only constrain pumping operations if further pumping may expose the egg mass to the air. Outside of the breeding season, the golf course can, and does, drain the wetland complex as close to the level of the groundwater interface: despite protocol guidance that suggests water levels should remain at 1.0 on the pumphouse gauge (depending on the extent of "emergent vegetation" in the system). Indeed, even in this year's drought conditions, pumping has been occurring regularly, draining the Laguna Salada wetland complex's water levels to extremely low levels.

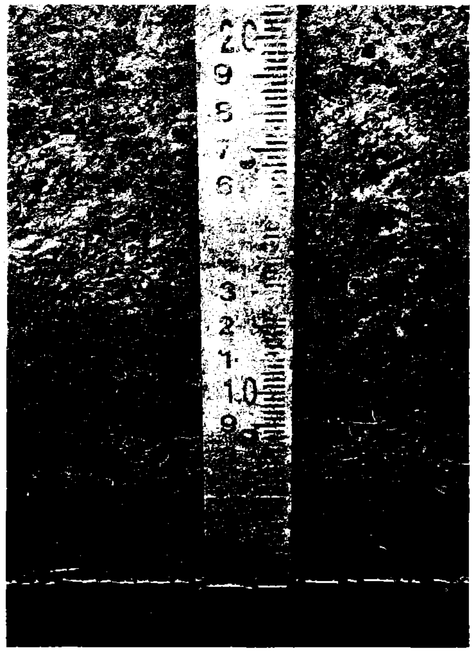

*Photo of Sharp Park Pumphouse Gauge 10/18/2013
shows water levels at .4, significantly below 1.0,
with evidence of recent pumping activity.*

This outside-the-breeding-season pumping is designed to create "storage capacity" for rainwater within the complex, which in turn is expected to keep water off of the golf course itself.

Given that the operating protocols permit the golf course to drain the Laguna Salada wetland complex to extremely low levels as if it were a water storage system rather than a rare and ecologically important coastal wetland system, it is simply not true that the operating protocols will prevent the Pumphouse Project from altering the amount and rate of water removal from the system.

B. INCREASING PUMPHOUSE OPERATIONS WILL HAVE SIGNIFICANT ENVIRONMENTAL EFFECTS ON ENDANGERED SPECIES, WATER QUALITY, AND HYDROLOGY.

> When a change occurs in one part of the circuit, many other parts must adjust themselves to it. Change does not necessarily obstruct or divert the flow of energy; evolution is a long series of self-induced changes, the net result of which has been to elaborate the flow mechanism and to lengthen the circuit. Evolutionary changes, however, are usually slow and local. *Man's invention of tools has enabled him to make changes of unprecedented violence, rapidity and scope.*

Aldo Leopold, *A Sand County Almanac* 181 (Oxford University Press 2001) (1949).

The Project Sponsor predicts that the Pumphouse Project will increase the rate at which water flows to the pumphouse, and keep Laguna Salada hydrologically connected to the pumphouse throughout a greater portion of the year. This will expand pumphouse operations at Sharp Park, which will in turn cause significant environmental effects on a variety of resources that are already stressed by the existing rate and scope of pumphouse operations. Yet none of these effects have been assessed, let alone mitigated, by the Department. This is a violation of CEQA, and the Department must remedy this violation by preparing an EIR for the Pumphouse Project.

1. EXPANDING PUMPHOUSE OPERATIONS WILL HAVE SIGNIFICANT ADVERSE EFFECTS ON THE CALIFORNIA RED-LEGGED FROG.

For two decades, the City has known that its operation and management of Sharp Park Golf Course takes large numbers of California red-legged frogs. For example, in 1992 consultants reported to the City that "pumping of water out of Horse Stable Pond and the resultant exposure of shoreline was causing massive frog egg mass mortality." Exhibit C, p. 24. Nonetheless, the City has continued to drain Sharp Park's wetlands to ameliorate chronic Golf Course flooding. As expected, the City stranded and desiccated numerous California red-legged frog egg masses in subsequent years, with the City's consultants and staff documenting multiple mortality events in 2003, 2004, 2005, and 2008.[3]

Then on January 3, 2012, before the first large rain of the 2011-12 California red-legged frog breeding season, the City ordered the pump house engineer to reduce the water level at Sharp Park by .5 feet. Exhibit B, p. 36. Once egg-masses were observed, SFRPD attempted to maintain a water level for Horse Stable Pond that will keep the eggs masses submerged in water.

Nonetheless, approximately 47 California red-legged frog egg masses were stranded, fragmented, or otherwise taken at Sharp Park between January 27, 2012, and March 8, 2012. Exhibit D, p. 1-4 (Summary of Campo et al., 2012). This is approximately 1/3 of all egg masses observed at Sharp Park between those dates. Stranded egg masses were observed in nearly all portions of Sharp Park's wetland features, including the northern and western potions of Horse Stable Pond, and the northern, eastern, and western portions of Laguna Salada.[4]

This level of take alone would present a fair argument of significant environmental affects from the proposed project. Alarmingly, when the Pumphouse Project is implemented regulators believe the City will take *virtually all egg masses* laid at Sharp Park each year that it operates—up to 130 egg masses every winter breeding season, roughly equivalent to the entire number of egg masses laid in the frog's most prolific and fecund breeding seasons.[5]

The Pumphouse Project's extraordinary amount of take is a logical consequence of the increased pumphouse operations the project will cause. Dr. Vance Vredenburg, a world-renowned herpetologist based at San Francisco State University has explained why this is so:

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[3] Swaim Biological Incorporated. *Sharp Park Wildlife Surveys and Special Status Reptile and Amphibian Restoration Recommendations*, December 4, 2008, p. 4-4.

[4] Campo et al. 2012, pp. 22, 26, 33, 36, 39, 49, 54, 62, 67. Submitted to the Department by Wild Equity during the public comment period and observed in the case file for the Pumphouse Project on October 10, 2013. Wild Equity incorporates these previously submitted documents by reference.

[5] U.S. Fish and Wildlife Service (USFWS). In Reply Refer To: 08ESMF00-2012-F-0082-2, Formal Endangered Species Consultation on the Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project in San Mateo County, California, October 2, 2012. p. 40.

[The California red-legged frog] has evolved over millions of years towards a strategy of egg-laying that balances water depth, water temperature, predator avoidance, and pond desiccation. The most successful frogs maximize the contrasting pressures of pond desiccation and water temperature. For example female frogs that choose to lay their eggs in deeper water are minimizing risk to desiccation but also exposing eggs to cooler water temperatures, which translate into slower growth and development. Deeper, more permanent water also harbors a more diverse food web which is more likely to contain aquatic egg and tadpole predators. Females that lay eggs in the shallowest water on the margin of ponds are maximizing growth potential (warmer temperatures) and minimizing exposure to aquatic predators, but are also exposing egg masses to higher probability of desiccation. *If the rains continue and the pond does not dry too quickly the strategy pays off and eggs in shallow waster hatch faster, tadpoles grow faster and outcompete other eggs and tadpoles from other frogs laid in deeper water.*

Ponds fill and dry seasonally and although it can seem rather dramatic from wet to dry years, the change over the course of days is not rapid because water levels decrease mostly due to evaporation from heat and use by terrestrial and emergent plants during photosynthesis. The pumping of water to dry up fairways at Sharp Park, however, is well outside the natural rate of pond drying and the frogs are not adapted to this type of rapid change in pond depth. Therefore, because these frogs have evolved a breeding strategy over millions of years that is cued in on natural rates of desiccation, the pumping of the ponds by the golf course will inevitable lead to a much higher mortality rate for the eggs that the females lay at the margins of the pond, in the shallowest water.

Vredenburg Decl., p. 11-12 (Exhibit E) (emphasis added). There is a fair argument supported by substantial evidence and expert opinion that clearing vegetation and sediment from Horse Stable Pond and the connecting channel so that water flows to the pumphouse even faster than it does presently will significantly reduce survivorship of California red-legged frog egg masses, a threatened species protected by the Endangered Species Act. This significant environmental effect cannot be ignored: the Department, through a thorough and complete EIR, must consider it.

2. EXPANDING PUMPHOUSE OPERATIONS WILL HAVE SIGNIFICANT ADVERSE EFFECTS ON THE LAGUNA SALADA WETLAND COMPLEX'S HYDROLOGY.

The connecting channel between Laguna Salada and Horse Stable Pond is shallow, with bed elevation ranges between 3.1 and 6.2 feet.[6] When water surface elevations recede below 6.2 feet, Horse Stable Pond and Laguna Salada become hydrologically disconnected. Letter from Greg Kamman, Kamman Hydrology & Engineering, Inc., to Ryan Olah, Chief—Coastal Division Branch, U.S. Fish and Wildlife Service (August 3, 2012) (Exhibit F, p. 4). When the two water bodies are hydrologically disconnected, the pumphouse's ability to drain the Laguna Salada wetland complex is reduced, and the negative environmental affects on the wetland system's hydrologic resources are arrested.

However, the Pumphouse Project proposes to remove 96,948 liquid gallons (480 cubic yards) of sediment from the connecting channel. The portions of the connecting channel to be dredged include the highest point along the longitudinal profile of the channel: the area near the culvert passing under the 12th fairway of the golf course.[7] If this area is dredged, Laguna Salada will remain hydrologically connected to the pumphouse for a greater portion of the year: which will in turn result in allow pumphouse operations to drain Laguna Salada's wetland complex more continuously than present. Exhibit F, p. 4.

This increased hydrological connectivity may result in significant adverse environmental effects in one of two ways. First, if the Project Sponsor is correct and the connectivity permits SFRPD to drain the Laguna Salada wetland complex more rapidly and thoroughly, the hydrological resources presently preserved in the Laguna Salada complex will be changed. For example, draining wetlands is known to increase tule and cattail populations, and as these species become more numerous Laguna Salada's open water habitats would decrease in size. Dr. Peter Baye, *Critical Review of the Biological Assessment for the "Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project"* May 2012. p. 5 (Exhibit G, p. 9). However, this effect is not considered in the FMND: even though reducing tule and cattails is the primary purpose of the project.[8]

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[6] The Department has stated in response that the channel's culvert is set at a depth of 6.54 feet. This statement is inconsistent with the findings of Greg Kamman, the expert hired to prepare a hydrologic report of Sharp Park, which precede this footnote. The Department's statement appears to be based on a subset of data collected by Mr. William Vandivere, which collectively indicates that the culvert's height is between 5.77 and 6.54 NAAVD. This factual dispute alone requires an EIR, because there is conflicting expert data over a critical issue of environmental concern. But putting that dispute aside, Kamman's point still holds: every inch of sediment removed from the culvert will lower the absolute elevation of water traveling through the culvert by one inch. This holds true whether the culvert's base elevation is 3.1 feet, 6.54 feet or somewhere in between—because at present sediment covers the bottom of the culvert, raising its effective elevation by the depth of the sediment. When these sediments are removed, they hydrological connectivity of Horse Stable Pond to Laguna Salada will be affected.

[7] Kamman Hydrology & Engineering, Inc. Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study: Laguna Salada Wetland System, Pacifica, California, March 30, 2009. p. 16.

[8] There is no evidence to support the Project Sponsor's position that tule and cattails at the Wetland Complex are impairing California red-legged frog breeding activity. Thus, it is not apparent that additional tule and cattail growth will negatively affect the species. But this is precisely why an EIR is necessary here: there is a substantial evidence of a fair argument of environmental affects that the FMND has failed to disclose, let alone analyze.

Second, it is also possible that the Project Sponsor is not correct, and that the Pumphouse Project will actually reverse the flow of water from Laguna Salada to Horse Stable Pond. Exhibit F, p. 4. Kamman Hydrology, the author of the Hydrologic Assessment that the Department relies upon to justify the project, has explained that SFRPD and the Department are not accurately interpreting his hydrologic study. In his Aug. 3 letter, Kamman explains that storm runoff into Horse Stable Pond is roughly double the amount of storm runoff into Laguna Salada. Because Horse Stable Pond's edge is much more steeply sloped than Laguna Salada's, the storm runoff causes Horse Stable Pond's surface level to rise much more rapidly than Laguna Salada's surface level, which tends to spread outward across its shallow edge, rather than upward. Because of this, initial storm surges tend to drive water from the high-elevation Horse Stable Pond through the connecting channel and into the lower-elevation Laguna Salada. *Id.* at 5.

The practical consequences of this analysis are two-fold: first, removing vegetation from the connecting channel will increase flooding at Sharp Park Golf Course compared to present conditions as waters from Horse Stable Pond are driven into Laguna Salada and extend outward along Laguna Salada's shallow margin. *Id.* Second, as waters flow from Horse Stable Pond into Laguna Salada (and therefore away from the pumphouse), the pumphouse will not function effectively as waters flow away from its intake pipe.

As explained in *Sierra Club v. County of Sonoma*, "if there is a disagreement among experts over the significance of an effect, the agency is to treat the effect as significant and prepare an EIR." 6 Cal. App. 4th at 1316. Here, the expert that prepared the hydrologic study relied upon by the FMND has informed the Department that the Project Sponsor has misinterpreted the expert's results, and provided the Department with the correct interpretation of his expert reports and opinions about the Pumphouse Project's probable impacts. Under such circumstances, CEQA requires the Department to prepare an EIR to fully consider the significant environmental impacts that may arise from the Pumphouse Project.

3. EXPANDING PUMPHOUSE OPERATIONS WILL HAVE SIGNIFICANT ADVERSE EFFECTS ON THE LAGUNA SALADA WETLAND COMPLEX'S WATER QUALITY.

The FMND suggests that Sharp Park's berm was completed in the 1940s and enhanced habitat conditions for California red-legged frogs and San Francisco gartersnakes by "eliminat[ing] the hydrologic connection between the Pacific Ocean and the wetland complex." FMND, p. 3. This suggestion is based on the presumption that Laguna Salada was once a tidal lagoon, influenced daily by ocean tides. Both the suggestion and presumption are inconsistent with the best available science.

Laguna Salada was never a tidal lagoon, nor did ocean waters daily or regularly influence it.[9] The most extensive natural history investigation ever conducted of Sharp Park concludes that Laguna

[9] The City's belief is based on (PWA 1992), which is relied upon to advance proposals in this and other Department projects at Sharp Park. However, the successor of this study—ESA-PWA 2011—thoroughly reviewed the 1992 report and determined it was deficient and out of date in numerous ways, ultimately rejecting the 1992 report's assumptions about the historical condition of the site (ESA-PWA 2011, p. 39-40). The Department's continued reliance on a discredited report that is more than two decades old—and its complete failure to reference a modern study by the same authors—is a prejudicial abuse of discretion that "precludes informed decisionmaking and informed public participation, thereby thwarting the

Salada was, under natural conditions, a fresh-to brackish backbarrier lagoon system surrounded by freshwater wetlands, separated from the ocean by a protective dune-like beach system.[10] Lagoons with these structures and ecological characteristics provide suitable habitat for frogs and snakes throughout the state—as did Sharp Park's lagoons before the berm was completed in the 1980s.

Aerial photos from the 1940s through the 1980s indicate that Sharp Park's berm was not complete and consistently present until after the mid-1980s.[11,12] Nonetheless San Francisco gartersnakes were recovering at Sharp Park until the mid-1980s.[13] The City has previously suggested that an ocean storm surge brought high salinity levels to Laguna Salada in 1986 and alone halted this recovery,[14] but this seems unlikely give the fact that Sharp Park's California red-legged frog and San Francisco gartersnake populations survived ocean storm surges as large or larger in the 1930s,[15] 1950s (see Figure 1), and 1970s. Exhibit I, p. 18-19.

The persistence of both species at Sharp Park through 1986 despite (a) an incomplete sea wall and (b) several coastal storm surges that inundated Sharp Park indicates that declines in the late 1980s are unlikely to be attributable to coastal processes. For example, "when aquatic habitat (ponds and streams) is abundant as a result of adequate rainfall, the California red-legged frog can produce large numbers of dispersing young, resulting in an increase in the number of occupied sites. In contrast, the California red-legged frog may temporarily disappear from an area during periods of extended drought." Revised Critical Habitat for *Rana Draytonii*, 75 Fed. Reg. 12816 (Mar. 17, 2010). From 1987-1992 California faced a severe drought, and "it is possible that the most severe impacts have been on the environment and the fish and wildlife that depend on the rivers for their sustenance."[16] Specifically, the drought severely degraded wetland habitats, and endangered species populations declined significantly.

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statutory goals" of CEQA review." *Al Larson Boat Shop, Inc. v. Board of Harbor Commissioners*, 18 Cal. App. 4th 729, 748 (1993).

10 ESA-PWA. 2011 *Conceptual Ecosystem Restoration Plan and Feasibility Assessment: Laguna Salada, Pacifica, California* 39. Exhibit L.

11 *Id.* at 40.

12 Arup North America. Sharp Park Sea Wall Evaluation, February 5, 2010. Figures 3-7 (Exhibit J).

13 SFRPD. Biological Assessment, Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project, August 16, 2012. p. 39.

14 *Id.* at 31.

15 The earliest of these storms occurred shortly after golf architect Alister McKenzie leveled the natural dune-like barrier protecting Laguna Salada from ocean storms. He did so to place several golf links on the beach. All of these links were destroyed in subsequent storms, and eventually the course was redesigned, moving many of these holes to the east side of Highway 1. Exhibit I, p. 18-19.

16 Dziegielewski, B.; Garbharran, H. P.; Langowski, J.F. Jr. *Lessons Learned from the California Drought (1991-1992)* IWR Report 93-NDS-5 (1993) p. 118.

Figure 1 April 4, 1958 flooding of Sharp Park. Caused by storm water runoff and wave overtopping of berm.
Geomatrix Consultants. Feasibility Study, Restoration of Coastal Embankment, Sharp Park Golf Course, Pacifica, California. November 1987. p. 20.


Figure 2 1966 Photo of the USS George Johnson beached at Sharp Park, with no seawall or berm present.


Figure 3. 1972 Coastal Records Project photo showing incomplete berm at Sharp Park.

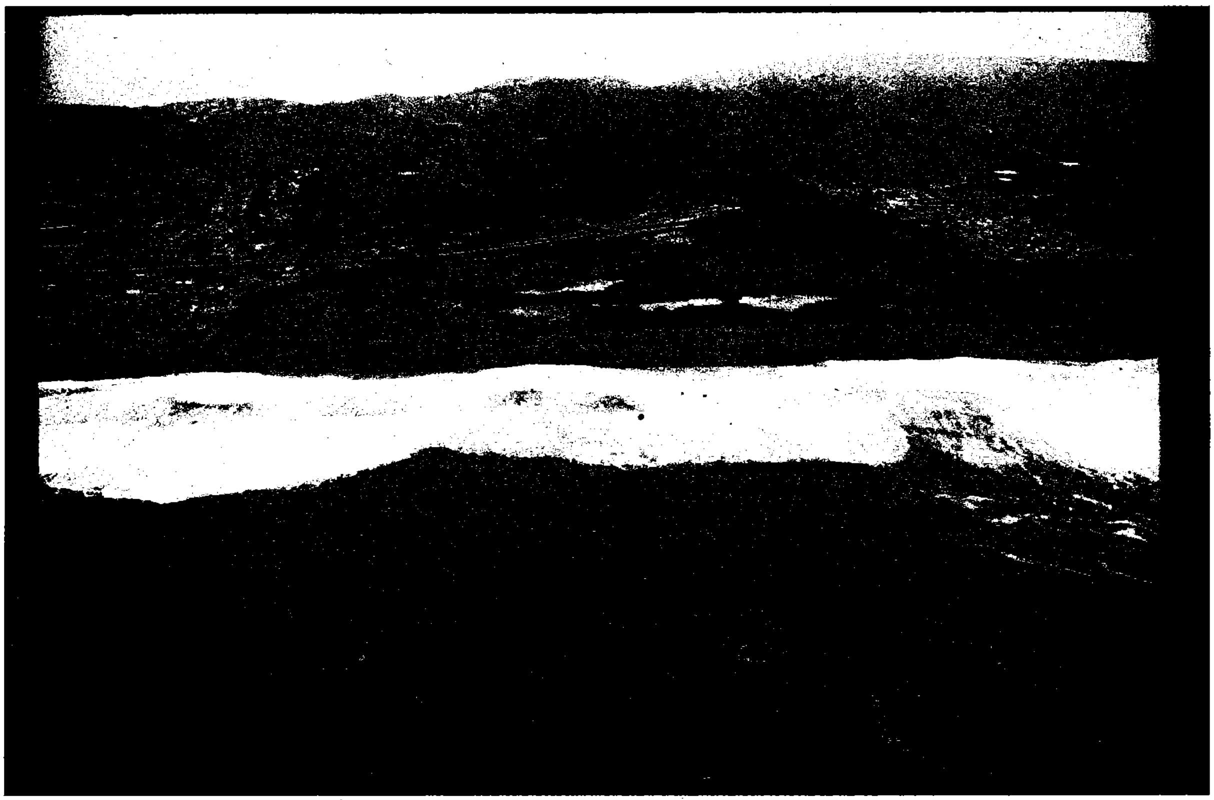

Figure 4 1979 Coastal Records Project photo showing incomplete berm at Sharp Park.

Figure 5 1987 Coastal Records Project photo showing incomplete berm at Sharp Park.

Figure 6 1993 Coastal Record Project photo showing completed berm.

This fundamental misunderstanding of Laguna Salada's ecological underpinnings has led the Department to overlook significant environmental effects of the Pumphouse Project, and to consider harmful project activities as mitigation measures. For example, retaining the sea wall while pumping Sharp Park's wetlands will exacerbate, not prevent, saltwater intrusion from the Ocean as marine waters are pulled through the existing groundwater (hydrologic) interface with the Ocean, eventually making the entire lagoon inhospitable to California red-legged frogs (ESA-PWA 2011, p. B-13). Moreover, the project's dredging proposal, rather than improving breeding habitat for listed species, will put them at risk by encouraging listed species to breed in the areas most vulnerable to pumping-induced saltwater intrusion. *Id.*

Given the substantial evidence that the Department's basic ecological presumptions are flawed—and the resulting significant environmental effects that were ignored or exacerbated because of this flawed presumption—the Department must consider the best available information about Sharp Park's natural history and ecology, and ensure that the Project is both biologically and ecologically sound through a complete EIR.

II. THE PUMPHOUSE PROJECT HAS AN UNSTABLE, SHIFTING PROJECT DESCRIPTION, FRUSTRATING INFORMED DECISIONMAKING AND PUBLIC OVERSIGHT OF SHARP PARK.

The project description for the Pumphouse Project "includes elements that are required under a Biological Opinion issued by the U.S. Fish and Wildlife service." FMND, p. 5. But the project description also segments several of the Biological Opinion's required elements from the Pumphouse Project. The Department then declares that these segmented elements of the

Pumphouse Project are either categorically exempt from environmental review, or includes the element's effects in the environmental baseline. In either case, the Department is "chopping a large project into many little ones. . .which cumulatively may have disastrous consequences." *Bozung v. Local Agency Formation Commission* (1975) 13 Cal.3d 263, 283-284. Specifically, the action subject to the Biological Opinion has now been segmented into at least three projects for purposes of CEQA: (1) a .5 acre upland habitat restoration project that the Department declared categorically exempt from CEQA on August 5, 2013, thus evading environmental review;[17] (2) pumping operations that the Department deems to be a component of the environmental baseline, thus evading environmental review; and (3) the remainder of the Pumphouse Project: which the Department has refused to review through a complete EIR.

CEQA forbids such "piecemeal" review of the significant environmental impacts of a project. This rule derives, in part, from Cal. Pub. Res. Code § 21002.1(d), which requires lead agencies to "consider[ ] the effects, both individual and collective, of all activities involved in [the] project." In the instant case, SFRPD declared to the Fish and Wildlife Service just a few months ago that the upland habitat restoration, pumphouse operations, and the rest of the Pumphouse Project was a single action. In response, the Fish and Wildlife Service imposed mandatory terms and conditions on SFRPD in exchange for authorization to kill threatened and endangered species. Those terms and conditions included (1) completing the upland restoration project, (2) operating the pumphouse pursuant to specific protocols, and (3) implementing other terms and conditions for the Pumphouse's construction actions. Thus, each of these three projects has been treated as a "crucial functional element of the larger project such that, without it, the larger project could not proceed." *Communities for a Better Environment v. City of Richmond* (2010) 184 Cal.App.4th 70. Indeed, the Biological Opinion expressly states that each element of the project description, reasonable and prudent measure, and each term and condition are "non-discretionary," and must become "binding conditions . . . in order for the [take exemption] to apply." Biological Opinion, p. 39. Thus, these segmented activities are "conditions of approval" for the Pumphouse Project as a whole, and as such it is improper for the Department to segment these elements of the project and evade stringent environmental review. *See Tuolumne County Citizens for Responsible Growth, Inc. v. City of Sonora* (2007) 155 Cal.App.4th 1214, 1224.

The adverse consequences of this piecemealing are already evident at Sharp Park. Laguna Salada has traditionally been a place for birdwatchers to observe wildlife, and several unique birds have been observed there in recent years. At the same time illegal off-leash dog activity has the potential to adversely affect the Laguna Salada wetland complex. SFRPD proposed fencing Sharp Park's berm to address these concerns, and included this fencing as a component of the Pumphouse Project SFRPD submitted to the Fish and Wildlife Service for review.
But a few months ago SFRPD segregated the fencing project from the environmental review process for the Pumphouse Project, and moved forward with the fencing project as a separate project exempt from environmental review. But the fence constructed by SFRPD is so large that it

[17] One practical consequence of the Department's decision to take a condition of approval in the Biological Opinion and implement it in advance of the Pumphouse Project's review is that the upland restoration project can no longer serve as a mitigation or conservation measure for the Pumphouse Project. Instead, it must be considered a part of the environmental baseline for the Pumphouse Project, and provide additional mitigation for the Pumphouse Project's significant environmental effects.

unnecessarily eliminated all bird watching access to Laguna Salada. Similarly, SFRPD attempted to segment a so-called "grading" project for the path along Sharp Park's berm, but then proceeded to place rip-rap and armoring along the berm, resulting in a stop work order from the Coastal Commission. Exhibit M.

If these project had not been piecemealed, informed decisionmaking with public oversight almost certainly would have prevented these significant environmental effects. Yet RPD has suggested that these projects can be piecemealed because the projects do not "rely on or trigger the need for each other." Staff Response p. 17-18. But the Pumphouse Project triggered the need for both the upland restoration project and the fencing project: because they were mandated by the Fish and Wildlife Service in order to mitigate the negative environmental effects of the Pumphouse Project. It is clear that the Department is not applying its piecemealing determinations consistently, and is instead characterizing projects differently in different forums for expediency. Expediency is the opposite of what CEQA processes are designed to do: ensure a careful deliberation of the environmental consequences of a project before it is implemented.

III. THE PUMPHOUSE PROJECT IS INCONSISTENT WITH SEVERAL PLANS, RESULTING IN SIGNIFICANT PHYSICAL ENVIRONMENTAL EFFECTS.

The Pumphouse Project is inconsistent with several plans in ways that either cause significant physical environmental effects or frustrate mitigation measures designed by the Department to ameliorate significant environmental effects. Because of this, the Department must prepare an EIR for the Pumphouse Project.

A. THE PUMPHOUSE PROJECT IS INCONSISTENT WITH THE 1995 AND 2006 SIGNIFICANT NATURAL RESOURCE AREA MANAGEMENT PLANS.

From 2005 until 2011, SNRAMP contained a project-level proposal for Sharp Park's wetland complex, largely based on PWA's 1992 Laguna Salada Resource Enhancement Plan. Although public comments suggested RPD should consider restoring habitat over the entire Sharp Park Golf Course area, the City refused to do so, explaining in 2009 that "[s]hould changes to the Sharp Park Golf Course be proposed, they would undergo a separate regulatory review, including CEQA environmental review."

The Pumphouse Project is inconsistent with the 2005 proposed SNRAMP. The Pumphouse Project will enhance pumping operations at Sharp Park and dredge Sharp Park's Natural Areas to ease the conveyance of water out of the Laguna Salada wetland complex, into the pumphouse, and ultimately out to sea. None of these activities are proposed in the original SNRAMP proposal for Sharp Park. The FMND implicitly recognizes that the Pumphouse Project is inconsistent with SNRAMP, because the Department did not make a consistency finding in the FMND. The Department must therefore be aware that there are significant, unmitigated environmental effects from this inconsistency, and the Department must therefore conduct further environmental review.

B. THE PUMPHOUSE PROJECT IS INCONSISTENT WITH THE SAN FRANCISCO BAY BASIN WATER CONTROL PLAN.

The Pumphouse Project will disturb oligohaline sediments in the Laguna Salada wetland complex, which in turn results in the oxidative formation of acid sulfates. This impact is substantially certain to occur, because experts have directly observed these sediments in the area proposed for dredging: these soils are ubiquitous and conspicuous throughout the wetland complex. Exhibit G, p. 4-5. Experts have also explained the pathway by which the sulfates will harm water quality, wildlife, and endangered species, Exhibit G, p. 10, and explained why these effects will be significant, lethal effects. *Id.*

The primary mitigation measure proposed is M-BIO-2A, which would require SFRPD to disturb sediments outside of the California red-legged frog breeding season. But this is not a sufficient mitigation measure for this threat. First, California red-legged frog tadpoles are known to overwinter before metamorphosing under certain conditions. Exhibit K, p. 2. Thus, it is likely that tadpoles and other sensitive receptors will be present during the dredging activity, even during the frog's non-breeding season. Second, oxidative formation of acid sulfates is a relatively lengthy process: it can take many days or weeks to occur, and therefore there is no indication in the mitigation measure that there is an adequate buffer to ensure acid sulfates disturbed towards the end of the construction period do not affect breeding frogs.

The Department has also proposed a deferred, byzantine, and ultimately unenforceable mitigation proposal called Mitigation Measure M-BIO-2B to address significant effects of disturbed oligohaline sediments. The measure proceeds through a voluntary, non-binding, multi-step assessment process. As a preliminary matter, the deferral of mitigation until this process is complete is wholly unnecessary, because it is indisputable that oligohaline sediments are present in the Laguna Salada wetland complex. The process eventually concludes with three possible remediation outcomes: addition of lime to the wetland complex, the injection of sodium nitrate into the wetland complex, or the use of suction dredging to reduce the rate of re-suspension of oligohaline sediments.

However, mitigation measure M-BIO-2B is not fully enforceable, and therefore is not adequate to mitigate the significant environmental effects of oligohaline soils. The Department must ensure that "measures to mitigate or avoid significant effects on the environment are fully enforceable through permit conditions, agreements, or other measures." CEQA Guidelines § 21081.67(b). Public agencies therefore may not defer mitigation measures unless the agency commits itself to mitigation and articulates specific performance criteria or standards that must be met for the project to proceed. *Endangered Habitats League, Inc. v. County of Orange* (2005) 131 Cal.App.4th 777, 793-794.

The Department has failed to meet both criteria here. First, there is no commitment to mitigation within the meaning of CEQA. Nowhere does the mitigation measure specify that an authoritative body will mandate the mitigation measures through a permit, agreement, or other measure. Instead, the measure relies upon voluntary reviews and comments throughout the mitigation process. While the fourth and fifth stage of the measure (Toxic Pathways Analysis and Remediation) suggest that either the U.S. Fish and Wildlife Service or the California Department of Fish and Wildlife—but critically not any City regulatory body with oversight over the Project—

will "approve" SFRPD's toxicity standards or its remediation measures, the Department does not identify any permit, agreement, or other measure that could in fact serve as the vehicle for these approvals.

Second, the mitigation measure does not articulate specific performance criteria or standards that must be met for the project to proceed. There are no thresholds of significance identified, and no other specific measure that would alert the agency or any member of the public that a performance criterion had not been met. Instead, the mitigation measure orders study after study to occur, but leaves the actual triggers for remediation and the remediation objectives completely undefined.

Moreover, at least one of the remediation measures—suction dredging—will likely cause new and significant environmental effects if it is implemented. Suction dredging will remove large amounts of both sediment and water from the wetland complex—much more than the clam shell or bucket type dredging equipment identified in the project description, which typically contain 80-90% solids. Suction dredging will require distinct technologies to dispose of watery dredged materials: it would not be permissible to allow these waters to drain back into the wetland complex given that they are likely acidic or hypoxic to begin with. Yet the FMND does not discuss any proposed mitigation measure for suction dredging: CEQA requires at least some discussion in situations such as this. *Stevens v. City of Glendale* (1981) 125 Cal.App.3d 986.

Other mitigations measures also fail this test. For example, the FMND suggests that discharges from Sharp Park's pumphouse are authorized under an existing San Francisco Bay Region Water Quality Control Board ("RWQCB") Permit. However, no such permit exists, so it will not be possible to make any provision of this mitigation measure binding through an amendment of any existing permit. Similarly, the Army Corps of Engineers—the action agency for the Pumphouse Projects Section 7 Consultation—has agreed to incorporate the Biological Opinion into a wetland fill permit for SFRPD *only when* a permit has been issued by the RWQCB. As the Fish and Wildlife Service has explained, unless and until the wetland fill permit from the Army Corps of Engineers is made effective and incorporates the terms of the Biological Opinion into non-discretionary permit terms, the mitigation measures derived from the Biological Opinion cannot be enforced by the Fish and Wildlife Service against the City: and therefore they are not lawful mitigation measures. Exhibit N.

C. THE PROJECT IS INCONSISTENT WITH THE COASTAL ACT.

The Coastal Act, as well as Pacifica Zoning Code Section 9-4.4302, defines an "environmentally sensitive area" as "any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activity or developments."[18] The Act states that "[e]nvironmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas."[19]

Sharp Park constitutes an ESHA under this definition because both the CRLF and SFGS are rare, and their presence is regularly documented at Sharp Park; because Sharp Park's habitats are both

[18] *Id.* § 30107.5.
[19] *Id.* § 30240.

rare and especially valuable to these species, because they constitute a rare coastal lagoon ecosystem that is the northern-most known habitat for the SFGS; and because the species and their habitats are disturbed and degraded under existing conditions, and the Project will cause additional degradation and disturbance.

However, the FMND does not recognize ESHA at Sharp Park, nor any of the implications this status has on the Pumphouse Project. Therefore it fails to ensure that the Pumphouse Project is consistent with the Coastal Act.

D. THE PUMPHOUSE PROJECT IS INCONSISTENT WITH THE CALIFORNIA RED-LEGGED FROG RECOVERY PLAN.

The Sanchez Creek Watershed is a Priority 2 watershed for CRLF recovery. Priority 2 Watersheds provide the necessary habitat connectivity between core areas and is an important contribution to the recovery of the California red-legged frog throughout its range. These watersheds have Watershed Management and Protection Plans that address, among other things, restoration, controlling water flow, assess suction dredging impacts on water quality and thus the frog (sedimentation increases are cited as a possibility), flood control activities, and recreation activities. Recovery Plan p. 53. The FMND makes no mention of this planning process at all except to respond to this comment, and an EIR would be required to consider this plan in ways the FMND does not.

E. THE GOLF COURSE REDEVELOPMENT PROJECT IS A PROJECT LEVEL CEQA DOCUMENT, AND DOES NOT MERELY GUIDE MANAGEMENT AT SHARP PARK.

The City's plan to reconstruct Sharp Park Golf Course is reasonably certain to occur, will adversely affect Sharp Park, and is interrelated with this proposal: it's effects must therefore be assessed as part of this CEQA process. However, throughout the FMND, the Department suggests that this project level review will merely "guide" management at Sharp Park in the future. This is a significant error, and indicates that the Department must reassess the interrelatedness of these projects and consider them as one project.

1. The City's Golf Course Construction Plan Has Been Significantly Changed.

In 2009, the San Francisco Board of Supervisors unanimously passed an ordinance ordering RPD to study restoration alternatives at Sharp Park. The report RPD ultimately released contained a radical new golf course construction plan for Sharp Park guised as a "recovery" effort for listed species (TetraTech 2009).

After scientists criticized the plan's several significant flaws (Davidson et al. 2011, pp. 1-2), the City convened the fact-finding Sharp Park Working Group (Holland 2011, p. 4-5). Exhibit O. When the Working Group released findings that adopted many of (ESA-PWA 2011) recommendations,[20]

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[20] The penultimate draft of the Sharp Park Working Group's findings did not make any conclusion about Sharp Park Golf Course's integrity or compatibility with the site. However, shortly before its scheduled release, Dave Holland, then director of San Mateo County Parks, leaked a copy of the document to golf advocacy groups (Holland 2011, p. 1-3). These advocates demanded that Mr. Holland "insert something along the following line: 'None of the foregoing is incompatible with preservation of the historic 18 hole

RPD announced it would abandon a core element of its golf course construction plan—armoring Sharp Park's seawall—but continued to insist that Sharp Park's 18-hole golf course would remain in its historic footprint, even as it acknowledged that sea level rise will erode the seawall and force it inland, squeezing endangered species habitats in a narrow area between the golf areas and the advancing ocean (Holland 2011, pp. 4-5).

Contemporaneously the City was preparing a Draft Environmental Impact Report ("DEIR") for the City's Significant Natural Resource Areas Management Plan ("SNRAMP").

However, when the DEIR was released in 2011 the PWA-based Laguna Salada plan had been replaced with the TetraTech golf course construction plan.[21] Under this plan, 60,000 cubic yards of material would be dredged from the Laguna Salada's wetland complex, creating 12,100,000 gallons of water storage capacity (RPD 2011, p. 99). Four golf links surrounding Laguna Salada would be raised by up to 3.5 feet, creating additional (although unquantified) water storage capacity in the lagoon system (TetraTech 2009, p. 43). Another link would be narrowed, and another removed[22] (RPD 2011, Figure 3). It also calls for filling ½ acre of Sharp Park's wetlands to create an island in Laguna Salada (RPD 2011, p. 99) and landfilling areas where California red-legged frogs breed to "prevent localized ponding" and "to allow more complete drainage to Laguna Salada" (RPD 2011, p. 377).

2. The Golf Course Construction Plan and the Project are Interrelated.

The DEIR's golf course construction project is interrelated with the proposal here. Both are designed to reduce golf course flooding, and depend upon each other to implement this larger action. The City's larger plan to reduce golf course flooding is composed of (1) ensuring maximum pump rates are reliably achieved, (2) increasing water flow rates towards the pumps, (3) increasing water storage capacity by deepening lagoons and (4) increasing storage capacity by elevating the rim of the lagoon. If any one of these components fails or is not achieved, pumping rates will decrease and golf course areas will flood.

While there is some overlap, this project is primarily designed to accomplish the first and second elements of this plan, *see* Exhibit O (RPD Biological Assessment, 2012, p. 6), while the DEIR is primarily designed to implement the third and fourth elements of the plan. RPD 2011, p. 99. But the elements are expressly interlinked: the DEIR repeatedly states that the golf course

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golf course that exits on the property.'" *Id.* Mr. Holland agreed to do so, and was able to insert a single line at the end of the document: "These habitat enhancements and golf could be compatible." *Id.*

[21] The plan was attached to the DEIR as Appendix I, and will be referred to throughout this document as (TetraTech 2009) or (RPD 2011) interchangeably.

[22] Although Hole 12 will be removed at Sharp Park, the DEIR requires the City to rebuild the link in another location at Sharp Park (RPD 2011, p. 28). The DEIR proposes two locations for this link: west of Laguna Salada, between the seawall and frog breeding areas, or east of Highway 1. The DEIR suggests that surrounding Laguna Salada with golf links would have fewer significant impacts because it would retain historic integrity of the golf course, even thought it would negatively affect wildlife and intrude on protected natural areas. However, the DEIR defers the ultimate decision to subsequent environmental review.

construction project is dependent on efficient pump operations (RPD 2011, pp. 146, 361, 374, 377), and further explains that the golf course construction plan is designed to meet flood control objectives while reducing wear-and-tear on the pumps (TetraTech 2009, p. 43).

The City's statement that the golf course construction plan is wholly separate from the Project (Wayne 2011b, p. 2) is belied by its recent permitting strategy discussion with other agencies (Anonymous 2012, p. 1) Exhibit O. The agenda from this discussion indicates the Pumphouse Project and the golf construction project are two temporal phases of a single management strategy. Effects from the later phases are classic indirect effects, because they are caused by the proposed action and are later in time, but still reasonably certain to occur. They also derive, either directly or indirectly from an interrelated element of the City's larger flood management strategy. In either case, by law the City must review these effects during this CEQA process, regardless of the City's colloquial assertion that the projects are separate.

3. The Golf Course Construction Plan is Reasonably Certain to Occur.

The City's proposal has already been approved by several oversight bodies, and in each case the City made clear that it would not review or consider restoration alternatives at Sharp Park. The City's single-minded approach to Sharp Park and its completion of many steps in its approval process show that the golf course construction project is reasonably certain to occur.

The City's proposal to rebuild Sharp Park Golf Course's original layout was endorsed by San Francisco's Recreation and Parks Commission in December of 2009, to the exclusion of all other options for Sharp Park's future (RPD 2011, p. 2). In the SNRAMP DEIR, the City concluded that only an 18-hole Golf Course at Sharp Park was a feasible alternative for the property, and refused to consider other restoration options that would provide additional benefits to listed species (RPD 2011, p. 3). Moreover, the DEIR contains a mitigation requirement that will force the City to rebuild a golf link in one of two places in subsequent environmental review (RPD 2011, p. 28). Thus, the City's existing approvals and contemporaneous permitting procedures create a binding requirement to implement the golf course construction plan.

Furthermore, when the San Francisco Board of Supervisors passed an ordinance requiring the City to negotiate with the National Park Service to implement a restoration plan for the property, the Mayor vetoed the ordinance, Exhibit O (Lee 2011, p. 1), again indicating the City's intent to ensure the golf course construction project occurs. And with the City's encouragement, San Mateo County passed a resolution calling for San Francisco to "maximize recreation opportunities" at Sharp Park by implementing the golf course construction plan (San Mateo Co. 2011, p. 2). Exhibit O.

These actions by the City are all that is necessary to show that the golf course construction plan is reasonably certain to occur. While there may be some ambiguity about how the ultimate Golf Course design will turn out, the City's CEQA documents must give consideration of the effects of interrelated and interdependent activities whether or not all of the activities' impact is known.

IV. THE CUMULATIVE EFFECTS ANALYSIS IS INADEQUATE.

The Pumphouse Project FMND fails to address the cumulative impacts—or any impacts at all—on the San Francisco gartersnake, which has been greatly impacted by the golf course for many decades. This is particularly troubling given Sharp Park's role in the recovery of the species, and SFRPD's failure to aid in that recovery.

V. THE CITY MUST CONSIDER ALTERNATIVES TO THE PROJECT.

The project description does not indicate the City will consider alternatives. In a case like this where public concern and controversy is high, evidence of alternatives is widespread, and when massive take has occurred under existing protocols, the City cannot ensure that there will be no significant adverse environmental impacts without at least considering alternatives to the project proposal.

In particular, (ESA-PWA 2011) contributed a restoration model for Sharp Park that is based on the best scientific data available at Sharp Park and addresses all of the above deficiencies in the project. For example, where the project suggests that both species are "conservation reliant" due to their isolation, the ESA-PWA proposal emphasizes connective habitat corridors across Sharp Park.

Where the project suggests it will continue to drain and fertilize Sharp Park's wetlands on the one hand, and then dredge excessive tule and cattail growth on the other, PWA-ESA's mitigation model constrains pumping so that water levels will rise high enough to drown excessive vegetation growth, and ensures that water levels rise and fall slowly so that Sharp Park's entire wetland feature remains hydrologically connected and contains sufficient water for egg masses to develop into adult frogs.

Where the project ignores the fundamental changes climate change will bring to this landscape, ESA-PWA's plan provides mitigation and recovery areas upland and inland from areas that will be immediately impacted by catastrophic flooding events, and then creates natural defenses around these areas by restoring wetlands and vegetative features between the rising sea and the restored habitats. These features will absorb and slow the rate of water if intrusion ever does occur.

Where the project blames the frog for an apparently indiscriminant breeding behavior and for laying eggs in 'unsustainable' habitats, ESA-PWA's mitigation and restoration plan recognizes that the California red-legged frog can successfully breed under natural conditions at Sharp Park, so long as the velocity, rapidity, and scope of the wetland draining project implemented by San Francisco is curtailed.

All of these outcomes would provide greater conservation and public benefits than the project disclosed in the notification, yet the City does not seem prepared to consider alternatives to the project proposal. Such reluctance is inconsistent with sound environmental review and the strictures of CEQA.

VI. THE PROJECT WILL DESTROY COVER HABITAT TO ENHANCE BREEDING HABITAT, EVEN THOUGH BREEDING HABITAT IS NOT A LIMITING POPULATION GROWTH FACTOR AT SHARP PARK, CAUSING UNNECESSARY AND SIGNIFICANT ADVERSE ENVIRONMENTAL IMPACTS.

The California red-legged frog and the San Francisco gartersnake require multiple habitat conditions to survive. For example, "essential habitat for a breeding [San Francisco gartersnake] population includes open grassy uplands and shallow marshlands with adequate emergent vegetation, and the presence of both Pacific tree frog (*Pseudacris regilla*) and California red-legged frog breeding populations." "Emergent and bankside vegetation such as cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), and spike rushes (*Juncus* spp. and *Eleocharis* spp.) apparently are preferred and used for cover."[23]

Similarly, the "California red-legged frog requires a variety of habitat elements with aquatic breeding areas embedded within a matrix of riparian and upland dispersal habitats."[24] The frog "spend[s] considerable time resting and feeding in riparian vegetation when it is present" and can be "found up to 30 meters (100 feet) from water in adjacent dense riparian vegetation for up to 77 days."[25] "Overall, [California red-legged frog] populations are most likely to persist where multiple breeding areas are embedded within a matrix of habitats used for dispersal."[26] Recent studies demonstrate that in both breeding and non-breeding periods, California red-legged frogs predate almost exclusively on terrestrial species, Vredenburg Decl., p. 7 (Exhibit E), indicating uplands are also essential habitat for California red-legged frog prey.

Sharp Park currently provides the habitat mixture both species require.[27] However, the project proposal would transform one essential habitat type—emergent vegetation—into open water habitat "to improve water flow to the pumps"[28] so Sharp Park's wetlands can be rapidly drained during the California red-legged frog's breeding season. The City suggests this transformation is justified because "areas along the connecting channel and [Horse Stable Pond] that contain dense cattail growth are considered to be very low quality breeding habitat for the [California red-legged frog]"[29] and presumes the transformation will therefore cause frog populations to increase, ultimately providing more prey for the San Francisco gartersnake.

The City's position is not supported by available evidence. If, as the City hypothesizes, emergent vegetation limits growth of California red-legged frog and San Francisco gartersnake populations at Sharp Park, the City's records should show a decline in egg masses as the extent of emergent vegetation has increased. But the evidence indicates California red-legged frog egg mass counts

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[23] U.S. Fish and Wildlife Service (USFWS). Consultation for the Proposed Sharp Park Golf Course Storm Drain Repair Project, Pacifica, San Mateo County, California. 81420-20008-F-1952. October 7, 2008. p. 8.

[24] U.S. Fish and Wildlife Service (USFWS). Recovery Plan for the California Red-legged Frog. p. iv. (2002).

[25] *Id.* at p. 13-14.

[26] *Id.* at 12.

[27] SFRPD. Biological Assessment, Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project, August 16, 2012. p. 34.

[28] *Id.* at 12.

[29] *Id.* at 48.

have been generally increasing at Sharp Park/Mori Point since 2004[30]; indeed, during the 2010-11 breeding season the City "recorded more than 3 times the eggmasses [SIC] than any other year."[31] Similar numbers were observed during the 2011-12 breeding season. Exhibit D, p. 4.

Nor does available evidence indicate that Sharp Park's San Francisco gartersnake population is limited by prey availability. If Sharp Park's California red-legged frog population were too small to support its predator, City records should show a decline in adult frogs at Sharp Park. But while testifying against endangered species conservation measures at Sharp Park on behalf of golf advocacy groups, Dr. Mark Jennings stated "it has been common for the past couple of years at Sharp Park to find dozens and dozens of juvenile and adult [California red-legged frogs]," and concluded that "there are relatively few sites within the current geographic range of the species that have such large populations of adult [California red-legged frogs]".[32] Furthermore, "trapping studies at Mori Point and Sharp Park since 2004 suggest that the [San Francisco gartersnake] population again may be increasing, at least at Mori Point."[33] "[C]apture rates for 2006 and 2008 reflected an increase over the 2004 rate of 104% and 5%, respectively . . . we observed an overall increase in the number of [San Francisco gartersnakes] trapped per unit effort within the project area."[34]

While neither the availability of open water habitat nor frog population sizes limits productivity at Sharp Park, the best available science does indicate that egg mass and juvenile *survivorship* limits the California red-legged frog's population growth "pumping expose[s] California red-legged frog eggs to desiccation,"[35] and that destruction of upland habitats limit the San Francisco gartersnake's population growth:

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30 *Id.* at 42.

31 E-mail from Jon Campo, Recreation and Park Department Natural Areas Program, to David Kelly, U.S. Fish and Wildlife Service (Jan. 21, 2011) (Exhibit D, p. 5).

32 Jennings Decl., p. 16 (Nov. 18, 2011). However, as pointed out by Dr. Marc Hayes, Dr. Jennings wrongly attributed his observations to Sharp Park Golf Course management and operations. "[I]t is my professional opinion that any increase in egg masses observed in the Sharp Park/Mori Point complex reflects continued increases in recruitment from the Mori Point ponds. Yet because defendants' activities at Sharp Park are taking the CRLF in several ways, including by adversely altering habitat conditions at Sharp Park, defendants activities are in fact having negative population-level impacts on the entire Mori Point/Sharp Park CRLF population" Hayes Expert Report, p. 26-27 (Jan. 20, 2012) (Exhibit H).

33 Swaim Biological Incorporated. *Sharp Park Wildlife Surveys and Special Status Reptile and Amphibian Restoration Recommendations*, December 4, 2008, p. 1-4.

34 Swaim Biological Incorporated. *San Francisco Garter Snake Habitat Improvement Project at Mori Point, Pacifica, California 2004-2008*, January 31, 2009, pp. 14, 19.

35 U.S. Fish and Wildlife Service (USFWS). Formal Consultation on the Mori Point Restoration and Trail Plan in the Golden Gate National Recreation Area, U.S. National Park Service, San Francisco, California. 1-1-06-F -1575 (July 13, 2006) p. 22.

> Nearly all of the areas surrounding Laguna Salada and Horse Stable Pond are mowed regularly by the Golf Course, very near or immediately adjacent to the wetland edge. This leaves a very narrow band of emergent wetland habitat between the open water areas of the lagoon and the Golf Course links, and no protected upland in which SFGS can bask, breed, or seek refuge in a burrow. Beyond the narrow band of emergent vegetation, SFGS would face a very high likelihood of being taken directly by mowing operations.

Dexter Decl., p. 10 (Exhibit K).

These effects are significant by any measure, and cause adverse environmental impacts that require thorough environmental review and mitigation.

VII. The Pumphouse Project Fails to Consider Entrainment of Listed Species.

The Pumphouse Project does not describe the biological screens to prevent listed species from being entrained. Biological monitors at Sharp Park have observed crayfish entrained by Sharp Park's pumping operations, and stated that "[I]f crayfish can become entrained in pump than frogs might also" (Swaim 2008b, p. 1). (Hayes 2012) makes recommendations on screening at Sharp Park.

VIII. Conclusion.

For the foregoing reasons, SFRPD and the Department must complete a full EIR for the Pumphouse Project. This letter and its exhibits, along with all other documents submitted into the record for this project or related Sharp Park projects are incorporated herein by reference.

Sincerely,

Brent Plater

EXHIBIT A

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

City and County of San Francisco
Recreation and Park Department
Golf Division

McLaren Lodge in Golden Gate Park
501 Stanyan Street, San Francisco, CA 94117
TEL: 415.831.6310 FAX: 415.753-7262 WEB: http://parks.sfgov.org

November 30, 2006

Christopher D. Nagano
Chief – Endangered Species Division
2800 Cottage Way, Rm. W-2605
Sacramento, CA 95825

Dear Chris Nagano:

Your e-mail to the Natural Areas Program of the San Francisco Recreation and Park Department concerning pumping activities at Sharp Park Golf Course was forwarded to me yesterday. You requested that your office be notified as soon as possible should the pumps at Sharp Park be turned on due to flooding. We have not yet had a significant rain event that would cause flooding to Laguna Salada or Horse Stable Pond. We have been pumping down Horse Stable Pond on a controlled basis for the past three weeks and are installing a" by pass" pump to bring down the level of Laguna Salada to hopefully prevent the flooding that occurred last winter. The channel draining Laguna Salada into Horse Stable Pond is completely choked with tules and bulrush which have dramatically slowed the natural drainage from Laguna Salada. Our plan is to increase the water holding capacity of the Laguna Salada basin prior to any large winter storms.

I have been in contact with the Natural Areas group and they are monitoring for Red-Legged Frog activity and egg masses and there have not been any egg masses reported to my office this season. As soon as any egg masses are reported we will follow the protocol established last season keeping the masses hydrated and the water levels above the egg masses until we receive word from the Natural Areas that the hatch is complete.

We are holding a meeting with the City of Pacifica, San Francisco Recreation and Park Department, State Fish and Game and representatives from GGNRA on January 10, 2007 at 10 AM. The meeting will be held at the Calera Creek Waste Water Treatment Plant conference room at 700 Coast Highway in Pacifica. You are invited to attend or send a representative. The Laguna Salada basin is rapidly infilling with tules and bulrush, large areas of water that used to be open are now vegetated and the habitat is being altered to the potential detriment of the Red-Legged Frog, the San Francisco Garter Snake and the San Francisco Forktail Damselfly. We are looking for acceptable solutions and would welcome your expertise.

Sincerely,

Sean K. Sweeney

Sean K. Sweeney
Golf Program Director

c: Scott Holmes, City of Pacifica
Dave Johnston, State Fish and Game

Dennis Kern, Director of Operations, SFRPD
Terry Schwartz, Superintendent, SFRPD
Sue Gardner, Golden Gate National Parks Conservancy
Christopher Campbell, Natural Areas Program, SFRPD

CCSF006070

EXHIBIT B

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

TOTAL WATER PUMPED FROM SHARP PARK WETLANDS: 12/21/10 – 1/13/12

Date	Water Level at Vault Gauge	Water Level Converted to NAAVD	Small Pump Hour Reading	Large Pump Hour Reading	Water Pumped Since Last Reading in gallons	Total Gallons Pumped Since 12/21/10	Notes
12/21/10	2.6	8.5	140.6	21.8	n/a	**0.00**	RPD orders station engineer to pump down pond before rains and frog lays eggs.
12/26/10	2.0	7.9	220.8	50.9	15,288,000.00	**15,288,000.00**	First egg masses observed for the season.
1/6/11	2.1	8.0	411.9	78.1	21,258,000.00	**36,546,000.00**	RPD moves 16 egg masses. Engineer told to shut pumps off.
1/7/11	n/a	n/a	n/a	n/a	n/a	**n/a**	RPD moves 28 egg masses.
1/10/11	2.5	8.4	411.9	78.1	0.00	**36,546,000.00**	Engineer turns pumps back on.
1/11/11	2.1	8.0	427.5	78.9	1,224,000.00	**37,770,000.00**	Engineer told to raise water levels.
1/14/11	2.5	8.4	427.5	78.9	0.00	**37,770,000.00**	RPD moves 28 egg masses.
1/21/11	n/a	n/a	n/a	n/a	n/a	**n/a**	RPD moves 35 egg masses.
2/21/11	3.0	8.9	539.4	174.9	41,274,000.00	**79,044,000.00**	Snavely finds egg mass at risk at Horse Stable Pond.
2/22/11	2.6	8.5	540.6	197.6	8,244,000.00	**87,288,000.00**	Bowie observes egg mass stranded at Horse Stable Pond.
2/23/11	2.5	8.4	550.1	209.2	4,746,000.00	**92,034,000.00**	Dr. Vredenburg confirms stranded egg mass is CRLF.
2/24/11	2.6	8.5	571.3	211.1	1,956,000.00	**93,990,000.00**	FWS Informed of egg mass stranding.
3/2/11	2.3	8.2	680.2	218.1	9,054,000.00	**103,044,000.00**	On 3/1/11, Snavely observes stranded Horse Stable Pond egg mass completely desiccated partially frozen.

TOTAL WATER PUMPED FROM SHARP PARK WETLANDS: 12/21/10 – 1/13/12

Date	Water Level at Vault Gauge	Water Level Converted to NAAVD	Small Pump Hour Reading	Large Pump Hour Reading	Water Pumped Since Last Reading in gallons	Total Gallons Pumped Since 12/21/10	Notes
6/24/11	2.6	8.5	1199.4	411.2	100,668,000	**203,712,000**	Lisa Wayne directs water levels dropped to 2.2.
1/3/12	1.9	7.8	1296.8	413	6,492,000	**210,204,000**	City orders water level dropped to 1.5.
1/27/12	n/a	n/a	n/a	n/a	n/a	**n/a**	First egg masses observed this season.
1/28/12	1.4	7.3	1407.5	420	9,162,000	**219,366,000**	Ely observes egg masses stranded at Laguna Salada.
1/30/12	1.4	7.3	1415.7	420	492,000	**219,858,000**	Ely informs SBI employees of stranded egg masses they missed during surveys. RPD orders pumps turned off.
2/1/12	n/a	n/a	n/a	n/a	n/a	**n/a**	Ely returns to observe stranded egg masses, discovers it missing.
2/2/12	n/a	n/a	n/a	n/a	n/a	**n/a**	Stringer observes more egg masses stranded at Laguna Salada.
2/8/12	n/a	n/a	n/a	n/a	n/a	**n/a**	Stranded egg masses all removed from Laguna Salada.
2/11/12	1.8	7.7	1415.7	420	0.00	**219,858,000**	RPD orders pumps on and set to turn off at 1.9.
2/17/12	n/a	n/a	n/a	n/a	n/a	**n/a**	Ely observes Horse Stable Pond egg mass stranded.
2/29/12	2.0	7.9	1415.7	420	0.00	**219,858,000**	
3/11/12	2.0	7.9	1416.5	420	48,000	**219,906,000**	Last Pump House log entry available.

TOTAL WATER PUMPED FROM SHARP PARK WETLANDS: 12/21/10 – 1/13/12

NOTES:

- Hour readings indicate the total number of hours the pump has been running. **Numbers** derived from Sharp Park Pump House Log.
- John Ascariz, Station Engineer, estimates that the small pump operates at 1,000 gallons per minute (maximum capacity 1,500 per minute) and the large pump at 6,000 gallons per minute (maximum capacity 10,000 gallons per minute). All figures are based on Ascariz estimates, not actual capacity of pumps.
- Pump house vault gauge is not calibrated to any reference point. Kamman 2012 calibrated the instrument and created a conversion factor for NAAVD88 heights.
- Whenever cell indicates n/a, pump engineer did not make a recording for that day.

UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF CALIFORNIA

--oOo--

WILD EQUITY INSTITUTE, a non-profit corporation, et al.,

Plaintiffs,

vs. No. 3:11-CV-00958 SI

CITY AND COUNTY OF SAN FRANCISCO, et al.,

Defendants.

Deposition of

JOHN ASCARIZ,

Wednesday, December 14, 2011

Reported by:

KIMBERLEE SCHROEDER, CSR, RPR, CCRR

License No. 11414

Job No.: 33712

A. That's for the small one can't keep up with the runoff that's coming from Sharp Park.
Q. Okay. She'll give you a level to set them at. Does she tell you both levels or just the small one?
A. You still only have one level. That's maintained in the shutoff at 2.0. The level goes over that, it's just a big pump. That's not the concern, is to try to get out the water, to maintain that 2.0 at all times.
Q. So she gives you sort of the lowest number?
A. That's where she wants to maintain that level. Anything over 2, we try to get rid of.
Q. Right. In terms of setting, I think if I'm understanding, there's sort of three floats. There's the lowest level, there's the shutoff for the small pump, and then there's the turn on for the large pump. Do I understand that right?
A. Yes, yes.
Q. In terms of the shutoff for the small pump, does she tell you what level to set that at?
A. 2.0.
Q. That's the lowest level? The next one up I'm trying to understand.
A. 2.3.
Q. Does she tell you 2.3?

A. No. That's our differential that we set that at.
Q. Why do you set it at 2.3?
A. For you don't short cycle the motor. For if you had the shutoff at 2.0 and had the float at 2.1, that pump would fluctuate and turn on and off in minutes. So you let the water get up a little bit and then the pump kicks on. So it has time to run to pump that water out.
Q. Why not have the pump turn on and off every few minutes?
A. You'll wreck it.
Q. What do you mean?
A. You're talking on and off on and on and on multiple times. You have a motor starter. It's not -- you try not -- you try to prevent that from happening on motors.
Q. So one of the goals is to preserve the motor, I guess; is that right? Trying to make sure the motor --
A. Yes.
Q. What will happen to it? When you say "wreck it," what does that mean?
A. You take a lot of wear and tear out of the motor. You got contacts. You got 260 volts flashing with contactors. You got carbon buildup on the

A. Yes.
Q. Do you sometimes see water flowing between the two?
A. Can't recall. The tulies are there. It's hard to see it. You don't see a big flow. Just filters really slow through all the tulies that are there.
Q. Do you see water in the channel?
A. Yes.
Q. Have you ever looked at the channel and seen there's no water in the channel?
A. No.
Q. So in your experience, there's always at least some water?
A. Yeah, residual water in that --
Q. That's what I wanted to ask, whether you knew about the level at which the connection between the Horse Stable Pond and Laguna Salada no longer exists?
A. No.
Q. You don't know anything about that?
A. No.
Q. We talked just for a second about how strong the pumps are. You talked about a smaller pump and a larger pump. What is the difference between the two?
A. Do you want me to give you a calculation on gallons? We got an estimated small pump, we're going to

pump out about a thousand GPM, and large pump --
Q. What is GPM?
A. Gallons per minute. And large pump, say about 6,000 GPM.
Q. When the small pump is on, can you see water flowing into the pump?
A. If you had something to sight it off of like a piece of tulie floating, very, very slow as it's moving in towards the pump, very slow.
Q. How about for the large pump?
A. Maybe just speed it up a little faster, not much.
Q. Does that change as the sediment builds up near the pump?
A. Unclear on what you mean by the sediment.
Q. The debris that you talked about.
A. Yeah, it would slow it down a little bit, yes.
Q. Why do you clear debris for the pump?
A. Just for it doesn't work it's way in.
Q. To keep it out of the --
A. Yeah. You got to keep it till it will actually, here's a screen. It will actually starts here, it will start working its way down here.
Q. The debris?
A. Yes. Keep that clear.

can keep it say estimated say we're going to keep it at 1.5, that will stop that golf course from flooding.

Q. The lower the number the more it's going to pump?

A. Yes.

Q. I got that right?

A. Yeah.

Q. So I guess one thing I'm still trying to understand, if we can, is how the growth of the tulies over time is impacting that number?

A. To not let the water come into the pump station.

Q. It's keeping the water out of the pump station?

A. Keeping it way up above. All those tulies is keeping like a dam and keeping all that water all up in the golf course instead of letting it flow down. You were saying through that channel creek is all grown where it's stopping the water from draining to our pump station.

Q. It's your understanding that at some point the pump is no longer draining the golf course; is that right?

A. Very slow.

Q. Very slow. Okay. And that's gotten worse over time as well; is that right?

Q. Right. I think we talked before about what the level is changed over time, say 2.3 --

A. Yes.

Q. -- at that point, the golf course would start to flood?

A. Yes.

Q. So if I'm understanding, with regard to the second part again before the frogs laying eggs, the goal that you've been told is to pump low so that the frogs won't lay eggs at a high level because if they did, you would have to maintain the water at that level; is that right?

A. Yes.

Q. Okay. But in the last winter, for example, the water level did go up; right?

A. Yes. I can recall, yeah, to the log book and the water level that year being high.

Q. Do you recall seeing the golf course flooded last winter?

A. Yes.

Q. And why did it flood if you had the pump set at this low level?

A. Because all the tulies.

MR. CLEMENTS: Objection. It's an incomplete hypothetical. It's vague. You can answer.

THE WITNESS: Because the tulies are growing and stopping our water from coming to the pumps. Then it floods all out. It's holding the water all out at the golf course instead of letting it come to our pumps for we can pump it out.

MR. CRYSTAL: Q. As far as you understand, let's say, were you there at a time -- the problem with the tulies it's gotten worse over time --

A. Yes.

Q. -- that you've been there?

Again, as best you understand from your experience, if the tulies were removed, then the pumps would be able to get the water out more efficiently; is that right?

A. Yes.

Q. And do you think that you would be able to keep the course from flooding if the tulies weren't there?

A. Yes.

Q. Even in a winter like last winter where there was a lot of rain?

MR. CLEMENTS: Objection. Calls for speculation.

MR. CRYSTAL: Q. Based on your experience.

A. Yes. It would do good with the pumps running. It would pump that water out.

level.

Q. Right. So if they wanted you to maintain a certain level, they can tell you to adjust the floats?

A. Yes.

Q. If the water was below that level, that would turn off the pumps?

A. Yes.

Q. If they weren't sure of the level, they might tell you to shut off the pumps?

MR. CLEMENTS: Calls for speculation.

MR. CRYSTAL: Q. That's right.

A. Yes.

(Plaintiff's Exhibit No. 12 was marked for identification.)

MR. CRYSTAL: Q. So giving you what's been marked No. 12, this is another page from the log book; is that right?

A. Yes.

Q. Again, your entries?

A. Yes.

Q. These are your notes?

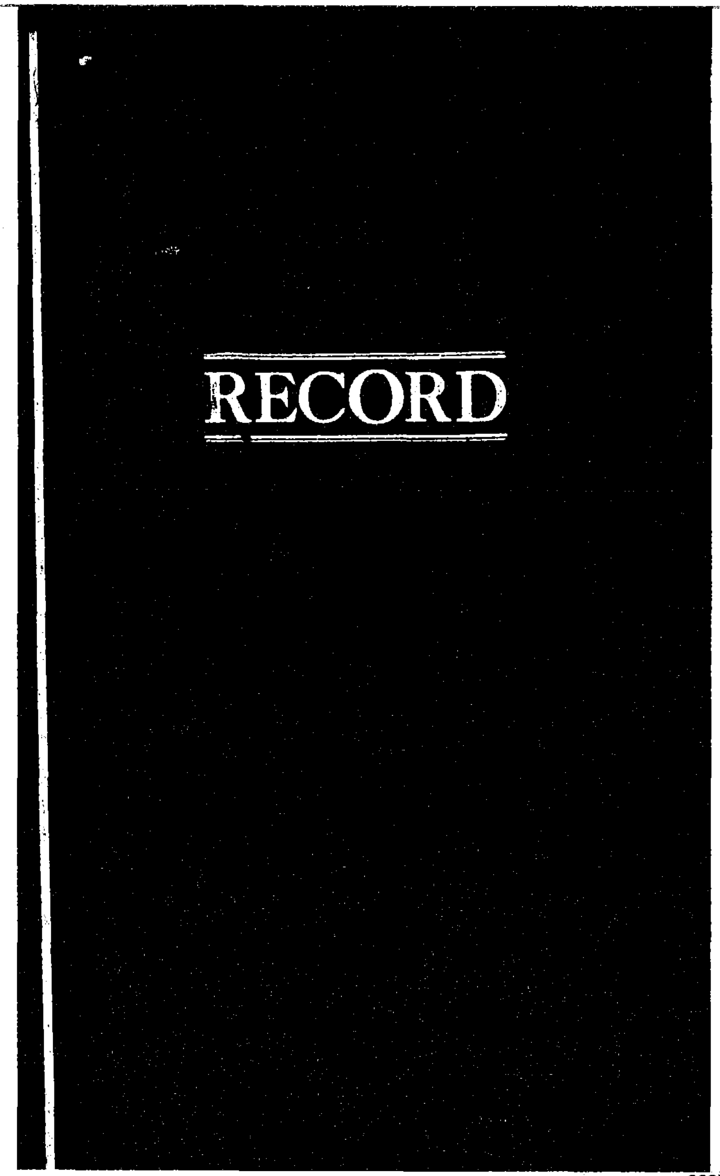
A. Yes.

Q. So if you look at the entry for March 31st, I just want to talk about the numbers at the end of that entry where it says, "Small pump and large pump." Could

you read that for us?
A. "Small pump, 918.5, large pump 407.9."
Q. Again, what are those numbers?
A. Those are hour meters.
Q. That is telling you how many hours those pumps have operated?
A. Yes.
Q. Is that right?
So if you go to the -- actually, do it this way. Give you another exhibit.
(Plaintiff's Exhibit No. 13 was marked for identification.)
MR. CRYSTAL: Q. Giving you what's been marked No. 13, is this another page from the log?
A. M-hm, yes.
Q. These are your notes?
A. Yes.
Q. Is that right?
I just want to look at the bottom. You see the entry for December 7th, 2010?
A. Yes.
Q. At the very bottom of that, see where it says, "Small and large." Can you read those?
A. "Small 58.0, large 1.5."
Q. So what I wanted to do was compare. If I am

understanding right, December 7th, 2010, the reading on the gauge for small pump was 58, and the reading on the gauge for large pump was 1.5?
A. Yes.
Q. Those are the numbers of hours they had been running; is that correct?
A. Yes.
Q. If you switch back to page 90 that we were looking at, you read these other numbers, "Small pump, 918.5, large pump 407.9," those reflect the numbers of hours they had run as of March 31st, 2009?
A. Yes.
Q. If you take the number on March 31st and subtract the number on December 7th, for example, on the large pump take the 407.9 hours and subtract the 1.5 hours, am I right that would tell you how many hours the large pump ran between December 7th, 2010 and March 31st, 2011?
A. Yes.
Q. That's approximately 400 hours; right?
A. Yes.
Q. Am I right during the winter of 2010/11, from early December to late March, the large pump ran for about 400 hours?
A. Yes.

Q. How about the small pump?
A. You're looking at 900 about 30.
Q. It was 918 hours on March 31st?
A. Yeah.
Q. And ran for 58 hours already?
A. Right.
Q. It's between 850 and 900; is that right?
A. Right.
Q. That's the number of hours the small pump ran last winter?
A. Right.
Q. Okay. Just one more of these, and we should take a break.
(Plaintiff's Exhibit No. 14 was marked for identification.)
MR. CRYSTAL: Q. So another page of the log book, you see that the signature in the middle it says --
A. Mark Seigenthaler.
Q. Who's he again?
A. Mark Seigenthaler, he's my foreman.
Q. Does he ever -- does he monitor the pumps at the pump house?
A. Not really monitor them. Might go and do a review, overlook them.



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6/15/10 level at 2.1 cleaned intake ops check large pump 37080.
tulies are growing close to pump house need to be removed J Arcey

7/26/2010 level at 1.8 check bulbs and pumps tulie are growing close to pump house will have problems this year with flooding on north side J Arcey

8/16/2010 level at 1.6 came to meet with contractor. big motor installation.
small pump 287031 J Arcey
large pump 071042 on

10/19/2010 installed small pump. no more need for oilers central shape installed gent fitting on bearings
J Arcey
I Reyes

11/7/2010 raining came to turn small pump on for first time being rebuilt turned to auto low water .5 level at 2.0
J Arcey
I Reyes.

11/13/2010 meet with contracting to remove silt from intake lots of sand J Arcey

11/20/2010 level 2.1 small pump off adjusted floats for water level to log at 1.8
#1 pump low water 2.0
#2 pump off line J Arcey

11/21/2010 level at 2.2 pump came on low meter 9.8.
J.A.
Izzy

11/22/2010 level at 2.1 removed old oilers installed heat tape on small meter low water 12.2
J Arcey

11/24/2010 level at 2.2 droped floats to turn on small pump to pump down to 1.8 hour meter 19.8
J Ascay

11/25/2010 level at 2.1 need to set floats for small pump stays on longer hour meter 21.8 J Ascay

11/27/2010 level at 2.1 suppose to rain all day, lowerd floats to kick on small pump hour meter. 21.8
John Ascay

11/28/2010 level at 2.1 suppose to rain droped floats to kick on pumps. hour meter 34.4 J Ascay

12/3/2010. installed pump & meter ran pump to test amps #1.106 #2 #107 #3 98
J Ascay
M Hemming

12/5/2010 level at 2.1 ran big pump for 20min Hour meter 1.3 level 1.7 reinstalled floor cleaned out garbage and swept floor. left big pump offline when pumping level drops past low water level. need top take 6" weir out might help out small pump on line hour meter 47.4.
J Ascay

12/6/2010 small pump on. around level at 1.84 hour meter 56.7 water is just above weir. pump shut off. 56.9
J Ascay

12/7/2010
level at 2.1. came to meet contractor to show him lose angle iron, removed weights from check valve small pump came on. weir is set at 1.8 needs to be lowered contractor will try and be out here friday to fasten angle iron so we could lower weir small 58.0 large 1.5 John Ascay

12/8/2010 pump on level at 1.9
raining all day small pump
doing good hour meter 63.9
large pump turned off.
J Ascariz

12/9/2010 level at 1.9 pump running
pond water dirty
hour meter 79.1
J Ascariz

12/13/2010 level at 2.1 greased small
pump hour meter 104.4
Joh Ascariz

12/19/2010 Water level above
motor cover in pump house
no power lost one leg
have lights no pumps
called PG&F meet with
him told him problem installed
new connectors on pole no
good problem down line
found broken dever he is
going to call out another crew
I took out 3 wire.
J Ascariz

12/20/2010 power restored
large pump running 3.8
level 3.1 small pump 132.2
330 level at 1.9 large pump
running 13.6
J Ascariz

12/21/2010 level at 2.6 big pump
on. meet with Dan Mower.
droped level to 1.5 to pump
down pond before rain and
frogs laying eggs.
big pump 21.8 small pump 140.6
greased small pump.
raked intake screen clean
300 big pump shut off 1.6 25.3
lowered floats to shut off
@ 1.5
J Ascariz

12/22/2010 level at 1.6 both
pumps off. large pump 34.3
small pump 146.8
200 level at 1.5 big pump
just turned off
small pump 149.8
large pump 38.3
small pump starts @ 1.9 J Ascariz
large pump starts @ 2.1

12/23/2010 small pump running
level at 2.0 tides are
letting water by slow
large pump 42.2
small pump 158.4
J Ascariz

12/26/2010 5:00 AM small pump running
level at 2.0
small pump 215.0
large pump 50.9
1130 level at 2.1 small
pump running greased
small pump pulled [illegible]
out [illegible] from intake.
small pump 220.8
large pump 50.9.
J Ascay

12/27/2010 small pump running
level at 1.9. small pump
shut off small pump 239.6
large pump 50.9 J Ascay

12/28/2010 level at 2.0.
small pump start at 2.2½
large pump start 2.3½.
try to maintain 2.0 - 2.2.
level is good.
small pump 263.3 J Ascay
large pump 50.9

12/29/2010 5:30 AM level at 2.3½ rained
heavy last night large
pump on 61.0
small pump 264.6
2:00 pm level at 2.2 large
pump running very windy
small pump 266.7
large pump 66.5

12/30/2010 5:00 AM level at 2.1 big
pump running.
large pump 72.8
small pump 274.7
3:30 small pump running 280.7
level at 2.25
large pump 74.7
J Ascay

12th O.P.'s New Year

1/1/2011 5:00 AM level at 2.1½
small pump running
rained a little last night
small pump 317.4
large pump 75.3
J Ascay
1/2/2011 5:00 AM level at 2.2
large pump running
rained heavy last night
large pump 75.6
small pump 339.5
J Ascay

1/3/2011 level at 2.2 small pump
running no rain last
night just yesterday
small pump 361.3
large pump 77.9
J Ascay
3:00 pm level at 2.1
small pump running
small pump 369.3
large pump 78.1 J Ascay

1/5/2011 level at 2.2 no pumps running raked out intake
small pump 403.7
large pump 78.1
J Ascay

1/6/2011 level at 2.25 no pumps running checked intake
small pump 407.6
large pump 78.1
J Ascay

330 was told to shut off pumps. I shut off pumps on breaker panel to further notice.
level at 2.1 J Ascay
small pump 411.9
large pump 78.1 J Ascay

1/10/2011 level at 2.5 turned pumps back on
small pump 411.9
large pump 78.1
large pump come on J Ascay

1/11/2011 level at 2.1 pump off
small pump 422.5
large pump 78.9
300pm received call to raise water level to 2.3
raised floats.
small pump 427.5
large pump 78.9
J Ascay

1/12/2011 level at 2.4 no pumps running.
small pump 427.5
large pump 78.9
J Ascay

1/14/2011 level at 2.5 no pumps running. pump should come on soon.
small pump 427.5
large pump 78.9 J Ascay

1/17/2011 level at 2.5+ no pumps running nice morning
small pump 436.4
large pump 78.8
Joh Ascay

1/18/2011 level at 2.5 no pumps running small pump 439.0
large pump 78.8
J Ascay

1/23/2011 level at 2.5 no pumps running weather nice no rain in forcast
small pump 452.8
large pump 78.8
J Ascay

1-30-2011 level at 2.5 raining slightly
small pump 477.7
large pump 78.8
J Ascay

2-14-2011 level at 2 3/4 started raining pump is running
small pump 499.3
large pump 78.8
Job Ascay

2-15-2011 level at 2.5 no pumps running small pump 507.6
large pump 78.8
J Ascay

2-18-2011 level at 2.4 no pumps running rained yesterday
small pump 535.8
large pump 108.1
J Ascay

2-20-2011 level above marker rained heavy all day yester golf course floded large pump running small pump 539.4
150.3

2-21-2011 level at 3.0 top of marker no rain yesterday lots of run of water from hills
small pump 539.4
large pump 174.9
large pump running J Ascay

2-22-2011 level at 2.5 1/2 large pump running. No rain yesterday
small pump 540.6
large pump 197.6
J Ascay

2-23-2011 level at 2.5 small pump running
small pump 550.1
large pump 209.2
added oil to ailer J Ascay

2-24-2011 level at 2.6 small pump running raked out infront of in take large pump started small pump 571.3
large pump 211.1
J Ascay

2-25-2011 level at 2.6 large pump running. reaned yesterday
small pump 590.3
large pump 214.6
J Ascay

2-27-2011 level at 2.4 1/2 small pump running nice day no rain
small pump 642.0
large pump 218.1
Job Ascay

3-2-2011 level at 2.3¼ small pump running then shut off pump turns on at 2.6 turns off at 2.3¼.
small pump 680.2
large pump 218.1
J Ascay

3-6-2011
level at 2.4 small pump running raining small pump 715.4
large pump 218.1
J Ascay

3-7-2011 level at 2.4 small pump running no rain small pump 728.6
large pump 218.1

3-9-2011 levels at 2.4½ small pump running pulled floats up to turn off pump. reset floats to turn off at 2.5 as told
small pump 745.2
large pump 218.1
J Ascay

3-13-2011 level at 2.5 small pump just shut off.
small pump 751.5
large pump 218.1
J Ascay

3-17-2011 level at 2.5¼
rained yesterday.
small pump 801.2
large pump 218.1
J Ascay

3-19-2011 level at 2.8 small pump running. raked intake of tulies. large pump came on. greased small pump. small pump 828.8
large pump 226.0
J Ascay

3-20-2011 level at 2.9 large
large pump running
lots of rain last night
checked dripper in.
large pump small pump 831.7
large pump 242.4
J Ascay

3-21-2011 level at 2.6½ raked out tulies from intake
large pump running
checked oiler ok.
small pump 832.3
large pump 266.2
J Ascay

3-22-2011 level at 2.7 small
pump running.
small pump 839.0
large pump 280.0
J Arcay

3-23-2011 level at 2.6 large
pump running rain
heavy last night
small pump 854.8
large pump 287.1
J Arcay

3-24-2011 level at 2.7 1/4 small
pump running raked
out intake of tulies
large pump came on
small pump 860.0
large pump 292.2
J Arcay

3-25-2011 level at top of marker
3.3 rain heavy yesterday
raked out tulies
from intake.
small pump 867.5
large pump 319.2
J Arcay

3-28-2011 level at 2.5 1/2 no
pumps running ~~on~~ raked out
intake small pump 868.1
large pump 390.1
J Arcay

3-30-2011 level at 2.7 1/2 large
pump running raked
out tulies from intake
small pump 895.9
large pump 407.1
J Arcay

3-31-2011 level at 2.6 small
pump running raked
out tulies added oil
to res in large pump
small pump 918.5
large pump 407.9

4-4-2011 level at 2.5 1/2
no pumps running
raked out intake
small pump 982.8
large pump 407.8

J Arcay

4-25-2011 level at 2.6
raked out tulies from
intake screen greased
small pum checked
oil in large pump res
small pump 1083.2
large pump 407.8
J Acucy

5-18-2011 level at 2.6 raked
out intake of tulies
ops checked small and
large pumps ok
small pump 1117.7
large pump 407.9
J Acucy

5-26-2011 level at 2.6 cleaned intake
screen small pump 1126.7
large pump 407.9
J Acucy

6-10-2011 level at 2.6 cleared out
tulies from intake ops checked
small and large pump.
large pump 411.2
small pump 1196.0
J Acucy

6-24-2011 received Email from
lisa wayne to drop level to
2.2 lowered probes to
2.2 set mark large pump
rose on small pump 1149.4
large pump 416.2
J Acucy

7-8-2011 ops checked pump
station all ok
Graffiti on side wall
will put in work order
to paint.
small pump 12408
large pump 411.6
level at 2.3.
J Acucy

8-30-2011 ops checked pumps
ran for two min
both pumps ok level at
2.0 small pump 012408
large pump 004116
J Acucy

10-3-2011 level at 1.7

Small pump 1240.9
lg. pump 411.6
Drilled holes for grease fitting access.
& ops checked fittings.

[signature]

10-20-2011 - 16:00

Water level @ 1.875

Small Pump Hours 1255.7

Large Pump Hours 411.6
Removed Log book for photo copying
M.Siegen

10-21-11 Returned Log book to Mori Pump Station
Water level @ 1.860 Pump hours same

M. Siegen

11-6-2011 level at 1.9 rained last night small pump 012578
large pump 00411.6
J Ascay

11-17-2011 ope checked pump house. level @ 1.9
small pump 1260.6
large pump 0411.6

J Ascay

12-8-11 level at 1.9.
small pump @ 1296.8
large pump @ 412.9
J Ascay

12-18-2011 returned log book
level at 1.9 floats set to turn off pumps at 2.0
small pump 01296.8
large pump 412.9
J Ascay

1-3-2012 received call from steve Flanney to lower floats to lower water level down to 1.5. dropped floats down large pump came on then set it to 1.5.
water level at 1.9
small pump 1296.8
large pump 413.0
oily set in large pump to purge every 6 sec. greased small pump

J Ascay

1-4-2012 level at 1.8
small pump 1298.9
large pump 413.2
there are so many tules
they are holding the water
back from coming into
the pump house. turned
on large pump to hand.
then turned off pump and
put to auto
J Acay

1-5-2012 level at 1.7
small pump 1301.8
large pump 414.4
ran large pump in hand
for 30 min to bring down water
level to 1.5. scrubbed marker
so it is readable. greased
small pump
J Acay

1-8-2012 level at 1.7
small pump 1307.9
large pump 414.4
J Acay

1-9-2012 level at 1.7
small pump 1308.9
large pump 414.4
raked intake
J Acay

1-11-2012 level at 1.7
readjusted floats to pump
water down to 1.2
the tules are holding water
back need to clean pathway
small pump 1309.4 J Acay
large pump 414.8 [illegible]

1-13-2012 level at 1.3
small pump 1321.0
large pump 414.8
J Acay

1-17-2012 level at 1.3
small pump 1327.8
large pump 414.8
greased small pump
raked intake
J Acay

1-21-2012 level at 1.3
raked out intake.
small pump 1343.0
large pump 418.9
rained last night
J Acay

1-23-2012 level at 1.4
small pump 1370.0
large pump 420.0
greased pump raked
out intake.
J Ascary

1-28-2012 level at 1.4
small pump on
small pump 1407.5
large pump 420.6
J Ascary

1-30-2012 level at 1.4
small pump 1415.7
large pump 420.0
turned small pump
and large pump off
per steve flannery request
J Ascary

2-11-2012 level at 1.8
was told to turn pumps
on and set float level
to turn off at 1.9.
per Lizy Wayne request
small pump 1415.7
large pump 420.0
J Ascary

2-15-2012 level at 1.9
cleaned intake checked
oil in large pump
greased small pump
small pump 1415.7
large pump 420.0.
J Ascary

2-29-2012 level at 2.0
intake clean
small pump 1415.7
large pump 420.0
ops checked pumps J Ascary

3-12-2012 level at 2.0
cleaned intake
small pump 1416.5
large pump 420.0
J Ascary

EXHIBIT C

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

Philip Williams & Associates, Ltd.
Consultants in Hydrology

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LAGUNA SALADA
RESOURCE ENHANCEMENT PLAN

Prepared for:

The City of San Francisco
and
The State of California Coastal Conservancy

Prepared by:

Philip Williams & Associates, Ltd.

Wetlands Research Associates, Inc.

and

Associated Consultants:

Todd Steiner

John Hafernik

June 1992

#621

621\621 RVS\06-16-92

Environmental Hydrology Engineering Hydraulics Sediment Hydraulics Water Resources

Wharton et al. (1987) noted other occasional prey to include earthworms, leeches and pond snails, and a previously killed rodent. Although Wharton et al. (1987) did not quantify age-specific food habits of the SFGS, they mention newborn snakes taking fish, but suggest that fish may be taken only when no other appropriate size food items were available. McGinnis (1986b) reported that a newly born snake from Mori Point taken into captivity would only eat small worms and young of the year California slender salamanders (*Batrachoseps attentuatus*).

iii. Competition

Competition between SFGSs and conspecifics has been considered to be an important factor in the recovery of the SFGS (McGinnis 1984, 1986; USFWS 1990). However, no data exist to support this contention. Competition between snake species has rarely been demonstrated (Reichenbach and Dalrymple 1980), and has not been shown to occur between SFGSs and other closely related species and subspecies.

McGinnis (1986a) emphasized the importance of competition in the recovery of SFGS because he reports that he has never found SFGSs when "(A) a pond frog species was not present, and (B) when the two other coastal garter snake species were present." However, Jennings (pers. comm.) reports finding RLF, both coast and Santa Cruz garter snakes at all locations where he has observed SFGSs (Pescadero, Waddell, Ano Nuevo). Sean Barry (pers. comm.) has reported similar results for a number of sites he investigated. Of the ten sites where Fox collected SFGSs, all three species of garter snakes were collected at five sites, two species were collected at three sites and only SFGSs were collected at two sites. The semi-aquatic habitat and food habits of the SFGS suggest that it is intermediate ecologically between the more aquatic Santa Cruz garter snake and the more terrestrial coast garter snake and may be more likely to be found when the two conspecific species are present.

iv. Mortality

SFGSs are known to be killed on the roads (Sean Barry, pers. comm.) and in mowing operations (Dalrymple and Reichenbach 1984). Mortality from vehicles and mowing operations are considered important mortality factors which can be reduced by proper management as demonstrated for endangered garter snakes in Ohio and endangered rattlesnakes in Missouri (Siegel 1986).

No known predator specializes on garter snakes in the study area. Carpenter (1952) and Fitch (1965) report a number of garter snake predators which are found in and around Sharp Park including several hawks, herons, racers (*Coluber constrictor*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*) and opposums (*Didelphis marsupialis*). Foxes (presumably the introduced red fox, *Vulpes fulva*, a specimen which was positively identified from a dead animal seen in nearby Calera Creek, although grey foxes, *Urocyon cinereoargenteus*, are native to the area) were seen in Sharp Park and are also common in the area. Carpenter

(1952) also reported large crayfish and frogs as garter snake predators. Large crayfish, presumably an exotic species from Louisiana (Mark Jennings, pers. comm.) are common at Sharp Park.

c. Distribution

The SFGS is restricted in geographic distribution to San Mateo and northern Santa Cruz counties and only a few viable disjunct populations are still known to exist (USFWS 1985). Beginning in 1946, Sharp Park has been surveyed for SFGSs several times. The results of these surveys indicate that in the mid-40's SFGSs were abundant, but that by the late 70's the population was greatly diminished. Barry (1978) suggested that their depleted numbers were primarily the result of commercial collection for the pet trade, based on interviews he conducted with reptile dealers. However, in 1979 Barry (1979) located thirty seven SFGSs in the wetland area adjacent to Horse Stable Pond and 46 SFGSs were observed on Mori Point, primarily in the "bowl" area. Barry hypothesized that... "the bowl is apparently of considerable importance to perhaps the entire Laguna Salada [SFGS] population..." and stated that the small number of recaptures of individuals in the bowl area suggests that the snakes were primarily using the area as a migratory corridor.

McGinnis made five different surveys of Sharp Park and Mori Point between 1984 and 1989. In several hundred survey-hours and thousands of trap-hours, only two SFGSs were observed; one giving birth and another lone adult, both on the far western end of Mori Point.

d. Occurrence at Sharp Park and Adjacent Areas

i. Methods

Surveys conducted during this study consisted of walking systematic transects around Laguna Salada, Horse Stable Pond, connecting canals and adjacent marshes and the creek. In addition, all unmowed areas were surveyed at least twice. All species of reptiles and amphibians encountered were recorded. Following winter rains, the study area was surveyed for the presence of temporary ponds. Surveys were conducted between May 1990 and May 1991. In addition, a reconnaissance survey was performed in January 1992. Sixty-eight hours were spent in Sharp Park (includes Laguna Salada, greater golf course area west of Highway One including Sanchez Creek, Horse Stable Pond and stable area) and thirteen hours were spent on Mori Point. No traps were used during this study.

Habitat was assessed qualitatively for availability of food, cover and over-wintering sites. In order to provide historical perspective in habitat changes over the last two decades a one-day survey was conducted with Sean Barry (University of California, Davis), who had previously studied the status of SFGSs at Sharp Park in the 1970s. In addition, a half-day was spent in Sharp Park east of Highway 1 following the creek up through the rifle and archery range, and site visits were made to Pescadero Marsh, San Francisco Airport and

Ano Nuevo to view additional habitats presently in use by SFGSs. Common and scientific names for reptiles and amphibians used in this report are those of Collins, et. al. (1978).

ii. Results

1) Present Status

No SFGSs were located in Sharp Park, but three juvenile SFGSs were found at Mori Point: two together on surveys in 1990-1991 and one in January 1992 (Figure 34). Two hundred ninety seven observations of garter snakes were made in Sharp Park. All positively confirmed sightings were of the coast garter snake (*Thamnophis elegans terrestris*). Approximately 40 garter snakes moved out of view before a positive identification could be made.

Although no SFGSs were located at Sharp Park proper during this study, Laguna Salada, Horse Stable Pond, the connecting canals and associated wetlands are most probably important feeding areas for existing SFGSs which still occur in the vicinity. The lack of observations suggests that populations remain significantly reduced compared to the historical records of Fox in the 1940s and Barry in the 1970s (1978, 1979). A number of factors have been identified as possible reasons for the decline (McGinnis 1986a, USFWS 1988) and are discussed below.

2) Prey Abundance

Small choruses of Pacific tree frogs were heard both day and night following winter and spring rains but no tadpoles or egg masses were located. No more than five tree frogs were found on any given survey around Horse Stable Pond and the connecting canal. Tree frogs were heard calling near a drainage ditch that runs off the golf course into Laguna Salada on its east side, but none in or around Laguna Salada itself.

The only earthworm and salamander populations were located under the isolated debris in patches of Monterey cypress. Whether earthworms are numerous in the soil under the golf course grass was not determined. Slugs were common in marshes and were found in the stomachs of numerous coast garter snakes. Small fish were common along the edges of Laguna Salada, Horse Stable Pond, Fairway Drive Creek and the connecting canal.

Additional feeding areas are present south across Mori Point to Calera Creek; these areas contained prime feeding habitat (McGinnis 1990) that was severely degraded recently, but is in the process of being restored (Michael Vasey, Pacifica City Council and San Francisco State University, pers. comm.). Mori Point may also provide alternative feeding sites at temporary ponds that form after heavy rains during winter and spring. McGinnis (1986b) previously reported a lack of salamanders on Mori Point except at one location at the far western end of Mori Point, but the present study recorded an abundant supply of slender salamanders, earthworms and slugs during the wet conditions of winter and spring.

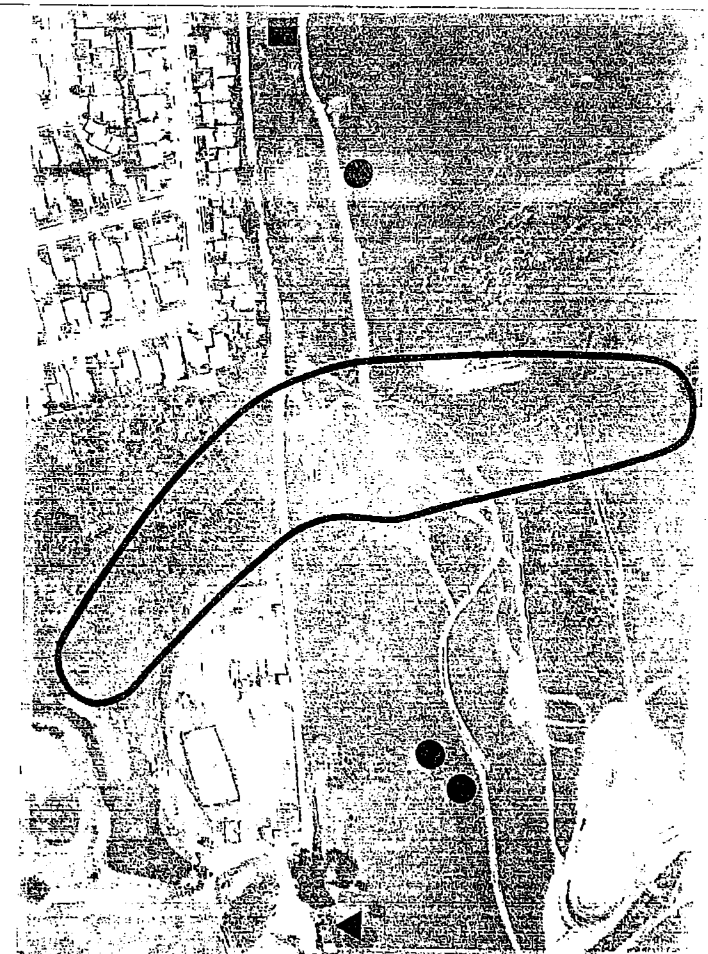

Figure 34 Location of SFGS sightings from present study (square), McGinnis, 1986b (triangle), and Barry, 1978b (circles indicate single sightings, solid line denotes area of multiple sightings).

Wetlands Research Associates, Inc.

The large-scale salt water intrusion into the lagoon and pond during the mid-1980's undoubtedly caused amphibian populations, SFGS primary prey, to decline sharply. Once viable, reproducing frog populations are reestablished, the area will provide much greater foraging habitat for SFGS.

3) Habitat Assessment

Overall size of marsh habitat at Sharp Park has not changed dramatically since Barry's study in 1978 (Sean Barry, University of California, Davis, pers. comm.), although several years of drought conditions probably have reduced hydroperiods significantly during the last five years. McGinnis's (1986a) description of Laguna Salada proper also mirrors present conditions

Laguna Salada proper provided partial cover for snakes along most of its margin, except for open sandy areas along the western side. The abundance of aquatic organisms appeared to decrease as one moved from south to north, and this included frogs, fish, and aquatic insects. In general, prey levels of frogs were low, although small fish were common.

The connecting canals provide good cover for SFGSs and frog and fish prey availability. They also provide cover for movements between Laguna Salada and Horse Stable Pond. McGinnis rated the canal areas connecting Laguna Salada and Horse Stable Pond as prime SFGS habitat, and this area also provided significant numbers of sightings of coast garter snakes during this study. Good cover and abundant prey items suggest that this area remains important feeding habitat for SFGSs. Presumably, the canal also provides migratory paths for snakes from Laguna Salada south to Horse Stable Pond and Mori Point.

Sanchez Creek provides adequate cover for SFGSs along its western terminus where it meets Horse Stable Pond. In other areas the creek either passes underground or is overshadowed by dense cypress and has little or no vegetation. In these areas, Sanchez Creek provides poor frog and fish habitat and little SFGS cover.

Horse Stable Pond provides good cover for SFGSs along its southern edge. The northern and western edge of the pond had adequate cover at the beginning of the study, but winter freezes followed by heavy storms reduced cover significantly. By summer of 1991, new vegetation provided adequate cover. Horse Stable Pond had the highest concentration of frog and fish prey items and provides excellent feeding habitat for SFGSs.

No natural upland habitat, which is now believed to be important to SFGSs (McGinnis and Keel 1987, USFWS 1988), exists on the golf course west of Highway One. The artificially created berm which separates the Pacific Ocean and the golf course currently has little vegetation on it and does not now appear to support any small mammal burrows which are thought to serve as overwintering retreats (McGinnis 1988).

Mori Point is separated from Horse Stable Pond by an abandoned stable area which contains a ring of tires, old barns and a number of old bathtubs. At the time of this study, the area is overgrown with grasses reaching a height of three feet and provides a dispersal corridor for SFGSs onto Mori Point and excellent foraging habitat. This upland area is the only upland habitat within Sharp Park and is an important habitat for SFGSs and the other special status species.

The privately owned uplands on Mori Point are critical to SFGS. These uplands provide overwintering sites, a corridor between Sharp Park and Calera Creek, and alternative feeding areas. In fact, since Barry (1978) located two SFGSs at Sharp Park, subsequent surveys have only located snakes on Mori Point uplands and at Calera Creek on the southern side of Mori Point. USFWS (1985) stressed the need to understand movements and activity patterns to properly manage the SFGSs. Site specific movements and activity patterns for Sharp Park remain unknown, except those reported by Barry (1979) that suggest that SFGS movement between the southern marsh area at the east end of Horse Stable Pond onto Mori Point.

The population status of the SFGS at Sharp Park remains critically low following heavy collection pressures in the 1970s, marine intrusion and drought conditions in the 1980s and the continued degradation of adjacent upland and feeding habitats at Mori Point and Calera Creek. The success of enhancement plans for the recovery of the SFGS at Sharp Park is intricately tied to protection and recovery of these adjacent habitats.

Although no SFGSs were found in Sharp Park during the present survey, the area probably serves as an important feeding habitat for the small population of SFGSs of the region, including those located on Mori Point. Furthermore, Horse Stable Pond, Laguna Salada and the connecting canal currently support RLF, the most often mentioned prey item for the SFGS.

3. <u>Red-legged Frog</u>

a. Introduction

The red-legged frog (*Rana aurora draytonii*) is a Federal candidate species for listing under the Federal Endangered Species Act (Federal Register, January 6, 1989, Volume 54(4):554-579) and will probably be recommended for federal listing within one year (Mark Jennings, California Academy of Sciences, pers. comm.). It is also considered a species of special concern by California Department of Fish & Game.

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b. Natural History

RLF feeding habitats have been the subject of quantitative analysis (Hayes and Jennings 1989). These investigators found RLFs were found in aquatic habitats that included "some area with water at least 0.7 m [2 feet] deep, [and that] had a largely intact emergent or shoreline vegetation." Shrubby willows (*Salix* sp.) were recorded at 67% of the sites. Adult frogs seemed especially sensitive to the need for dense vegetation and deep water as only juvenile frogs were found at sites where vegetation and water depth were limited.

c. Occurrence on Site

i. Methods

Between may 1990 and May 1991, four surveys (7 hours) were spent at Sharp Park after dark surveying for frogs that are primarily active at night (Mark Jennings, California Academy of Sciences, pers. comm). Special attention was given to RLFs, a federal candidate species, which may be an important prey species of SFGSs. One survey for RLFs was conducted in November with Drs. Mark Jennings and Marc Hayes, who have both been involved in extensive studies of this species, and are presently determining its status in California under contract to California Department of Fish & Game.

ii. Results

On warm days throughout the study period, juvenile RLFs were common around Horse Stable Pond and along the connecting canal. Up to 100 juvenile frogs were counted around Horse Stable Pond during one survey in May, undoubtedly a small fraction of actual number of frogs present. In comparison, less than 20 frogs were counted around the west, north and southern end of Laguna Salada proper, an area vastly larger than the small Horse Stable Pond. RLFs were rarely seen along Sanchez Creek, although some individuals were located under debris and in some temporary ponds near its terminus with Horse Stable Pond.

Adult RLFs are nocturnal and few were seen during nocturnal or diurnal surveys, although one large individual was located along the connecting canal. No choruses of RLFs were heard and no egg masses or tadpoles were seen during the surveys in 1990 and 1991. However, in March 1992, following a month of significant rainfall, numberous RLF egg masses were found at Horse Stable Ponds. The pumping of water out of Horse Stable Pond and the resultant exposure of shoreline was causing massive frog egg mass mortality.

The small number of adult RLFs present in Laguna Salada and Horse Stable Pond suggest that either the present frog population is relatively new and/or few breeding sites are available. Both are probably true. McGinnis reported no frogs in 1986 and five years of drought have reduced the reproductive success of this species at many sites (Mark Jennings, pers. comm.). Much of the present sites at Sharp Park do not offer adequate vegetative structure for breeding (Hayes and Jennings 1989; Mark Jennings, pers. comm.); for example, Sanchez Creek is currently too shallow and does not provide adequate vegetational structure to support RLF. Despite significant rainfall in 1991, no tadpoles or eggs of this species were located.

The low number of RLFs in Laguna Salada may also be due to inadequate vegetational structure and shallow water conditions (< 2 feet) along the edges of the lagoon. The possibility also exists that predatory fish are present in Laguna Salada. Sweeney (Sharp Park superintendent, pers. comm.) noted reports of bass in Laguna Salada, although he had no first-hand observations. Hayes and Jennings (1989) mentioned the elimination of RLFs at many locations following introduction of predatory fish.

Red-legged frogs are "explosive breeders", reproducing in a veryt short period of time following heavy rains as occurred in February 1992. The frogs by their eggs near the water surface attached to emergent vegetation. This reproductive behavior is disastrous with the present system of pumping down water levels following large rains. Egg masses are then exposed and dessicate. Those that hatch may be mpum,ped out to sea as indicated by the large numbers of fish pumped out in 1991. Hence, either water should be held in the system consistent with flood constraints or pumped out the north end of the lagoon.

4. San Francisco Forktail Damselfly

a. Introduction

The San Francisco forktail damselfly *(Ischnura gemina)* has the most restricted distribution of any western damselfly or dragonfly. The FTDF is associated with coastal and San Francisco Bay wetlands. Prior to human impacts on these areas, it probably was associated primarily with sluggish freshwater streams and marshes. Such wetland areas are now seriously threatened by urbanization, channeling of creeks, and other human activities. Because of threats to its survival and its association with threatened biological communities, this species is a Category 1 federal candidate for listing as an endangered or threatened species. It is also listed by the International Union for the Conservation of Nature (IUCN) as an endangered species. Recently, it has been used in a photo-essay as a symbol of threatened California invertebrates (Middleton 1988) and was included in an exhibition of photographs (**Sliding Towards Extinction: The Disappearing Wildlife of California**) co-sponsored by the California Academy of Sciences and the Nature Conservancy.

Current concern centers around the negative effects that rapid changes in Bay Area wetlands are having on this species. Most of its habitats have been greatly altered or eliminated. These alterations probably greatly restrict the area that can support this species, and threaten the existence of many colonies. In the past 12 years many colonies have been extirpated by development and habitat alterations (Hafernik, pers. obs.). Hybridization with closely related species in areas highly disturbed by humans also pose a significant threat to

IV. SUMMARY OF OPPORTUNITIES AND CONSTRAINTS

The existing conditions described in the previous section represent both opportunities and constraints for enhancement.

From a hydrologic perspective, the historical transition from a saline or brackish wetland to fresh water has allowed the development of endangered species habitat. Past ocean wave incursions represented catastrophic reversals back to saline conditions. The recent completion of the seawall should greatly reduce future catastrophic changes. However, these may still occur, and the opportunity exists to develop a response plan should ocean incursion recur.

Existing water sources are generally capable of sustaining a viable wetland. Late-summer dry periods have resulted in low water levels. In conjunction with some shallowing due to sand input from wave overwash, emergent vegetation is encroaching into previous open-water areas. Better water management and dredging of some areas could restore open water areas.

The present water discharge system (pumps and gravity culvert) is old and has deteriorated. A modern larger-capacity system would reduce flooding and improve water management. However, periodic high water levels from freshwater flooding primarily affects the golf-course operation. If sufficient upland refuge is available, vegetation and wildlife species will survive. Thus, major expenditures on flood control facilities are probably not warranted solely on the basis of wetland enhancement.

Biologically, four special status species are known to occur on or near the Sharp Park study area: San Francisco garter snake (SFGS), red-legged frog (RLF), San Francisco forktail damselfly (FTDF), and salt marsh yellowthroat (SMYT). The four special status species generally have compatible habitat requirements and therefore none of the proposed manipulations would result in decreased habitat values for any one species. The SMYT, FTDF and RLF are currently present albeit in relatively low numbers. The SFGS was historically found at Laguna Salada and is currently found on the adjacent Mori Point property. Because all four species are currently found on or near the study area, there is every expectation that the enhancement plan should (a) improve habitat conditions for these species, (b) increase use of Sharp Park and the surrounding area, and (c) increase their local population sizes to decrease the danger of extinction.

Sharp Park is publically held and not threatened by further development that would otherwise threaten the special status species. Nevertheless, the use of Sharp Park as a golf course and for public access to the coast has potential impacts for wildlife. However, public access impacts may be avoided with barriers in critical habitat and through public education. The USFWS Recovery Plan (1985) for the SFGS mentions the need to control heavy foot travel around waterways. Foot traffic continues to be heavy around the edge of the marsh areas, primarily by individuals collecting golf balls.

Any future expansion of traffic on the road between Sharp Park and Mori Point needs to be mitigated to prevent road killed SFGSs. Apparently, a ban of off-road vehicle use has not been effective (Michael Rothenberg, President, Pacificans for Mori Point, pers. comm.). Mori Point presently receives a large amount of recreational use. Hikers, bikers, off-road vehicles (including 4-wheel drive trucks, 3-wheel ATCs and motor bikes), parasailers, bird-watchers, and people walking their dogs were all observed in the area. The most detrimental activities to wildlife presumably comes from off-road vehicles which have scarred the landscape, eliminated vegetation and caused erosion. The area is also used as a dump with piles of mattresses, old cars, and trash.

Critical habitat is either privately owned or is immediately adjacent to private land in the Mori Point area. Hence, many of the enhancement suggestions at Horse Stable Pond, the marsh to the east, and the upland area to the south will be greatly affected by the extent and type of development. This is particularly true for the SFGS as it was only found on Mori Point and Mori Point is considered an important dispersal corridor for the snake.

Natural disasters, such as the storm surge that caused high salinities in the freshwater habitats at Sharp Park, should be anticipated to occur infrequently even with the recent additions to the sea wall. Such disasters may eliminate critical habitat for the special status species and alternative habitats should be provided. Water salinity was quite low during this study indicating Laguna Salada and Horse Stable Pond have returned to freshwater. McGinnis (1984) indicated salt-water intrusion had occurred two years previous to his 1984 survey based on interviews with golf course personnel, and he measured salinities in 1986 (McGinnis 1986b) which he believed too high to support RLF.

Finally, low water quality due to run-off from the golf course and other nearby housing developments may pose a threat to aquatic animals. Chemical treatments of the golf course, mentioned as a possible threat by USFWS (1985), may impact FTDFs and RLFs and other amphibians.

V. ENHANCEMENT PLAN OBJECTIVES

In determining the need for an enhancement plan for Laguna Salada, the City of San Francisco and the State Coastal Conservancy identified four broad goals:

- Preserve and enhance the site for endangered species, particularly the San Francisco garter snake.
- Protect and improve wildlife habitat.
- Provide for long-term, beneficial management and maintenance of the wetland.
- Coordinate with the City of San Francisco on any adjacent construction projects, particularly the sea wall.

During the collection of data on existing conditions and based on input from the interagency advisory group, these general policies have been refined as a series of specific goals. Although all of the goals are important, those relating to endangered species are critical. For several species, the site represents one of the most crucial areas of remaining habitat. The enhancement plan elements in Chapter VI are designed to respond to each of the following goals.

A. CRITICAL SPECIES GOALS

1. Determine the occurrence of target endangered species using the site at present.
2. Identify specific areas and habitat types being used by endangered species on the site.
3. Protect and manage existing habitats for endangered species.
4. Expand endangered species habitat by modification of adjacent areas to conditions favorable to the species.
5. Provide new information as feasible on the occurrence, behavior and overall natural history of the target endangered species.
6. Provide information on the role of adjacent off-site areas in the regional protection and enhancement of endangered species habitat.

B. MULTIPLE SPECIES HABITAT

1. Enhance existing degraded wetlands to improve overall wildlife habitat on the site.

2. Identify potential wetland expansion areas.

3. Improve riparian habitat along Sanchez Creek.

4. Improve upland habitat.

C. HYDROLOGY

1. Develop a water management plan to protect and enhance endangered species and maximize resource values without compromising adjacent flood control needs.

2. Identify current flood hazards (with completion of the sea wall). Recommend flood control strategies that are compatible with resource needs.

3. Discuss the feasibility of using tertiary-treated waste water (when and if it becomes available) to supplement natural freshwater inflow.

D. PUBLIC ACCESS

1. Manage public access to promote views of the site and use which is compatible with the natural resource values of the site and with the golf course operation.

2. Identify appropriate buffer zones to reduce human and domestic/feral animal intrusion into sensitive wildlife zones.

3. Discuss the impact of poaching on the SFGS.

4. Discuss possible educational opportunities.

E. COMPATIBLE LAND USES

1. Provide recommendations to the Golf Course Management regarding reconstruction of the former hole between Laguna Salada and the levee.

2. Provide information on the role of adjacent off-site areas to the ecology of critical species.

3. Discuss the role of off-site development on flood hazards.

4. Evaluate the role of the sea wall to the overall Laguna Salada Enhancement Plan.

VI. ENHANCEMENT PLAN ELEMENTS

A. PLAN OVERVIEW

The recommended plan focuses on the management and enhancement of the special status wildlife species found on or adjacent to Sharp Park. However, the recommendations will improve conditions for a variety of additional species. The plan recognizes that existing conditions are suitable for all four of the special status species and a dramatic major reconfiguration of habitat is not recommended. Instead, an overall water management program and specific, localized enhancement measures are recommended. The critically low number of individuals of some species suggests a cautious approach to developing or modifying adjacent off-site areas.

The format of the enhancement plan is as follows. In the first section, we make recommendations for the overall water management of the entire wetland system. Following this, the habitat needs of the four special status species, and specific enhancement features at each of the major components of the Laguna Salada system that meet their needs are listed.

B. WATER MANAGEMENT PLAN

It is clear that management of water levels and quality in Laguna Salada is crucial to both the overall habitat quality and to the enhancement of critical species on the site. In addition, it is a key element in the management of the golf course, particularly during floods. Water management may be separated into four broad categories:

- Water level management
- Management during floods
- Water quality management
- Supplemental water supply

These are discussed in the following sections.

1. <u>Water Level Management</u>

During the course of the year, the water level in the system fluctuates in response to water inputs (winter rainstorms, groundwater inflows, irrigation on the golf course, and periodic flows down Sanchez Creek) and outflow (pumped outflow, flow out the gravity

culvert, evaporation, and seepage). Many of these factors are uncontrolled, and the water surface elevations rise and fall in response to the natural variations. During the study period, water levels varied between about 3 ft. and 5 ft. NGVD, reflecting non-flood conditions. The optimum range for water surface elevations from a natural resource perspective is between 4 and 5 ft. NGVD. Above these, flooding of the golf course begins, while below 3.5 ft. NGVD, shallow water depths permit emergent vegetation (tules and *Scirpus*) to invade. Considering the flood hazards, it would be preferable to maintain water levels between 4.0 and 4.5 ft. Somewhat lower winter water levels (about 3.5 ft. NGVD) would be acceptable if the summer levels could be kept above 4.0 ft. Our primary concern has been that summertime elevations below 4.0 ft. are allowing encroachment and loss of open water by emergent vegetation. The main elements which allow some control over water levels are:

- The capacity of the pumps
- On-and-off level settings for pump controls
- Flow out the gravity culvert

a. Pump Sizes

The pumps are clearly undersized to prevent flooding of the golf course. In addition, they are old and in relatively poor condition, and should eventually be replaced. Our modeling results suggest that pumps with a capacity of 30 to 100 cfs will be required to reduce major flood hazards. However, their performance is more related to flood protection than resource enhancement. In addition, the cost of a new or substantially upgraded pump station would be high ($0.5 to $1.0 million) and is probably not warranted solely for flood reduction purposes. It should be noted that all rainfall runoff in the watershed eventually ends up in Laguna Salada and must be pumped out. Thus, any new development or roads in the watershed will increase flood hazards and pumping requirements. As such, a drainage fee should be leveed on development which can eventually be used to improve the pump system.

b. Pump Level Controls

Our surveys indicate that the pump level controls are currently switched on at 4.3 ft. and off at 3.2 ft. NGVD. The latter elevation is too low, if subsequent winter inflow does not raise the water level back to about 4.0 ft. We would prefer to have the pumps shut off at either 4.0 ft. or 3.75 ft. Typically, the level sensors are set with about a 1-ft. difference between on and off settings to prevent frequent "cycling" (on-and-off switching, which wears the pumps out more quickly). It is not clear if this would be a problem for these relatively small pumps. Some experimentation would be in order. If cycling is a problem, the on-and-off settings could be adjusted to 4.5 ft. and 3.5 ft. respectively. Cycling will be less of a problem when the connector channel is deepened, as both Laguna Salada and the Horse Stable Pond will function as a single pond in these elevation ranges.

Considering both the flood control needs of the golf course and the water depth needs of the wetlands, the preferred solution would be to operate the pumps differently during the rainy season and the dry season. During the winter (October through March or April) the pumps could be operated as they currently are (on at 4.3, off at 3.2). However, as discussed under the section on red-legged frogs, rpid pumping after high-rain periods may drop water levels precipitously, thereby exposing RLF egg masses to dessication and washing larvae out of the pond into the ocean. During summer, the water levels would be maintained at 4.0 to 4.5 feet, and the pump level controls either reset to a higher level, or turned off. This may require addition of some water following the rainy season (when levels could be as low as 3 feet) and throughout the dry season to maintain water level. TTWW would be a likely candidate to supplement the natural surface of groundwater inflow.

c. Gravity Flow Culvert

The 2-ft. diameter outflow culvert from the Horse Stable Pond to the Pacific Ocean is also in poor condition. The inlet side in the Horse Stable Pond (pipe invert elevation = 3.3 ft. NGVD) has about a foot of sand in it. The outlet end on the beach is buried under about five feet of sand. To be useful during a flood, the discharge end is located by water seepage and excavated with a backhoe.

Similar to the pump station, the primary role of the culvert is for flood control; at present, it does not have a major role in the natural resource functioning of the ponds. However, despite being partially blocked, it may be allowing summertime seepage and contributing to the undesirable low water levels.

Major upgrading of the gravity outflow system for flood-control purposes would be expensive. Our hydraulic modeling shows that the existing 2-ft. diameter pipe should be replaced by one or two 4-ft. diameter pipes to effectively remove large amounts of water in a major rainstorm. To prevent blockage by wave-transported sand on the discharge side, the pipes would have to extend beyond the beach into subtidal water. This would probably require that they be attached to the current pier structure that supports the pump discharge pipe. The discharge ends of the pipes would be equipped with flap gates to prevent seawater backflow into the pipes. The cost to install 300 ft. of twin 48-inch pipes with headwalls and flap gates in this difficult working environment would probably be between $250,000 and $350,000. Their long-term functioning in the harsh marine environment is uncertain. For these reasons, this is not likely to be feasible at this time.

For natural resource enhancement, control of water surface elevation and seepage prevention out of the gravity culvert are desirable. To accomplish this and improve the existing inlet conditions, the inlet area should be dredged and the culvert cleaned. (This may be accomplished by excavating the discharge end of the culvert and flushing the culvert with

a high-pressure water jet.) The inlet end of the pipe should be fitted with a flashboard weir. To control water levels, the flashboard should be set at 4 ft. The flashboard weir will reduce blockage of the east end of the culvert from sediments in the pond. (Sand blockage from the beach will continue to affect the pipe.) A staff gage should be installed on the pump house to allow direct reading of the water elevations.

2. Management During Floods

As discussed in the Existing Conditions section, Laguna Salada and the golf course are subject to flooding from two sources: freshwater flooding during periods of extreme rainstorms and seawater flooding during periods of wave overwash. From a natural-resources perspective, the main adverse effect of rainfall flooding results from inundation of habitat. This can be partially mitigated by providing higher ground refuge, with adequate vegetation cover to prevent mortality from predators. This is discussed further in subsequent sections. Aside from this, the water level should be returned to the recommended 4-ft. operating elevation as soon as possible. Periodic flooding of wetland habitats is a natural phenomenon and (except for economic damages to developed areas) not adverse to the ecological system. As discussed in the previous section, measures to control flood levels (larger pumps and discharge culvert) would be expensive.

Seawater flooding has had much more serious consequences for wildlife, particularly the RLF and SFGS. Prevention of high salinity levels is justified for the preservation of these species. The newly-constructed seawall will dramatically reduce seawater flooding. The two main factors in its success will be frequency of overtopping and long-term stability. Constructed with a top elevation of 25 ft. NGVD, the levee will only be overtopped infrequently. Water volumes during overtopping will likely be low, assuming the levee remains intact.

If overtopping does occur, the City should monitor salinity levels in the lagoon. Pond salinity has dropped from 7 to 10 ppt during the 1983 and 1986 overwash periods to present levels below 1 ppt. If levels exceed 3 to 5 ppt, the lagoons should be pumped down and refilled with fresh water. If freshwater inflow is likely to be available from subsequent rainstorms, irrigation of the golf course, or tertiary-treated wastewater, the ponds should be pumped down to an elevation of about +1.0 ft. and refilled with fresh water. This would remove about 75 percent of the total water in the ponds; if the initial salinity were 5 ppt, it would be reduced to about 1.25 ppt. It would require pumping of about 22 acre-feet of water, which would take about 30 hours of pumping (assuming the pumps are operating at 9 cfs). The pond would likely require a month or longer to refill from groundwater seepage and natural runoff. A more rapid refilling (and concurrent reduction in salinity) would be preferred if a fresh water source is available.

The long-term stability of the seawall is obviously crucial to the prevention of salinity intrusion and sand transport to the ponds. At present, a portion of the compacted earth levee is protected with rip-rap. The City is monitoring erosion to determine the need for additional protection (Sean Sweeney, pers. comm.). We are assuming that the seawall will be maintained in perpetuity by the City. If this were not done, more frequent overwash would occur. The above pumping regime would be likely required on an annual basis; conditions for endangered species would deteriorate.

3. <u>Water Quality Management</u>

Salinity management is the most critical water quality management issue affecting endangered species use of the site. The construction of the seawall wall and the pumping regime/freshwater replacement approach suggested above should provide adequate fresh water for the RLF and SFGS.

Other issues include the quality of inflow water to the ponds. Direct runoff from the golf course will transport fertilizers or any herbicides/pesticides used in turf management. Runoff from adjacent developed areas may transport traces of heavy metals and other urban pollutants. These are not quantifiable without a specific monitoring program. The one-time spot samples collected did not indicate unusually high pollutant levels. The absence of wildlife mortality also indicates that toxic pollutant levels have not occurred. Long-time pollutant effects are unknown.

The proposed changes in hydrology will reduce mosquito problems by providing deeper water and improved circulation through the system.

4. <u>Supplemental Water Supply</u>

The City of Pacifica has indicated that its treatment plant may be capable of providing significant amounts of tertiary-treated wastewater (TTWW) in the future. If this were done, this water may be available for use in wetland enhancement as well as golf-course irrigation. The treatment plant is located about 2,000 ft. north of the golf course. For relatively small amounts of water delivery, a relatively small (3- or 4-inch line) pressure line could be constructed directly from the plant to the golf course. As the tertiary-treatment capacity expands. The effluent would likely be pumped to a holding reservoir in the watershed and then distributed via a major gravity line (about 30 inches in diameter) to users.

There appears to be a number of alternative scenarios:

a. No use of the TTWW on either the golf course or the wetlands.

b. Use of the TTWW for golf-course irrigation. Eventual seepage and groundwater flow to the ponds.

c. Direct discharge of TTWW to the ponds in emergency situations (either to fill the ponds following pumping drawdown to remove saltwater, or as a supplement to maintain water levels during a drought).

d. As a continuous inflow source to the lagoons to provide regular circulation during summer months or throughout the year.

e. As a water source to create new wetlands in adjacent areas.

The main question (on a nationwide basis) regarding the use of TTWW is that of water quality. If the treatment process provides water with acceptable pollutant levels, the water represents an attractive source. As such, the wetland use would probably be competing with other water users. In any event, final determination of the potential use must be based on water quality issues.

For Laguna Salada, it appears that existing water sources are capable of creating and maintaining a high-quality wetland capable of supporting all four endangered species. Water levels or circulation do not appear to limit these species. As such, Alternative d (continuous inflow of TTWW) is not recommended at this time. Alternatives b, c, and e do appear to have merit. Use of TTWW on the golf course (Alternative b) is particularly attractive. If the ponds experience a significant wave overwash event, the resulting high salinity in the ponds will eliminate RLF and greatly reduce habitat value for the SFGS. Pumping out the salt water and replacing it with low-salinity TTWW represents the only realistic approach to minimizing salinity damage.

Perhaps the most attractive use of TTWW would be the possible creation of new wetlands in existing upland areas (Alternative e). Here, the extensive use of TTWW would not affect existing wetlands or endangered species. Unfortunately, there is almost no land on the site and very little available land on adjacent areas where wetland creation is feasible. Virtually all of the site is developed as a golf course or is already an integral part of the wetlands. Some areas just south and east of Horse Stable Pond could be converted to wetlands, but this can likely be done by excavation alone, using existing water surfaces. Surrounding open-space areas to the south are hilly. While wetlands could be created by grading a series of ponds and wetland plateaus, this would be of questionable value; in addition, the SFGS already uses this area.

In summary, it appears that TTWW can represent a valuable supplement to existing water sources under certain conditions. However, there does not appear to be a major need or opportunity to use it in significant quantities on a regular basis at this time. In response to the Draft Enhancement Plan, the City of Pacifica provided additional information on the possible use of TTWW. This letter (included as Appendix D) stresses the volume of the water for circulation, and describes additional water quality and risk factors. It also points out the use of TTWW may provide a funding wource for the Enhancment Plan.

The use of TTWW would require construction of a connecting line either directly from the treatment plant (approximately 1,500 feet south of Laguna Salada). The size of pipe would likely be determined by the volume required for irrigation of the golf course. A 3-in. to 4-in. diameter pressure pipe installed along Palmetto Avenue would be the most direct route to the golf course. If this route were unfeasible, the water line could be placed along the seawall.

C. SPECIAL STATUS SPECIES HABITAT REQUIREMENTS

The proposed enhancement plan recommends habitat modification, public education and awareness programs, and wildlife protection to improve habitat conditions for the four special status species at Sharp Point: San Francisco garter snake (SFGS), red-legged frog (RLF), San Francisco forktail damselfly (FTDF), and salt marsh yellowthroat (SMYT). The plan will also improve habitat conditions for other wildlife, such as song birds and amphibians.

Table 3 lists the critical habitat requirements of the four special status species and Table 4 identifies briefly how the enhancement plan fulfills these requirements. The major enhancement plan elements are shown in Figure 40 and in the 100-scale plan enclosed in the map pocket. Details of the enhancement plan elements and location of the site are provided in the following sections.

D. ENHANCEMENT OPTIONS

1. Laguna Salada

Laguna Salada itself does not currently support any of the special status species. However, the habitat modifications listed below would significantly improve habitat values and the four special status species would be expected to use the lagoon and its perimeter in the future. These modifications are:

- Deepen the edge of Laguna Salada to provide breeding habitat for RLFs. Optimum depth for breeding RLFs is approximately 2 feet. Two foot depths should be alternated with depths of >3 feet to prevent closure of open water by cattails. This habitat structure would provide suitable habitat for the RLF, SFGS and FTDF (Areas "B", Figure 41). Along the shore this may be accomplished by alternating fingers of deep and shallow areas (Figure 42).

- Channels >3 feet deep should also be cut across the base of peninsulas extending into the lagoon to create small islands (Figure XX). Such islands would provide refugia for SFGS by preventing human and domestic and

Table 3:

Habitat requirements of the San Francisco garter snake, red-legged frog, San Francisco forktail damselfly, and salt marsh yellowthroat.

Species	Habitat Requirements
SFGS	Abundant prey including tree- and red-legged frogs, basking sites, protected dispersal corridors, upland overwintering sites, protection from predators and road and mower mortality.
RLF	Two-foot deep water for breeding, reliable year-round water sources, diverse vegetational structure adjacent to water including emergent vegetation and willows, elimination of predatory fish (if present).
FTDF	Sunlight areas with low vegetation in water habitats for breeding, tall grass-forb vegetation for roosting and foraging, protected shallow sunlight wetlands.
SMYT	Dense willows with a thick undergrowth of herbaceous plants, nest sites over or near open water, moist conditions in marshes that promote high insect abundance.

Table 4.

Habitat enhancement recommendations to meet the requirements of the special status species at Sharp Park.

San Francisco garter snake

1) Create shallow pools (< two feet) for treefrog breeding and deeper pools (two feet) for red-legged frog breeding sites.

2) Alternate fingers of various depths along the shoreline of the pond and lagoon to provide frog breeding sites.

3) Create canals across small peninsulas in the lagoon to make small islands for snake refugia and canals for frog breeding sites.

4) Create mounds adjacent to water for basking sites.

5) Leave a strip of unmowed grassland as a buffer surrounding water courses and ponds as foraging and dispersal habitat.

6) Open Sanchez Creek across southern fairway. Prune cypresses to allow light penetration to the creek area that is heavily shaded. Plant low growing emergent vegetation to increase foraging habitat.

7) If possible, secure adjacent Mori Point uplands and "bowl" area to protect dispersal corridors and overwintering sites.

Red-legged frog

1) Create pools, canals and deepen shoreline on pond and lagoon to two foot depths for breeding habitat.

2) Use tertiary-treated water to ensure year-round water supply.

3) Build mounds adjacent to the pond and lagoon and plant willows to provide vegetational structure.

4) Open Sanchez Creek, as in (6) above, to provide breeding habitat.

San Francisco forktail damselfly

1) Control cattails and other emergent vegetation in connecting canal, Horse Stable Pond, and the lagoon by increasing water depth in sections to >3 feet and by dredging to provide open, sunlight areas for breeding.

2) Leave an unmowed buffer of grasses and forbs around connecting canal, Horse Stable Pond and the Lagoon for roosting and feeding sites.

3) Create shallow, sunlight wetland pools for additional breeding sites.

4) Open Sanchez Creek, as in (6) above, to provide breeding habitat.

Salt marsh yellowthroat

1) Plant willows on mounds at edge of pond and lagoon for additional breeding habitat.

2) Use tertiary treated water to ensure year-round water supply and moist meadow conditions.

All Species

1) At a minimum, the critical habitat should be fenced and signs posted: "Sensitive Wildlife Habitat. Please Do Not Enter." A more formal wildlife reserve designation could be developed in consultation with CDFG and USFWS.

2) Post signs to limit foot traffic into and through critical habitats. Although this would not eliminate access, such as golfers retrieving balls from the rough within the fence, overall human intrusion would decline.

3) Build low wooden fencing to shield critical habitat from human intrusion.

4) Institute and educational program and provide interpretive material to golfers and other public users to increase awareness of the site's unique wildlife.

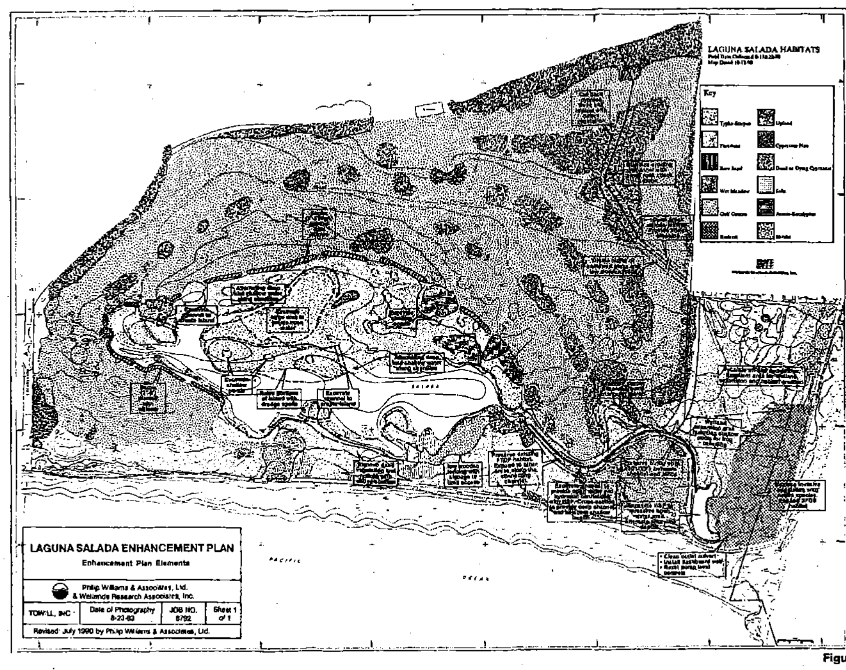

Figure 40

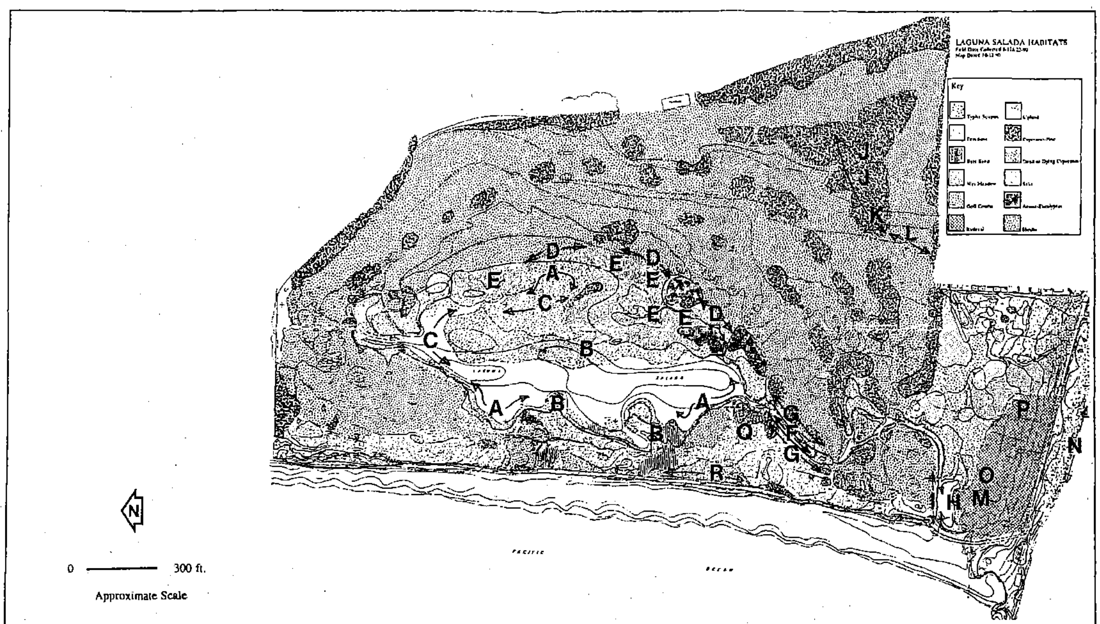

Figure 41 Location of enhancement plan objectives. Letters correspond to descriptions in text.

feral animal intrusion. The channels would also provide breeding habitat for RLF and FTDF (Areas "B", Figure 41). In addition, the central "peninsula" (see Figure 40) when cut-off should be expanded. As suggested by McGinnis (1986a), the island should have some elevated mounds approximately 6 inches high which are built around piles of concrete on slabs to provide retreat areas for SFGS.

- Large areas of the lagoon are choked with dense stands of tules or cattails that create poor habitat conditions for the RLF, SFGS and FTDF. Portions should be cleared and dredged to depths greater than 3 feet to provide open water areas for these species and for waterfowl (Areas "C", Figure 41).

- A series of low berms or mounds should be created on the eastern margin of Laguna Salada and planted with willows (Figure 42). This would provide a barrier to shield portions of the marsh vegetation from foot-traffic, create basking areas for SFGS and RLF, provide vegetative structure for RLF, and create suitable nesting habitat for SMYT (Areas "D", Figure 41). Low areas between the berms would prevent water ponding problems behind the berms.

- Create several small pools in the wet meadow east of Laguna Salada to provide breeding sites for RLF and Pacific tree frogs (Figure 42) (Areas "E", Figure 43).

- Remove exotic vegetation including pampas grass, broom (*Cytisus* spp.), fennel and iceplant from some sites surrounding Laguna Salada and replant dead eucalyptus and acacia with willows.

- The area could be designated with signs providing a statement such as "Critical Wildlife Habitat. Please Do Not Enter". A more formal designation and protection could be developed in consultation with the CDFG & USFWS.

2. Connecting Canal

- Redesign the canal profile to include a shelf of relatively shallow water (two feet) and a deeper channel (> 3 feet). This will ensure open water and abundant emergent vegetation (Area "F", Figure 41).

- Create a 10 foot wide unmowed buffer along the canal to provide roosting and feeding habitat for FTDF and feeding habitat for SFGS. This will also provide a secure dispersal corridor between Horse Stable Pond and Laguna Salada for SFGS (Area "G", Figure 41).

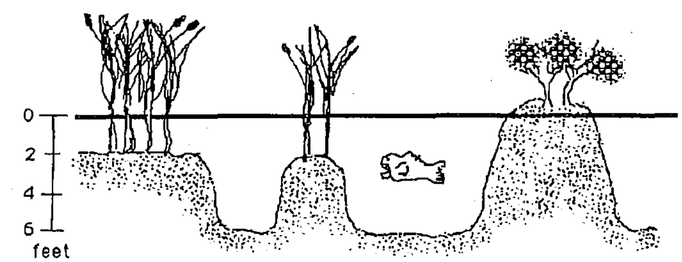

Figure 42 Profile of lagoon and pond edge showing areas excavated to provide a mosaic of open, deep water and shallow habitats.

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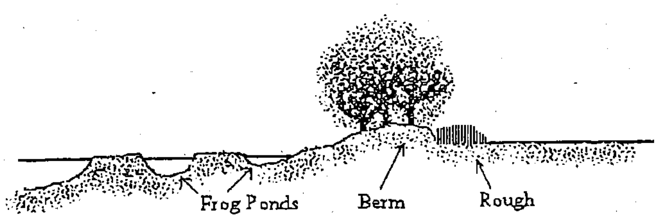

Figure 43 Area east of lagoon showing excavated frog ponds, berm planted with willows, and 10 foot unmowed buffer adjacent to fairway.

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- Limit foot traffic in the unmowed buffer with low wooden fencing and by posting appropriate signs.

3. Horse Stable Pond

- Deepen the edge of Horse Stable Pond as described above for the lagoon to provide breeding habitat for RLF and a bank for basking snakes and frogs. Optimum depth for breeding RLF is approximately 2 feet. Adjacent areas should be deepened to >3 feet to prevent closure of open water by cattails. Along the shore this may be accomplished by alternating deep and shallow areas. This habitat structure would provide suitable habitat for RLF, SFGS and FTDF (Area "H", Figure 41).

- Create buffer vegetation on the west and north side of the pond. Tall (3 foot) upland vegetation adjacent to water provides roosting and foraging habitat for FTDF and foraging areas for SFGS. Limit public access into the buffer with signs and fencing (Areas "I", Figure 41).

4. Sanchez Creek Wetlands East of Horse Stable Pond

- Create a hydrological system that retains water from winter storm runoff and thus increases the depth and length of the hydroperiod in marshes east of Laguna Salada and south of Horse Stable Pond. Increased water depth in spring would decrease cattail growth and provide small pools in the lower areas in the marsh for breeding FTDF and Pacific tree frogs. Extending the period of surface water in the marsh would also benefit SMYT and make the habitat more desirable for breeding. However, the impacts of increased water depth on willows should be determined before any significant change in hydroperiod is instituted .

- Tertiary treated wastewater could be used, given suitable water quality, to maintain year-round water flow through Sanchez Creek and wetlands adjacent to Horse Stable Pond.

5. Sanchez Creek, Upstream

- Sanchez Creek should be modified to incorporate several small ponds and increase vegetational structure to provide breeding habitat for RLF and Pacific tree frogs (Areas "J", Figure 41).

- The Monterey cypress should be trimmed back to increase light penetration to the understory. This should promote understory growth and provide cover for SFGS, RLF and FTDF (Area "K", Figure 41).

- Open Sanchez Creek on the southern most fairway and plant portions with emergent vegetation. An unmowed buffer should be left between the fairway and the creek. This would provide habitat for all four special status species (see Figure 44) (Area "L", Figure 41).

6. Uplands South of Horse Stable Pond

- The old tires, sheds, bathtubs and other debris should be removed (Area "M", Figure 41). This should be done under supervision of a trained biologist to avoid harming snakes that may occur in the area.

- If possible, the privately owned adjacent upland should be protected from development and maintained as SFGS habitat. This area is critical to SFGS because it allows the snakes to move freely between Sharp Park and upland overwintering sites (Area "N", Figure 41).

- The tall (3 foot) vegetation in this upland area provides foraging and perhaps nesting habitat for SMYT, roosting and foraging habitat for FTDF, and foraging and dispersal habitat for SFGS. However, the vegetation includes largely nonnative, invasive species which could be replaced with native grasses and forbs in a phased revegetation program (Area "O", Figure 41). Before such a program is implemented, surveys in the designated sites would need to be done to insure that no snakes are harmed in the process.

- There is a shallow depression downhill from the bowl on Mori Point and to the east of Horse Stable Pond. SFGS were abundant in this area in the '70's. A portion of the upland habitat south of the pond and adjacent to this depression could be excavated to provide shallow pools in the spring. This would create both frog and FTDF breeding sites and encourage use by SFGS. Such excavation should be done on a phased, small-scale, experimental basis to ensure the success of the modification (Area "P". Figure 41). Resurveys would be required to insure that no snakes would be harmed; any snakes present would be moved to an adjacent area on site.

7. Golf Course and Levee

- When rebuilding the lost fairway and green on the southwest corner of the Laguna, the green should be elevated, sloped slightly toward the tee, and set back from Laguna Salada to reduce intrusion into the shoreline vegetation on the lagoon perimeter. The green would be elevated to provide views of the lagoon and also provide a buffer area between the green and the lagoon edge vegetation. The area surrounding the fairway

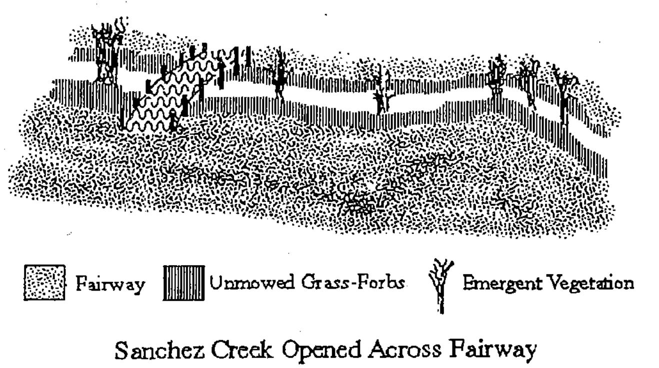

Figure 44 Sanchez Creek opened across southern fairway.

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and green should be planted with native dune vegetation (Area "Q", Figure 41).

- The levee currently supports little vegetation. It should be planted with perennial grasses on the upper slope. The lower sandy slopes should be planted with native coastal dune vegetation (Area "R", Figure 41).

8. Educational-Public Awareness

- Institute an endangered species environmental education curricula for Pacifica students.

- Post signs identifying critical areas as sensitive species habitat.

- Require golf course personnel to consult with wildlife agencies or trained biologists before altering sensitive species habitat with bulldozers or other heavy equipment.

- Institute an educational program and provide interpretive material to golfers and other recreational users of the park and adjacent Mori Point to increase awareness of the area's importance for a number of endangered species. Encourage people to actively protect their unique park.

E. PROPOSED DREDGING PLAN

To accomplish the enlargement plan elements described in the proceeding sections, a dredging and spoiling disposal/grading program will be required. The major components are shown in Figure 45 which shows proposed bathymetric (deep water only) contours and spoil placement locations. The total dredged quantities are listed in Table 5. A maximum of about 33,000 cubic yards (cy) of sediment would be excavated. More detailed estimates would be provided during the final design. In Laguna Salada the east arm of the main pond will be dredged to a bottom elevation of -1.0 feet. This will provide 4 to 5 feet of water depth during normal dry season conditions, which will prevent encroachment by emergent vegetation. Along the shoreline, alternating bands of deep and shallow water will be provided. Three peninsulas of land which extend into the pond will cut off as islands by excavating open water channels at their base. In addition, a number of shallow ponds will be excavated along the east side of the Laguna and on the main island. The majority of the excavated dredge spoils will be placed in a band 100-200 feet wide along the tee, fairway and green of the former golf hole (which is proposed for rebuilding). The spoils will require drying and conditioning, prior to final grading. The placement of dredge spoils will raise this area 5 to 7 feet. In addition to providing on-site disposed of spoils (greatly reducing construction cost), the raised golf hole will provide an overview of the wetlands of ponds

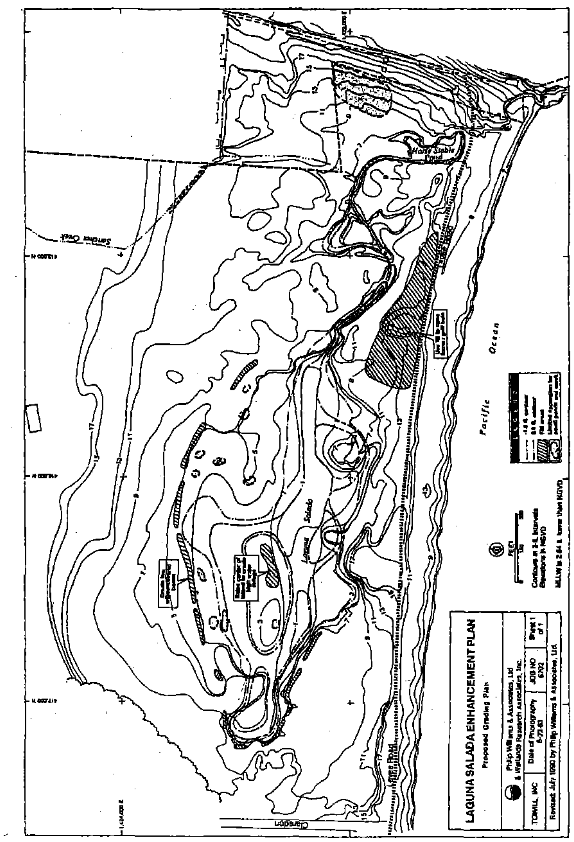


Figure 45

Table 5:

EXCAVATION VOLUME AND SPOIL PLACEMENT ESTIMATES

EXCAVATION SITES		VOLUME (cubic yards)
1.	Laguna Salada	26,400
2.	Horse Stable Pond	2000
3.	Connecting Channel	3300
4.	Sanchez Creek	550
5.	Additional Small Ponds	1000
	TOTAL EXCAVATED VOLUME	33,250

DISPOSAL ZONES		
1.	Berms: Assume 1500 LF, average height of 3 feet:	2,100 cy
2.	Former Golf Hole: Assume 600 ft. long, 200 ft. wide, 7.0 ft. high:	31,000 cy
	TOTAL SPOIL PLACEMENT	33,250 cy

without requiring closer access. This will allow maintenance of a buffer zone ground the wetlands.

In addition, some spoils will be used to create a series of low berms 2-4 feet high around the wetlands. These will further identify the border between the golf course of the wetlands, restricting access and reducing intrusion.

Along the connecting channel, the channel bottom will be deepened to -1.0 feet NGVD. This will provide a continuous hydraulic connection along all the wetlands between LS and the HSP. In addition to the deep channel, the connecting channel cross-section will also include a shallow bench or terrace along the west bank to create additional habitat for the FTDF. Closer to the HSP, a small triangular shaped area of wetland will be enhanced with a perimeter, open water channel. All construction work in this area will have to be closely monitored to insure no damage to the existing FTDF habitat.

The Horse Stable Pond will also be deepened to provide open water, free of emergent vegetation. The shoreline will provide alternating deep of shallow water habitat. Dredging will extend up to the pump house of gravity outflow culvert to allow more efficient water management. Some additional ponds will be created in the uplands along the south project property lines. Additional, habitat for the SFGS, as suggested by McGinnis (1986), could be constructed with dredge spoils along the south-west property line.

We have also proposed opening Sanchez Creek across the golf hole which parallels Fairway Drive. This would provide additional freshwater marsh and open creek habitat which we believe could be integrated with the golf hole.

The type of dredging and staging areas will be determined during the final project design/implementation phase. Three methods of dredging are feasible:

1. Land-based dredging and disposal, using hydraulic excavators, and dump trucks. A variant of this is the "Sauerman Technique", which uses a land-based crane operating a bucket on a cable. This system is capable of excavation in a large open water zone using land-based equipment.

2. A floating, clamshell dredge, with spoils placed in a small barge and then transferred to a dump truck.

3. Suction dredging, with the liquified spoils pumped to the disposal area.

Land-based dredging (Method 1) would be the least expensive and simplest. It will be used for all accessible areas, including the connecting channel, small ponds, Sanchez Creek and much of Horse Stable Pond. It may also be feasible in parts of Laguna Salada

A variant of this technique, referred to as the Sauerman Technique, allows land-based equipment to conduct dredging beyond the reach of excavator arm. A long, circular cable is looped around a pulley attached to an immovable object (bulldozer, tree, etc.) on the opposite side of the pond and controlled by the crane. A bucket is attached to this cable. This system is less precise than normal hydraulic excavator-based dredging and more expensive. However, it does provide the opportunity to use land-based equipment in open water areas, which is cheaper and may be less destructive than floating equipment.

For areas inaccessible by land, methods 2 or 3 will be used. Method 2 (floating clamshell) is preferred since the dredge spoils are dryer and easier to handle and shape following excavation. However, transport from the excavation area in Laguna Salada to the shore may be difficult. Suction dredging (method 3) would simplify transport by using a temporary pipeline to pump the spoils to the disposal area. However, to allow pumping, the spoils are mixed with water to create a slurry, and a dewatering pond must be constructed. This method generally requires a location for discharge of the decanted overflow water from the dewatering pond.

Final selection of the dredging and disposal method will be made in conjunction with the dredging contractor. For preliminary cost estimates, land-based dredging (least expensive) has been assumed for all sites except for Laguna Salada. Costs for dredging the main pond assumes that one of the two more expensive methods will be used.

Management of the dredging program will be required to minimize disturbance to the shoreline habitat and golf course. Specific pond access locations and haul routes will be staked by the monitoring team. Sensitive wildlife areas will also be identified and fenced-off.

Timing of the construction will be determined by the project biologists to minimize wildlife impacts. While some disturbance to the site vegetation is inevitable, most of the wetland vegetation is robust and will recover fairly quickly. However, avoidance of construction impacts to the critical species is essential.

F. RECOMMENDATIONS ON REGIONAL PLANNING ISSUES

1. Mori Point Development

Privately held lands on Mori Point are both directly and indirectly important to SFGS, RLF, FTDF, and the SMYT. All of these species are found in areas adjacent to or on Mori Point lands and the SFGS is currently found only on Mori Point. In addition, Mori Point may serve as a critical SFGS dispersal corridor between Sharp Park and suitable habitat on Mori Point and Calera Creek. The marsh immediately east of Horse Stable Pond and the uplands to the south and southeast are an integral part of the Horse Stable Pond watershed. The proximity of these privately held lands to the Sharp Park project area makes their

development of great concern to the success of the proposed enhancement plan and future of the special status species.

2. Golf Course Planning

The proposed enhancement plan identifies several issues that bear directly on golf course planning. These issues are outlined here and discussed in more detail in Section V:

- When rebuilding the lost fairway and green for the hole southwest of the Laguna, the green and fairway should be elevated, sloped slightly toward the tee, and set back from the lagoon to reduce intrusion into the shoreline vegetation on the lagoon perimeter. The dead trees along the lake perimeter in this area should be replanted with native shrubs and shrub-like trees such as willow. The fairway and greens can be elevated, using dredge spoils to provide a view of the Laguna without requiring proximity.

- A series of small berms should be created on the east side of the lagoon and the connecting channel between the pond and the fairways and planted with willow. This would reduce intrusions into shoreline vegetation along the lagoon perimeter and provide basking sites for SFGS, diverse vegetational structures for RLF, and nesting habitat for SMYT.

- Grassland-forb vegetation adjacent to the lagoon, Horse Stable Pond, and the connecting channel should not be mowed. This would provide increased cover for SFGS and roosting and foraging areas for FTDF. The width of the unmowed buffer will vary depending on fairway configuration but at a minimum should be 10 feet on either side of the waterways.

- Sanchez Creek currently flows through the golf course. It is above ground when passing through the stands of Monterey Cypress but flows underground beneath the fairways. The Monterey Cypress trees that overhang the creek should be heavily trimmed to allow light to pass to pass through and the creekbed planted with emergent vegetation. The creek should also be opened across the final fairway before it opens into the marsh and planted in places with low growing emergent wetland vegetation and in manner consistent with golf course use. This would provide habitat for SFGS prey items and FTDF. This will not increase mosquito populations at Sharp Park. Fencing and signage would deter golfers from retrieving golf balls from the creek and surrounding vegetation although this activity would not completely end.

EXHIBIT D

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

2011-12 California Red-legged Frog
Sharp Park Egg Mass Survey
Summary 1/27/12-3/8/12

Date Egg Mass First Observed	Egg Mass Number	Fate:
1/30/12	1	
1/27/12	2	
1/30/12	3	
1/27/12	4	
1/30/12	5	
1/27/12	6	
1/30/12	7	Notes say stranded
1/27/12	8	
1/30/12	9	
1/27/12	10	
1/30/12	11	
1/27/12	12	
1/30/12	13	
1/27/12	14	
1/30/12	15	
1/27/12	16	
1/30/12	17	
1/27/12	18	
1/30/12	19	
1/27/12	20	
1/30/12	21	
1/27/12	22	Discovered stranded on 2/8/12
1/30/12	23	Includes stranded egg masses Vredenburg lab observed
1/30/12	25	Includes stranded egg masses Vredenburg lab observed
1/31/12	26	
1/30/12	27	Includes stranded egg masses Vredenburg lab observed
1/31/12	28	
1/30/12	29	Includes stranded egg masses Vredenburg lab observed
1/31/12	30	fragmented
1/30/12	31	Includes stranded egg masses Vredenburg lab observed
1/31/12	32	
1/30/12	33	Includes stranded egg masses Vredenburg lab observed
1/31/12	34	fragmented
1/30/12	35	Includes stranded egg masses Vredenburg lab observed
1/31/12	36	
1/30/12	37	Includes stranded egg masses Vredenburg lab observed
1/31/12	38	

Date Egg Mass First Observed	Egg Mass Number	Fate:
1/30/12	39	Includes stranded egg masses Vredenburg lab observed
1/31/12	40	
1/30/12	41	Includes stranded egg masses Vredenburg lab observed
1/31/12	42	In saturated mud at waters edge with shallow margin
1/30/12	43	Includes stranded egg masses Vredenburg lab observed
1/31/12	44	In saturated mud at waters edge with shallow margin
2/14/12	45	
1/31/12	46	In saturated mud at waters edge with shallow margin
2/14/12	47	
1/31/12	48	In saturated mud at waters edge with shallow margin
2/14/12	49	
1/31/12	50	In saturated mud at waters edge with shallow margin
2/14/12	51	
1/31/12	52	In saturated mud at waters edge with shallow margin
2/14/12	53	
1/31/12	54	In saturated mud at waters edge with shallow margin
2/14/12	55	
1/31/12	56	In saturated mud at waters edge with shallow margin
2/14/12	57	
1/31/12	58	In saturated mud at waters edge with shallow margin
2/14/12	59	
1/31/12	60	In saturated mud at waters edge with shallow margin
1/31/12	62	In saturated mud at waters edge with shallow margin
2/14/12	63	
1/31/12	64	fragmented, scattered
2/14/12	65	eggs on bottom, broken
1/31/12	66	In saturated mud at waters edge with shallow margin
2/14/12	67	broken, on bottom
1/31/12	68	In saturated mud at waters edge with shallow margin
2/14/12	69	separated into parts
1/31/12	70	
2/14/12	71	
1/31/12	72	
2/14/12	73	
1/31/12	74	
2/14/12	75	
1/31/12	76	
2/14/12	77	
1/31/12	78	
2/14/12	79	

Date Egg Mass First Observed	Egg Mass Number	Fate:
1/31/12	80	In saturated mud at waters edge with shallow margin
2/14/12	81	Damaged, covered in algae on 3/7/12
1/31/12	82	In saturated mud at waters edge with shallow margin
2/14/12	83	
1/31/12	84	In saturated mud at waters edge with shallow margin
2/14/12	85	
1/31/12	86	13 egg masses, fragmented, at least six in mud
2/14/12	87	
2/14/12	89	
2/8/12	90	
2/14/12	91	
2/8/12	92	
2/14/12	93	
2/8/12	94	
2/14/12	95	broken apart
2/8/12	96	
2/14/12	97	embryos decaying, but not yet at hatching stage
2/8/12	98	stranded
2/14/12	99	
2/8/12	100	
2/14/12	101	
2/8/12	102	
2/27/12	103	
2/27/12	105	
2/8/12	106	
2/8/12	108	
2/8/12	110	
2/8/12	112	
2/8/12	114	
2/8/12	116	
2/8/12	118	fragmented, no dogs on golf side
2/8/12	120	fragmented, no dogs on golf side
2/8/12	122	fragmented, no dogs on golf side
2/22/12	150	
2/22/12	152	
2/22/12	154	
2/22/12	156	
2/22/12 & 3/1/2012	158	Two egg masses recorded as this number.
2/22/12 & 3/1/2012	160	Two egg masses recorded as this number.
2/22/12 & 3/1/2012	162	Two egg masses recorded as this number.

Date Egg Mass First Observed	Egg Mass Number	Fate:
2/22/12 & 3/1/2012	164	Two egg masses recorded as this number.
3/1/12	166	
3/1/12	168	
3/1/12	170	
3/1/12	172	
3/8/12	174	egg mass fragments noted at this location on this date.
3/8/12	176	
3/8/12	178	
3/7/12	201	
3/7/12	203	
3/7/12	205	
3/7/12	207	
3/7/12	209	
3/7/12	211	
3/7/12	213	
Total Egg Masses Observed:	**148**	
Total Egg Masses Stranded, Desiccated, Fragmented, or Otherwise Taken:	**47**	
% of Total Taken:	**31.8%**	

Notes:

- Summary chart prepared by the Wild Equity Institute.
- Summary is based on attached RPD data sheets. RPD has provided data only through March 7, 2012. RPD consultants may have evidence of additional egg masses and/or stranded egg masses.
- According to RPD, skipped egg mass numbers were not used during surveys. Typically numbers were skipped if observed could not recall the last number used from previous survey. To avoid double-counting, observer would skip-ahead a large number on the next data sheet.
- Egg masses with no fate information have an unknown fate. They are presumed "not taken" by RPD for the purposes of this summary.

Jon Campo/RPD/SFGOV
01/21/2011 09:00 AM

To David_Kelly@fws.gov
cc Lisa Wayne/RPD/SFGOV@SFGOV
Subject Re: CRLF eggmasses Reference Number 81420-2011-TA-093Notes Link

Hi Dave,

I have some good news in regards to the CRLF's at Sharp Park golf course. The egg masses we have moved appear to be healthy as they approach gosner stage 15-21. Also, we seem to be having a banner year for breeding. I have been documenting the CRLF eggmasses at Sharp Park for over 8 years and this year I have recorded more than 3 times the eggmasses than any other year.

Unfortunately, the challange is that they are also breeding at a very high rate in unsustainable habitat. Yesterday I found another 24 eggmasses in the shallow swale on the east edge of Laguna Salada. Again, without intervention they will become stranded and descicate. I am assuming the USFWS is also supportive of moving these eggmasses. If have the your authorization, I can move the eggmasses tomorrow to a more sustainable habitat. Please feel free to call me to discuss this further.

Jon Campo
Natural Areas Program
SF Recreation & Park Department
811 Stanyan St.
San Francisco, CA 94117
Ph# 415.831.6332
Cell# 650.355.0247
Fax# 415.661.1979

-----David_Kelly@fws.gov wrote: -----

To: Jon.Campo@sfgov.org
From: David_Kelly@fws.gov
Date: 01/18/2011 06:35AM
Cc: Lisa.Wayne@sfgov.org, Chris_Nagano@fws.gov, Josh_Hull@fws.gov
Subject: Re: CRLF eggmasses Reference Number 81420-2011-TA-093

Jon Campo, thank you for the update.

David Lee Kelly
Biologist, Recovery Branch
US Fish and Wildlife Service
2800 Cottage Way, W-2605
Sacramento, CA 95825
Ph. (916) 414-6492

EXHIBIT E

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

WILD EQUITY INSTITUTE, a non-profit corporation, *et al.* Plaintiffs, v. CITY AND COUNTY OF SAN FRANCISCO, *et al.*, Defendants.	)	Case No.: 3:11-CV-00958 SI **DECLARATION OF VANCE VREDENBURG, PH.D.**

I, Dr. Vance Vredenburg, declare as follows:

1. I am submitting this declaration in support of plaintiff's motion for preliminary injunction. For the past decade I have worked as a post-doctoral researcher and professor studying the ecology of amphibians, with a particular emphasis on the causes of amphibian declines. I received my B.A. in Biological Sciences from the University of California Santa Barbara in 1992, and my Ph.D. in Integrative Biology from the University of California Berkeley in 2002. I am currently an Assistant Professor at San Francisco State University, and a Research Associate at the California Academy of Sciences and the Museum of Vertebrate Zoology at UC Berkeley. More detailed information about my background can be found in my *curriculum vitae*, which is attached as Exhibit A.

2. My research focuses on the causes of amphibian declines. For example, I conducted several whole-lake studies in the Sierra Nevada Mountains that conclusively demonstrated amphibian population declines when non-native fish were stocked in mountain lakes. This groundbreaking study was published in 2004 in the *Proceedings of the National Academy of Sciences*, arguably the world's most prestigious academic journal. I have since published over 30 peer-reviewed articles including five more articles in the *Proceedings of the National*

Academy of Sciences and several other prestigious scientific journals, and eight book chapters on amphibian ecology.

3. Currently I am collaborating with colleagues from UC Berkeley, UC Santa Barbara, and the University of Idaho on a National Science Foundation-funded study that seeks to understand how some populations of frogs survive disease epidemics. A newly discovered fungal pathogen (the chytrid fungus, *Batrachochytrium dendrobatidis*) has caused hundreds of recent amphibian extinctions and represents the worse case of a single pathogen driving vertebrates to extinction in recorded history. Because this is so unusual in evolutionary history, my research on this issue has garnered substantial media attention, including feature articles on my field research in the Sierra Nevada in the *New York Times*, *National Geographic Magazine*, and documentary videos on Animal Planet (with Jeff Corwin), the National Science Foundation's *Science Nation* show and coverage of my studies on the California red-legged frog at Sharp Park on KQED's Quest, a weekly television show on the Bay Area's science and environment.

4. Living amphibians (Class Amphibia, Subclass Lissamphibia) include frogs (Order Anura), salamanders (Order Caudata), and caecilians (Order Gymnophiona). Of the three groups, frogs and toads exhibit the most varied reproductive modes and habitat associations and comprise the majority of recognized species (>6000 species). Salamanders and caecilians, also diverse, have fewer species and are more restricted but still have a widespread distribution (614 species and 188 species, respectively). Most of the world's amphibian diversity occurs in the tropics, especially in Central and South America, but other amphibian biodiversity hotspots include sub-Saharan Africa, Madagascar, Sri Lanka, Southeast Asia and Australia.

5. Amphibians are represented in diverse aquatic and terrestrial ecosystems and frequently are important components of communities and food webs. In some parts of the world they are the dominant predator, both in terms of numbers and total mass. They are diverse in behavior. Most salamanders have the structure of a generalized tetrapod with four legs, a relatively short

trunk, and a tail, but some are extremely elongated with very small limbs or only forelimbs, and some reach very large size -- in excess of 1.5 meters. Caecilians, restricted mainly to the tropics, are limbless and their eyes are covered by skin. They have larger numbers of trunk vertebrae and are very elongated, but they either lack or have an exceedingly short tail. Frogs have a characteristic form consisting of a large head, a very short trunk, and four legs, the hind limbs containing four major segments, being elongated associated with jumping and /or swimming, and being suspended from elongated and specialized pelvic girdles. However, despite the constraints of body form frogs are diverse in morphology, coloration and behavior.

6. Adult amphibians are effective predators and both salamanders and frogs have tongues specialized for rapid, long distance prey capture. Caecilians generally feed on subterranean prey such as earthworms. The amphibians are long-term survivors (existing on earth for more than 350 million years) that endured four previous mass extinctions (e.g., 95 percent of all living species were lost in the Permian-Triassic extinction). Through these extinctions, all three orders of amphibians escaped extinction, and even most families and genera survived. This was not the case for most other groups of organisms (e.g. dinosaurs, etc). Yet today the amphibians, presently including more than 6,800 species, are the most threatened group of vertebrates on Earth with over 40 percent of species in decline and over 30 percent threatened with extinction.

The geographic extent of the declines is worldwide. The areas most affected are located in Central and South America, the Caribbean, the wet tropics of eastern Australia (Figure 2), and western North America (Stuart et al. 2004). Less is known about the status of species in Africa and Asia due to a lack of long term studies. The first reports of massive collapse of amphibian faunas came from montane areas in Central America and Australia. The loss of more than 50% of the species in a large tropical montane fauna (Monteverde Cloud Forest Reserve) in Costa Rica in the course of a single year (1987) was a profound shock, and included the first prominent extinction (the Golden Toad, *Bufo periglenes*). Collapse of amphibian fauna in montane and lower montane Central America and South America is on-going. Several species of frogs declined dramatically, some to apparent extinction, in eastern Queensland, Australia, starting at about the same time (1980's).

7. Concern has been expressed over declines of frogs in California for many years, and in the 1980's and early 1990's the phenomenon accelerated. Now there have been reports of mainly geographically limited declines from many parts of the world. California, along with Central America and Australia, has been a focal area for the study of amphibian population declines, because of the severe declines of many of its species. The region is recognized as one of the world's biodiversity hotspots (the "California Floristic Province") and contains a heterogeneous landscape that sustains a wide variety of ecosystems, such as Sonoran deserts, marshes and wetlands, oak woodlands, high-elevation alpine systems, temperate rain forests, and many others. The amphibian fauna is diverse and includes 67 recognized native species, including 41 species of salamanders from five families and nine genera, and 26 species of frogs and toads from five families and six genera (plus two introduced species). Amphibians in California can be found in nearly all habitat types ranging from near Mount Whitney (at 3,657 m, the highest peak in the contiguous United States) to Death Valley (85 m below sea level). Despite the fact that California contains some of the largest contiguous protected habitats in the continental United States, nearly one-quarter of amphibians in California are threatened. Many potential causes for the widespread declines of amphibians have been proposed. In general these can be grouped into two major categories: 1) factors general to the overall biodiversity crisis, including habitat destruction, alteration and fragmentation, introduced species and over-exploitation, and 2) factors associated with amphibians that might account for declines in relatively undisturbed habitats. The first category includes relatively well understood and reversible direct ecological phenomena, whereas the second includes complex and elusive mechanisms, such as climate change, increased ultraviolet (UV-B) radiation, chemical

contaminants, infectious diseases, and the causes of deformities (or malformations). Habitat alteration and outright destruction are the single most important cause of declines in California and worldwide. The underlying mechanisms behind all of the factors stated above are sometimes complex and may be working synergistically with more evident factors, such as habitat destruction and introduced species, to exacerbate declines.

In California, amphibian declines are associated with many of the various hypotheses. Habitat destruction, alteration, and fragmentation have affected a large number of species including the California red-legged frog (CRLF), the Foothill Yellow-legged Frog, the Arroyo Toad, and the California Tiger Salamander, to name a few. Some amphibians began suffering declines long ago. In the 19th century, the California Gold Rush brought waves of new settlers who quickly over-exploited some frog species for food, including the CRFL. They also altered the environment in ways that have had much more substantial effects on amphibians. Cities were built, rivers dammed and diverted, forests were cleared, and the waterways of Great Central Valley were completely altered for agriculture and to provide water for cities and industrial growth. The effect on California's ecosystems has been profound. As elsewhere, habitat conservation has become a central theme in efforts to preserve the region's biodiversity.

8. Throughout my career I have retained a particular interest in the California red-legged frog, *Rana draytonii*. This frog ranges in size from 1.5 to 5 inches in length, making it the largest native frog in the Western United States. Adult females are significantly larger than males, with an average length of 138 mm versus 116 mm for adult males. The hind legs and lower abdomen of adult frogs are often characterized by a reddish or salmon pink color, and the back is brown, gray, olive, or reddish brown, marked with small black flecks and larger irregular dark blotches. Dorsal spots often have light centers, and in some individuals form a network of black lines. Dorsolateral folds, raised fleshy stripes that run parallel to the length of the frog, are prominent in this species of frog. Tadpoles range in length from 14 to 80 mm, and are a dark brown or

olive, marked with darker spots. *R. draytonii* breeds when the rains begin in earnest, usually in November and , an breeding may continue through April, depending on local conditions. Egg masses consist of between 300 and 5,000 eggs. Egg masses are nearly always attached to submerged vegetation that has some standing plant matter above water. Eggs hatch after 6 to 14 days depending on water temperature. Larvae typically metamorphose in 3.5 to 7 months, usually between July and September, but some overwinter and transform after more than 12 months in the larval stage. Males may attain sexual maturity at 2 years, females at 3 years, and adult frogs may live 8 to 10 years. Like tadpoles of many frog species, larvae are thought to be algal grazers, and the adult diet consists mostly of invertebrates. Pacific Tree Fogs (*Pseudacris regilla*) and California mice (*Peromyscus californicus*) are occasionally consumed by adult frogs but the importance of them in the diet is unknown. Juvenile frogs may be active both nocturnally and diurnally, whereas adult frogs are primarily active nocturnally. The primary predators on *R. draytonii* include garter snakes (*Thamnophis spp.*), raccoons (*Procyon lotor*), and great blue herons (*Ardea herodias*). Less frequently, red-legged frogs are eaten by American bitterns (*Botaurus lentiginosus*), black-crowned night herons (*Nycticorax nycticorax*), and rarely by red-shouldered hawks (*Buteo lineatus*). Introduced species such as the bullfrog (*Rana catesbeiana*) and non-native fish also prey on the frog.

9. The California red-legged frog is often referred to as "Twain's frog" because the Mark Twain included them in his colorful stories of California's Gold Rush days. The species faces several threats, and there is a high probability that the species will one day go extinct if these threats are not addressed. The species is already gone from 70% of its historic range, and has suffered a 90% population decline. Destruction and adverse modification of terrestrial and aquatic habitat is the primary reason for these declines, along with disease, pollutions in the form of pesticides and fertilizers, exploitation of the species for food, and predation from nonnative, invasive species.

10. I have often shared my interest in the California red-legged frog with my graduate students and research assistants. Recently one of my master's graduate students completed her degree in a study on the California red-legged frog, including the California red-legged frog populations at Sharp Park, to determine precisely what comprises the frog's diet. We analyzed stable isotopes of carbon and nitrogen to trace energy flow through food webs. The basis of this technique is simply that carbon's isotopic signatures in aquatic and terrestrial plants are consistently different from each other (aquatic plants contain consistently more heavy isotopes than terrestrial plants). Because the isotopic signature of carbon does not vary once it is in the food chain (as you move up the food chain from plants to higher consumers), you can use it to trace where energy in food webs was first captured by plants. You can trace energy flow through food chains by comparing isotopic signatures in an organisms' tissues. We used this technique with California red-legged frogs and showed that the carbon in frog tissues could be traced back to terrestrial, and not aquatic sources. This ground-breaking study discovered that over 99% of the frog's diet is composed of terrestrial insects—*indicating that the frog's upland and terrestrial habitats are much more important to the species' long-term survival than previously imagined.*

11. My PhD training at UC Berkeley in the Museum of Vertebrate Zoology has provided me a deep understanding of amphibian morphology, phylogenetics, evolution and taxonomy. In 2007, I published a detailed peer-reviewed paper in the *Journal of Zoology* on California's mountain yellow-legged frogs showing that there are two distinct species, while previously only one was recognized. I used morphology, frog vocalizations and molecular data to distinguish the two species. This work built on previous molecular and phylogenetic work I conducted on the relationship between western North American frog lineages, including the California red-legged frog, and published in the journal *Molecular Phylogenetics and Evolution.* I have studied thousands of laboratory specimens including hundreds of the California red-legged frog at the

permanent collections at the California Academy of Sciences, the Museum of Vertebrate Zoology, and other biological science collections. These specimens have given me insight on the basic ecology, evolution and conservation of the species. As many others before me, I have been especially struck by how the species' population has been impacted over time. For example, museum records and specimens, perhaps more than any other line of evidence, illustrate the loss of populations because many specimens were collected in areas where the frog no longer exists today.

12. Because of my study of frogs in the field and in the laboratory, I am an expert in identifying frog species. I can identify all life phases of the California red-legged frog in particular.

13. I am also familiar with Sharp Park and its aquatic features that provide habitat for California red-legged frogs. As mentioned above, I have mentored a graduate student who has conducted field research at this site; I have visited the site to test the frogs for disease; and I regularly take my undergraduate and graduate students there on field trips to gain experience observing and identifying amphibians in the wild. I have also reviewed several reports about Sharp Park prepared by biological contractors for the City and County of San Francisco, and publications prepared by the U.S. Fish and Wildlife Service.

14. It is my professional opinion that Sharp Park is an extremely important area for the California red-legged frog. Sharp Park must have successful recovery actions implemented, or it will one day lose its CRLF population, and potentially jeopardize populations at nearby properties as well. Because Sharp Park is relatively free from American bullfrogs (*Rana catesbeiana*, also called *Lithobates catesbeiana* in the scientific literature)—a non-native predator and competitor of the California red-legged frog—and relatively free from disease, it is one of the last best restoration opportunities to help recover the species along the Coast. Moreover, Sharp Park is adjacent to several protected lands with California red-legged frog

populations of their own, and therefore it serves as a central location for populations of the species on adjacent PUC watershed lands and neighboring Mori Point National Park.

15. California red-legged frogs have been documented at Sharp Park for decades. Wade Fox, one of the first biologists to survey the area, noted that California red-legged frogs were found in the bellies of snake specimens he had collected from Sharp Park in the 1940s. The frog has persisted on the land since: although survey's in the 1980s did not find any California red-legged frogs on the property, surveys in the 1990's found significant evidence of the species, and several recent publications and reports produced by the City and County of San Francisco have confirmed the presence of the species on the property. I have personally observed the species at Sharp Park on numerous occasions. Sharp Park and the adjoining Mori Point are excellent teaching examples for the students in my courses at San Francisco State University, located not more than a 10 minute drive away. I use the contrast between land management in Sharp Park vs. Mori Point as an example how the effects of human development and ongoing activities on threatened amphibians can be reversed. At Mori Point, the National Park Service has restored several breeding ponds and the California red-legged frog population has responded very positively whereas at Sharp Park, human activities have obvious negative effects on the threatened frog. It is not hard to see the difference when you are standing right there at the border between the two properties. It is remarkable that you can park your car on Fairway Drive, walk 15 paces and view California red-legged frogs in the creek below. In the rainy months of the year the frogs lay hundreds of egg masses that are easily visible from shore. Even during the day adults can be seen at these sites and this is not always the case for California red-legged frogs. In many other areas where they still occur, you usually have to visit sites at night to see adult frogs. I believe they are visible at Sharp Park and especially Mori Point because there are few introduced bullfrogs and the habitat, especially the restored areas, is prime habitat for the species that can support robust populations. This has been the case dating back to the 1940s. At Sharp

Park and Mori Point all stages of California red-legged frog are visible, eggs, tadpoles, juveniles and adults. This is not only great for educational purposes, but also signals that the habitats can support robust populations. If it can be fully restored, this habitat is some of the best I've seen for the species. Unfortunately, it is well documented that Sharp Park Golf Course has been killing California red-legged frogs through operations and management of a pump house for many years. San Francisco's Conceptual Restoration Alternatives Report explains that the take of the CRLF, documented as early as 1992, is ongoing at Sharp Park.

16. After 2008, the City released a Final Draft Endangered Species Compliance Plan for Sharp Park. I have reviewed this plan, and I am also familiar with the City's effort to move egg masses in the Park. Even with these efforts, it is my professional opinion that there is a high degree of scientific certainty that take of California red-legged frog egg masses through desiccation will continue to occur in Sharp Park. Moreover, based on records of golf course management and operations I have reviewed, my own observations of Sharp Park, and my professional expertise, I believe that the City is not, and cannot, actually implement the Compliance Plan – which contemplates managing water levels to avoid desiccation of CRLF egg masses – making it virtually certain that California red-legged frogs will be taken unless the relief requested by plaintiffs here is granted.

17. The California red-legged frog requires aquatic habitats to breed successfully. If the aquatic features are not of sufficient depth and duration, the eggs may not survive.

18. At Sharp Park, the opportunity for frogs to complete this cycle is being undermined by the management of the golf course, whereby two pumps drain Sharp Park wetlands (upon which the golf course was built) during flooding that occurs as a natural function of winter rains. This unnatural draining of what would otherwise be a naturally functioning wetlands complex is causing the take of many California red-legged frog egg masses.

19. The Compliance Plan does not prevent egg mass strandings. This past winter, for example, the golf course operated the pumps with the Compliance Plan in place. Yet beginning in January, 2011, Recreation and Park Department staff had to move over one hundred egg masses that they concluded would not survive in the location where they were laid. It is my professional opinion that these egg masses would not have been stranded if the pumps were not draining Sharp Park's wetlands.

20. These frogs have evolved over millions of years towards a strategy of egg-laying that balances water depth, water temperature, predator avoidance, and pond desiccation. The most successful frogs maximize the contrasting pressures of pond desiccation and water temperature. For example female frogs that choose to lay their eggs in deeper water are minimizing risk to desiccation but also exposing eggs to cooler water temperatures, which translate into slower growth and development. Deeper, more permanent water also harbors a more diverse food web which is more likely to contain aquatic egg and tadpole predators. Females that lay eggs in the shallowest water on the margin of ponds are maximizing growth potential (warmer temperatures) and minimizing exposure to aquatic predators, but are also exposing egg masses to higher probability of desiccation. If the rains continue and the pond does not dry too quickly the strategy pays off and eggs in shallow waster hatch faster, tadpoles grow faster and outcompete other eggs and tadpoles from other frogs laid in deeper water.

21. Ponds fill and dry seasonally and although it can seem rather dramatic from wet to dry years, the change over the course of days is not rapid because water levels decrease mostly due to evaporation from heat and use by terrestrial and emergent plants during photosynthesis. The pumping of water to dry up fairways at Sharp Park, however, is well outside the natural rate of pond drying and the frogs are not adapted to this type of rapid change in pond depth. Therefore, because these frogs have evolved a breeding strategy over millions of years that is cued in on natural rates of desiccation, the pumping of the ponds by the golf course will inevitable lead to a

much higher mortality rate for the eggs that the females lay at the margins of the pond, in the shallowest water. This elevated mortality is completely man made and can be reduced if pumping is not allowed. Although RPD has for years been moving egg masses it determines are at some risk, egg mass movement is not part of the Compliance Plan.

22. Moving egg masses does not ensure their survival. Frog egg masses are encased in a protective jelly coating. California red-legged frogs females attach the egg masses to emergent vegetation usually suspended near the surface of the water to balance impacts from solar radiation from above while avoiding predators from below. Movement of egg masses can damage the embryos in a number of ways. For example, jarring movements can damage eggs directly and even when the embryos are at later stages and are less sensitive to movement, egg survival can plummet if egg masses are moved. Amphibian eggs are sensitive to changes in gas exchange rates across the jelly boundary and the egg membrane. If eggs masses are taken out of the water for more than a few minutes and exposed to air, then oxygen and carbon dioxide exchange rates can decrease rapidly because the jelly does not function well as a gas exchange membrane when exposed to air. The jelly can quickly begin to dry along the outer edge, this edge, like a thicker skin, impedes natural gas exchange rates. Additionally, once egg masses are placed in a new location, it is very difficult, to suspend them in the water column off the bottom yet also near the surface. If eggs become dislodged they can float away and end up in less than perfect microhabitats, for example they can be washed ashore by wind or even small wave action. Therefore, it is my professional opinion that at least some eggs and even entire egg masses that are relocated by the City in 2011 did not survive the relocation effort.

23. I am also concerned by the artificially high concentration of egg masses placed in Horse Stable Pond. Horse Stable Pond is the aquatic feature closest to Sharp Park's pump house, and therefore it is the area most impacted by the suction of the pumps. When a very large portion of Sharp Park's California red-legged frogs are placed in Horse Stable Pond, nearly the

entire population is at greater risk of entrainment, impingement, or desiccation. If the eggs did in fact survive, then the pond may be at risk of exceeding its ecological carrying capacity. Many species, and in particular amphibians, have been shown to display density dependent growth. The idea is a simple one: while each species or population has the potential to grow exponentially this does not happen because of interspecific and intraspecific factors. At some point a population's size is either limited by resources (food, space, breeding sites, etc) or other individuals (competitors, predators, parasites, etc.). If thousands of eggs are being artificially added to a pond that wouldn't naturally have that high a number, then this could have very negative effects on the population. It could make food acquisition more difficult, it could make the population a target to predators that may be attracted to the large number or prey items, or abiotic conditions in the environment (oxygen concentration in the water may be lowered, or excreted compounds could overwhelm natural decomposers leading to toxic levels of nitrogenous waste). Of course, not all egg masses can be moved. On February 21, 2011 a partially submerged egg mass was found on the edge of Horse Stable Pond. The water level of Horse Stable Pond, as measured by the gauge at the pump house, at 2.9 meters (relative scale), but massive amounts of water were being pumped through the system. On February 23, 2011, I visited this egg mass, and discovered that the water levels were at 2.6 meters (relative scale): and the egg mass was completely exposed to the air due to the ongoing pumping. I identified the egg mass as a California red-legged frog egg mass, and concluded that it was not likely to survive. A photograph of the egg mass I viewed on that date is attached as Exhibit B. On March 1, 2011 a follow-up visit to the egg mass found that it was completely desiccated and partially frozen. All of these egg mass strandings occurred despite the Compliance Plan, which cannot reduce egg mass strandings to zero or anything close to it. Because, even with the pumps on full throttle, it can take days for the water to draw down after significant rainfall, large numbers of California red-legged frog egg masses are often laid in areas that become exposed to the air due to the pumping operations, even though the Compliance Plan is functioning as designed. Finally, because the Compliance Plan provides for so much pumping the water that remains to secure egg and tadpole development is reduced. If a large rain event is followed by an extended drought, the buffer of rainwater provided by the initial storm event will have been eliminated, and the frog eggs and tadpoles also are at serious risk of desiccation and stranding. All of this is occurring despite implementation of the Compliance Plan.

24. It is my professional opinion that in order to reduce take of California red-legged frogs in the future, the relief requested by Plaintiffs in this motion must be granted. Specifically, San Francisco must be ordered to cease all pumping at Sharp Park. The best way to safeguard the frog is to reduce unnatural variation in pond levels which is known to increase egg mortality. These frogs evolved with naturally fluctuating water levels in ponds, the best thing we can do to insure their survival and recovery is to let the water levels at Sharp Park vary naturally.

25. Based on the stable isotope food web research done by my lab, as well as my understanding of CRLF biology and habitat requirements, it is also my professional opinion that mowing Sharp Park lands, particularly lands along the edge of aquatic features, is taking California red-legged frogs by significantly modifying the frog's habitats to the point where individual animals are killed or injured by impeding significant behavior functions, particularly feeding. As noted, our recent research demonstrated that for postmetamorphic individuals, the CRLF's diet consists mostly of terrestrial insects, which are produced and in many cases also obtained in terrestrial habitat. Mowing in these areas, therefore, is interfering with these essential life functions. Moreover, it is also my professional opinion that mowing in these areas is reasonably certain to take SFGS in Sharp Park, since the CRLF is a significant prey species for the SFGS. The City's Compliance Plan, which provides an inadequate monitoring protocol prior to certain mowing, would not avoid the significant risks of take even were it being implemented,

particularly given the massive scale of mowing in the vicinity of water features and the large scale habitat modification mowing causes.

26. This is why the plaintiffs requested relief is essential to protect the California red-legged frog and San Francisco gartersnake. The plaintiffs request to cease all mowing within roughly 200 meters of the delineated wetland boundary area will provide a large swath of buffer and edge habitat that will be free from mowing and wheels that could compress and take endangered frogs and snakes. Although I certainly believe a much larger buffer area would provide even further protection for the species, this will significantly diminish the risks as compared to current golf course operations.

27. If this relief is provided, it is my professional opinion that the probability of ongoing take as a result of golf course operations, while not eliminated, will be substantially reduced.

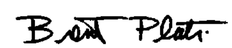
Pursuant to 28 U.S.C. § 1746, I hereby declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Executed on this _____ day of September, 2011. ________________________

Vance Vredenburg

I, Brent Plater, hereby attest that Vance Vredenburg's concurrence in the e-filing of this document has been obtained.

Executed on: September 23, 2011



Brent Plater

EXHIBIT A

Vance Thomas Vredenburg
Assistant Professor
Department of Biology
San Francisco State University

Research Area:
Amphibian ecology, evolution and conservation, disease ecology, food webs

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Web pages: http://biologysfsuedu/people/vance-vredenburg
http://web.me.com/vancevredenburg/Vances site/Home.html

Education
- PhD, University of California, Berkeley (Integrative Biology), Dec 2002 "The effects of introduced trout and ultraviolet radiation on anurans in the Sierra Nevada" Co-advisors: Dr Mary E Power and Dr David B Wake
- BA, University of California, Santa Barbara (Biology), 1992

Professional background
- 2007- to present *Assistant Professor* Department of Biology, San Francisco State University
- 2007- to present *Research Associate* Museum of Vertebrate Zoology, University of California Berkeley
- 2008- to present *Research Associate* California Academy of Sciences, San Francisco, California, USA
- 2003-2007 *Postdoctoral Scholar* Department of Integrative Biology and Museum of Vertebrate Zoology, University of California Berkeley
- 1998-to present *Co-Founder and Associate Director* of AmphibiaWeb.org an online bioinformatics project promoting science and conservation of the world's amphibians

Research Grants (currently funded)

2011-2013 National Science Foundation, (DEB) *The effects of climate change and fungal disease on Andean montane frogs*, V Vredenburg (PI)

2011-2012 The Rufford Small Grants Foundation, Grants for Nature Conservation, *Conservation of montane forest anurans in Southeastern Peru*, V Vredenburg (co-PI)

2007-2012 National Science Foundation, (DEB) *After the crash: factors allowing host persistence following outbreaks of a highly virulent disease*, C Briggs (PI), C Moritz (co-PI), R Knapp (co-PI), V Vredenburg (co-PI)

2008-2010 CalFed-Bay Delta Program *Climate change impacts to San Francisco Bay-Delta wetlands: Links to pelagic food webs and predictive responses based on landscape modeling* T Parker (PI), J Callaway (co-PI), M Kelli (co-PI), V Vredenburg (co-PI)

Publications (*SFSU Master's student; #SFSU Undergraduate student)

In Review

1. Catenazzi, A, E Lehr, and VT Vredenburg *Thermal physiology fails to link climate warming to enigmatic amphibian declines in neotropical mountains* (PNAS)
2. Reeder*, NMM, AP Pessier, and VT Vredenburg *Pathogen resistance identifies reservoir species and its role in infectious disease outbreaks in amphibians* (PNAS)
3. Woodhams, DC, Rollins-Smith, LA, Reinert, LK, Lam, BA, Harris, RN, Briggs, CJ, Vredenburg, VT; Caprioli, RM Chaurand, P *Microbial biotherapy causes immunomodulation of brevinin-1Ma, a novel antifungal peptide from the skin of mountain yellow-legged frogs, Rana muscosa* (Peptides)
4. Woodhams, DC, Geiger, CC, Reinert, LK, Rollins-Smith, LA, Lam, BA, Harris, RN, Briggs, CJ, Vredenburg, VT; Voyles, J *Treatment of amphibians with chytrid fungus: learning from failed trials with itraconizole, antimicrobial peptides, bacteria, and heat therapy* (Diseases of Aquatic Organisms)
5. Bishop*, MR, RC Drewes, and VT Vredenburg *Stable isotope approach illustrates the importance of terrestrial prey to the California red-legged frog* (Ecology)

In Press

1. Vásquez Almazán, CR, and VT Vredenburg (*2011*) Discovery of the lethal amphibian fungal pathogen, *Batrachochytrium dendrobatidis*, in a direct-developing salamander in Guatemala *Herpetological Review*

Published

1. Swei, A, JJL Rowley, D Rödder, MLL Diesmos, AC Diesmos, CJ Briggs, R Brown, TT Cao, TL Cheng*, B Han, J Hero, DH Hoang, MD Kusrini, TTD Le, M Meegaskumbura, T Neang, SPhimmack, D Rao, NMM Reeder*, SD Schoville, N Sivongxay, N Srei, M Stöck, B Stuart, L Torres#, TAD Tran, TS Tunstall, D Vieites, and VT Vredenburg (2011) Is Chytridiomycosis an Emerging Infectious Disease in Asia? *PLoS ONE* 6(8): e23179 doi:101371/journalpone0023179
2. Cheng*, TL, S Rovito, DB Wake and VT Vredenburg Coincident mass extinction of neotropical amphibians with the emergence of the fungal pathogen *Batrachochytrium dendrobatidis* 2011 *Proceedings of the National Academy of Sciences*108(23):9502-9507
   a) Review of Cheng et al 2011: Lips KR 2011 Museum collections: Mining the past to manage the future *Proceedings of the National Academy of Sciences USA* 108(23):9323-9324
   b) Cheng, et al. 2011 won the *Best Student Paper Award* at the Ecological Society of America general meeting 2011
3. Schoville, SD, TS Tustall, VT Vredenburg, AR Backlin, DA Wood, RN Fisher 2011 Conservation of evolutionary lineages of the endangered mountain yellow-

legged frog, *Rana muscosa* (Amphibia: Ranidae), in southern California *Biological Conservation* 144:2031-2040

4. Reeder*, NMM, TL Cheng*, VT Vredenburg, and DC Blackburn 2011 Survey of the chytrid fungus *Batrachochytrium dendrobatidis* from montane and lowland frogs in eastern Nigeria *Herpetology Notes* 4:83-86
5. Catenazzi A, E Lehr, LO Rodriguez, and VT Vredenburg 2011 *Batrachochytrium dendrobatidis* and the collapse of anuran species richness and abundance in the upper Manu National Park, southeastern Peru *Conservation Biology* 25: 382-391
6. Catenazzi, A, VT Vredenburg, and E Lehr 2010 *Batrachochytrium dendrobatidis* in the live frog trade of Telmatobius (Anura: Ceratophryidae) in the Tropical Andes *Diseases of Aquatic Organisms 92:187-191*
7. Blackburn, DC, B J Evans, AP Pessier, VT Vredenburg 2010 An enigmatic mass mortality event in the only population of the Critically Endangered Cameroonian frog *Xenopus longipes* (Anura: Pipidae) *African Journal of Herpetology 59:1-12*
8. Vredenburg, VT, LM Chan, T Tunstall, and JM Romansic 2010 Does UV-B radiation affet embryos of three high-elevation amphibian species in California? *Copeia* 2010:502-512
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10. Vredenburg, VT, RA Knapp, T Tunstall, and CJ Briggs 2010 Dynamics of an emerging disease drive large-scale amphibian population extinctions *Proceedings of the National Academy of Sciences* 107:9689-9694
    Reviews and other significant citations of Vredenburg et al 2010:
    a) Blaustein, AR and PTJ Johnson 2010 When an infection turns lethal *Nature* 465:881-882
    b) Jeremy, A 2010 Epidemiology: It's not easy being green *Nature Reviews Microbiology 8:467*
    c) Kinney, V C, J L Heemeyer, A P Pessier, and M J Lannoo 2011 Seasonal pattern of *Batrachochytrium dendrobatidis* infection and mortality in *lithobates areolatus*: Affirmation of Vredenburg's "10,000 zoospore rule" *PLoS ONE* 6(3):e16708
11. Briggs, CJ, RA Knapp, and VT Vredenburg 2010 Enzootic and Epizootic Dynamics of the Chytrid Fungal Pathogen of Amphibians *Proceedings of the National Academy of Sciences* 107:9695-9700
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14. Frías-Álvarez P, V T Vredenburg, M Familiar-Lopez, JE Longcore , E Gonzalez-Bernal, G Santos-Berrera, L Zambrano, and G Parra-Olea 2008 Chytridiomycosis survey in wild and captive Mexican amphibians *EcoHealth* 5: 18-26

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16. Woodhams, DC, VT Vredenburg, M Simon, D Billheimer, B Shakhtour, Y Shyr, CJ Briggs, LA Rollins-Smith, RN Harris 2007 Symbiotic bacteria contribute to innate immune defenses of the threatened mountain yellow-legged frog, *Rana muscosa Biological Conservation* 138: 390-398
17. Finlay, JC and VT Vredenburg 2007 Introduced trout sever trophic connections in watersheds: consequences for a declining amphibian *Ecology* 88(9): 2187-2198
18. Vredenburg, VT, R Bingham, R Knapp, JAT Morgan, C Moritz, and D Wake 2007 Concordant molecular and phenotypic data delineate new taxonomy and conservation priorities for the endangered mountain yellow-legged frog (Ranidae: *Rana muscosa*) *Journal of Zoology* 271(4): 361-374
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1. Catenazzi, A, E Lehr, LO Rodriguez, and VT Vredenburg Amphibian Disease in the Peruvian Andes 2011 *Smithsonian Institution Scholarly Press*
2. Vredenburg, VT, M Koo, K Whittaker, and DB Wake 2011 Global Declines of Amphibians *In Encyclopedia of Biodiversity* Elsevier Press
3. Cheng*, TL, S Rovito, DB Wake and VT Vredenburg (*In Press*) Museum specimens reveal spread of pathogen and collapse of amphibians in Central America *Froglog*
4. A Swei, JJL Rowley, D Rödder, MLL Diesmos, AC Diesmos, CJ Briggs, R Brown, TT Cao, TL Cheng*, B Han, J Hero, DH Hoang, MD Kusrini, TTD Le, M Meegaskumbura, T Neang, SPhimmack, D Rao, NMM Reeder*, SD Schoville, N Sivongxay, N Srei, M Stöck, B Stuart, L Torres*, TAD Tran, TS Tunstall, D Vieites, and VT Vredenburg (*In Press*) Prevalence and distribution of chytridiomycosis throughout Asia *FroLog* 98

Book Chapters and other publications

1. Vredenburg, V. T., C. J. Briggs, and R. N. Harris. 2011. Host-pathogen dynamics of amphibian chytridiomycosis: The role the skin microbiome in health and disease In *Fungal diseases: An emerging threat to human, animal and plant health*, edited by L. Olsen, E. R. Choffnes, D. A. Relman and L. Pray. Washington, D.C.: The National Academies Press IOM (Institute of Medicine). Pp. 342-355.
2. Vredenburg, VT, MS Koo, and DB Wake 2008 Declines of amphibians in California *In* Hoffman, M (Ed), *Threatened Amphibians of the World* Lynx Ediciones, Barcelona, Spain, pp 126
3. Vredenburg, VT, G Fellers, and C Davidson 2005 The mountain yellow-legged frog (*Rana muscosa*) *In* Lannoo, MJ (Ed), Status and Conservation of US Amphibians University of California Press, Berkeley, California, USA, pp 563-566
4. Vredenburg*, VT, M McDonald, & T Sayre (2010) *Amphibians and Climate Change* Natural Selections 6(1):10-12

Teaching Experience at SFSU

Ecology (BIOL 482) 40-60 undergraduates
Ecology and Evolution Seminar (BIOL 862) 12-18 graduate students
Vertebrate Evolution and Natural History (BIOL 470) 20 undergraduates

Student Mentoring

Master's Students-Chair

Completed

1. Natalie Reeder; *Potential role of the pacific chorus frog in the spread of chytridiomycosis disease* (6-25-2010) [This thesis was San Francisco State University's nomination for the 2010 Western Association of Graduate Studies Distinguished Master's Thesis Award 2010]
2. Tina Cheng; Title: *The effects of chytridiomycosis disease on Central American salamanders* (please see publication #2, published in PNAS; winner Ecological Society of America *BEST STUDENT PAPER 2011*)
3. Meghan Bishop*; Title: *Habitat use and conservation of red-legged frogs in coastal California* (*Official Chair was Dr R Drewes at the California Academy of Sciences)

In progress

1. Sam McNally; *Tracking the spread of Batrachochytrium dendrobatidis through amphibians in California's Sierra Nevada*
2. Stephanie Hyland; *Development of a rapid PCR Assay for* Janthinobacterium lividum, *a bacterium that occurs symbiotically on amphibian skin*
3. Raul Figeroa; *Was the fungal pathogen,* Batrachochytrium dendrobatidis, *spread throughout Asia by the amphibian food and pet trade?*
4. Celeste Dodge; *Effects of a fungal pathogen on the Yosemite Toad (*Bufo canorus*)?*
5. Danquing Shao; *Investigating the role of introduced American Bullfrogs in the spread chytridiomycosis disease in Chinese amphibians?*
6. Gabriela Rios-Sotelo; *Did the fungal pathogen* Batrachochytrium dendrobatidis *originate from Japan?*
7. *Angel Jacobo Pereira; The amphibian chytrid pathogen* Batrachochytrium dendrobatidis *in Guatemala*

Master's Students-Committee Member

Completed

1. Kim Vincent (Chair E Routman), *The effects of pesticides on tadpoles*
2. Anthony Chazar (Chair Dr R Sehgal), *Effects of deforestation on the prevalence and diversity of blood parasites in two African rainforest birds*
3. Maria Tonione (Chair E Routman), *Microsatellite variation in the hellbender,* Cryptobranchus alleganiensis
4. Jenny Carlson (Chair R Seghal), *Evolution of blood pathogens*
5. Hazel Thwin (Chair J Dumbaucher), *Ornithology of Myanmar*
6. Molly Dodge (Chair R Sehgal), Transmission of haemosporidian pathogens in resident and migrating birds
7. Holly Archer (Chair R Seghal), *Emerging infectious disease and blood parasite prevalence in countryside birds*

8. Stephen Micheletti (Chair E Routman), *Population structure of Side-blotched Lizards (*Uda stansburiana*): Displaying adaptive dorsal coloration*

In progress

1. Alexandra Vasquez Ochoa; El ensambleaje de anfibios en 13 localidades de la region Andina central oriental, Orinoquia y Amazonia de Colombia; Pontificia Universidad la Javeriana, Bogota, Colombia

PhD Students-Committee Member

In progress

1. Brooke Talley (Chair K Lips, Southern Illinois University), *Distribution of* Batrachochytrium dendrobatidis *in amphibians of Illinois*

Service

University Level

1. San Francisco State University Academic Senator (elected Fall 2011)
2. Curriculum Review and Approval Committee

Departmental Level

1. Undergraduate General Biology Major advisor

Graduate Student advising

1. Weekly lab meetings in Vredenburg Lab, students participate in reading and evaluating recent scientific publications, present updates on student and lab projects and report on animal status in the SFSU animal care facility
2. Weekly individual meetings with graduate students

New Course Development

1. Biol 470 Evolution and Natural History of Vertebrates - course includes lectures, weekly laboratories and field trips (This course uses preserved museum specimens maintained at SFSU by Vredenburg)

Committee work

1. CRAC -Curriculum Review and Approval Committee
2. Biology Undergraduate and Graduate Scholarship Committee (2009-2010)
3. CSU System-wide Student Research Competition (2009-2010)
4. Undergraduate Curriculum Committee (2008-2010)
5. Judge for the College of Science and Engineering Project Showcase (2009-2010)
6. Biology Chair Evaluation Committee (2011)

Synergistic Activities

1. Co-Founder and Associate Director: wwwAmphibiaWeb.org an online research and conservation resource for the world's amphibians This site has an average of 20,000+ successful queries per day by students, conservation scientists, and the general public
2. Faculty Sponsor at SFSU for 7 graduate students (see below) and 9 undergraduate students (4 undergraduates are underrepresented minority students receiving funding from NSF and NIH)
3. Provided training in the form of lectures, field trips and lab methodology *in Spanish* to students and faculty in Latin America (Training Course on Quantitative PCR Detection of Chytridiomycosis, Mexico City, Mexico, at

UNAM, for the Red de Análisis para los Anfibios Neotropicales Amenazados; and in Guatemala City, Guatemala for the Museo de Historia Natural, Univ de San Carlos de Guatemala; and to professors and students at Pontificia Universidad la Javeriana, Bogota, Colombia)

Public Outreach/Education/News coverage of the Vredenburg Lab

Television

1. Animal Planet: *The Vanishing Frog* with Jeff Corwin; 11-20-09
2. ABC-News; CNN; CBS Evening News (various appearances)

Radio

1. NPR-Science Friday-*Modern Extinctions* (KQED; 5-14-10)
2. WALO 1240 AM Radio Puerto Rico (6-22-10)- in Spanish

Movie Documentaries

1. NSF Science Nation (*Disappearing Frogs: Trying to save the world's amphibians*, by Miles O'Brien and Marsha Walton; 11-2-09)
2. NPR KQED QUEST (*Disappearing Frogs*; 5-15-08)

Print/News media

1. National Geographic Magazine (4-1-09); *The Vanishing* by Jenny Holland
2. New York Times (05-10-10); *Toiling against a deadly disease to save a threatened frog* by Erica Rex
3. Popular Science (in press); *Can skin microbes save our frogs?* By Susannah Locke
4. GEO Magazine (Germany; 07/01/10); *Amphibians in Crisis* by Markus Wolff
5. National Parks Magazine (2011)
6. Audubon Magazine (*in press*)
7. Deep-Sea News (volume5: 9-12-2011)

Biology Textbook featuring Vredenburg research

1. Campbell, NA, & Reece, J B (*In Press*) *Biology*, Benjamin Cummings, 8th edition pp650-651 (*This is the most commonly used Biology textbook in Introductory Biology Courses in the USA)*

Collaborators & Other Affiliations

1. Collaborators and Co-Editors J Taylor, C Moritz (UC Berkeley); R Knapp, C Briggs (UC Santa Barbara), E Rosenblum (U Idaho)
2. Graduate and Postdoctoral Advisors PhD co-advisors Mary Power and David Wake (UC Berkeley); postdoc advisor Cheryl Briggs (UC Santa Barbara)
3. Thesis Advisor and Postgraduate-Scholar Sponsor Master's students: *completed* (3) Natalie Reeder (6-25-10); Tina Cheng (6-25-11), Meghan Bishop (5-22-11) *current* (7) Celeste Dodge, Raul Figeroa*, Stephanie Hyland*, Danquing Shao, Gabriela-Rios-Sotelo*, Sam McNally, and Angel J. Pereira* (*underrepresented minority)

Reviewer

1. National Science Foundation (two Panels)
2. National Geographic (research grants)
3. Scientific Journals
   a) *Proceedings of the National Academy of Sciences*
   b) *Nature*

   c) *Public Library of Science Biology*
   d) *Public Library of Science Pathogens*
   e) *Journal of Animal Ecology*
   f) *Conservation Biology*
   g) *Herpetologica*
   h) *Journal of Herpetology*
   i) *Diseases of Aquatic Organisms*
   j) *The Herpetological Journal*

Invited presentations/lectures

1. Special Forums
   a) National Academy of Sciences/Institute of Medicine, Dec 2010 *Forum on Microbial threats: Fungal Diseases; Washington, DC*
2. *Departmental Seminars*
   a) 2011 Universidad de los Andes, Bogota, Colombia
   b) 2011 La Javeriana University, Bogota, Colombia
   c) 2011 California Academy of Sciences
   d) 2010 University of Nevada Reno, Dept of Biology
   e) 2009 University of San Francisco, Dept of Biology
   f) 2008 Department of Zoology; Southern Illinois University
   g) 2008 Department of Biology; Museo de Historia Natural, Guatemala City, Guatemala
   h) 2007 Department of Biology; University of Puerto Rico, PR USA
   i) 2005 Department of Ecology and Evolution; University of California Santa Cruz
   j) 2002 Department of Ecology and Evolutionary Biology; University of Connecticut
1. *Scientific Meetings*
   a) *2012 World Congress of Herpetology - symposium presentation*
   b) *2011 Ecological Society of America- symposium presentation*
   c) *2009, 2011, 2012 Integrative Research Challenges in Environmental Biology*; Amphibian declines and chytridiomycosis; Arizona State University, Tempe, Arizona
   d) *2007* Partners in Amphibian and Reptile Conservation; Amphibian declines and chytridiomycosis; Tempe, Arizona

Symposium Organizer

1. 2012 World Congress of Herpetology: Reversing the effects of introduced species on amphibians
2. 2007 Ecological Society of America: Disease emergence and amphibian decline: using ecology to understand patterns and promote restoration; San Jose, California
3. 2005 Declining Amphibian Population Task Force; Berkeley, California
4. 2000 Amphibian Conservation; 4th Asian Herpetological Conference; Chengdu, China

Provided qPCR Prep and Analysis Training

1. NSF Collaborative Network

a) The Research and Analysis Network for Neotropical Amphibians (Red de Análisis para los Anfibios Neotropicales Amenazados); Training Course on Quantitative PCR (Q-PCR) Detection of Chytridiomycosis; invited by Dr Gabriela Parra (Univ Nacional Autonoma de Mexico) Course co-funded by NSF and the IUCN Amphibian Specialist Group

2. Faculty - Pontificia Universidad la Javeriana, Bogota, Colombia
3. Postdocs - UC Berkeley; Gonzaga University; Smithsonian Institution
4. Graduate students - Universidad Nacional Autonoma de Mexico (UNAM), Mexico City, Mexico; Southern Illinois University; Museo de Historia Natural, Guatemala City, Guatemala; Pontificia Universidad la Javeriana, Bogota, Colombia

EXHIBIT B

EXHIBIT B, p. 1
Declaration of Vance Vredenburg
February 23, 2011, 11:01am
Southeastern Shore of Horse Stable Pond, Sharp Park Golf Course

EXHIBIT B, p. 2
Declaration of Vance Vredenburg
February 23, 2011, 11:01am
Southeastern Shore of Horse Stable Pond, Sharp Park Golf Course

EXHIBIT F

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

Kamman Hydrology & Engineering, Inc.
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Telephone: (415) 491-9600
Facsimile: (415) 680-1538
E-mail: Greg@KHE-Inc.com

August 3, 2012

Ryan Olah, Chief
Coastal Division Branch
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, CA 95825

Jane Hicks, Chief
Regulatory Division
U.S. Army Corps of Engineers
San Francisco District
1455 Market Street, 16th Floor
San Francisco, CA 94103

Subject: Technical Review Comments to Biological Assessment
Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project

Dear Mr. Olah and Ms. Hicks:

I have reviewed the subject Biological Assessment (BA) prepared by Recreation and Park Department, City and County of San Francisco, dated March 14, 2012. In addition, my firm and I have completed numerical storm modeling in an effort to evaluate the benefits and/or impacts associated with proposed project actions. The reason for this letter is two-fold. First, because my firm's work and study conclusions are cited within the BA, as well as having a unique knowledge of the site, I would like to clarify and elaborate on selected sections within the BA. Secondly, based on our analyses, it is my opinion that some of the key proposed actions in the BA intended to reduce flooding and improve California red-legged frog and San Francisco gartersnake habitat would fail at providing the desired benefits and may adversely affect these species. Specifically, my analyses indicate the following.

- Removing vegetation from the connector channel will increase the flow rate from Horse Stable Pond to Laguna Salada during the early parts of storm events, causing the water level in Laguna Salada to reach a maximum level sooner under BA conditions than currently exists.
- The maximum simulated water level attained in Laguna Salada under BA project conditions is about 0.2-feet higher than the existing condition simulated water level for a one inch storm event. This means that the extent of flooded area within Laguna Salada and near the golf course associated with a one inch rainfall

storm event will be larger under proposed BA project conditions than existing conditions.

- The maximum simulated 2- and 5- year storm water levels attained in Laguna Salada during the proposed BA project conditions reach the same elevation that water levels reach under existing conditions, just sooner. This means that the extent of flooded area associated with these storm events remains virtually the same between existing and BA project conditions.

- Simulation results indicate that removal of vegetation from the connector channel does not lead to faster drainage of water or reduced duration of inundation in Laguna Salada and the golf course area between existing and proposed BA project conditions. Therefore, the associated conversion of cover habitat to open water habitat for CRLF would not provide any reduction in the extent or duration of flooding in LS and the surrounding golf course.

My comments associated with specific sections of the BA and rationale for my conclusions are provided below after a paragraph summarizing my credentials.

I am a hydrologist with over twenty five years of technical and consulting experience in the fields of geology, hydrology, and hydrogeology. I have been providing professional hydrology services in California since 1991 and routinely manage projects in the areas of aquatic ecosystem restoration planning and design, surface- and groundwater hydrology, water supply, water quality assessments, water resources management, and geomorphology. Most of my work is located in the Coast Range watersheds of California, including the Northern and Southern San Francisco Bay Counties. My areas of expertise include: characterizing and modeling watershed-scale hydrologic and geomorphic processes; evaluating surface- and ground-water resources/quality and their interaction; assessing hydrologic, geomorphic, and water quality responses to land-use changes in watersheds and causes of stream channel instability; and designing and implementing field investigations characterizing surface and subsurface hydrologic and water quality conditions. I co-own and operate the hydrology and engineering consulting firm Kamman Hydrology & Engineering, Inc. in San Rafael, California (established in 1997). I earned a Master of Science in Geology, specializing in Sedimentology and Hydrogeology as well as an A.B. in Geology from Miami University, Oxford, Ohio. I am a Certified Hydrogeologist (CHg) and a registered Professional Geologist (PG).
I am also very familiar with Sharp Park. In 2009 my firm was retained by Tetra Tech of Portland, Oregon on behalf of the San Francisco Recreation and Parks Department to prepare a hydrological report for Sharp Park. Our work focused on characterizing conditions on the site and preparing a suite of analytical models that were used to a) evaluate hydrologic and drainage conditions, and b) design marsh, pond, and stream restoration alternatives that would benefit the California red-legged frog (CRLF) and the San Francisco gartersnake on the property. Our study is documented in a report[1]

[1] Kamman Hydrology & Engineering, Inc., 2009, Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study, Laguna Salada Wetland System, Pacifica, CA. Prepared for Tetra Tech, Inc., San Francisco, CA, 30p.

summarizing our hydrologic assessment, salinity assessment, and storm response modeling for Sharp Park. In writing this report, I studied historic rainfall records, local surface runoff, pumping operations, and water storage capacity of Laguna Salada, Horse Stable Pond, Sanchez Creek, and Sharp Park as a whole.

The following sections provide comments to selected sections of the BA that warrant clarification and elaboration with respect to the feasibility of proposed project actions.

1. Section 2.2 Project Description – Elaboration on Historic and Future Conditions

On page 4, the BA states, "A seawall on the western boundary of Sharp Park eliminated the historic hydrologic connection between the Pacific Ocean and the wetlands complex." Prior to construction of the seawall, there was likely a higher degree of exchange of water between Pacific Ocean and the Laguna. The current seawall likely inhibits floodwater drainage to the Ocean and is the primary cause for the winter flooding of the Laguna and golf course. With the seawall in place, the current and future outflow from Sharp Park is primarily controlled by the Horse Stable Pond pumps and to a lesser degree on internal drainage features. I elaborate on how the proposed BA project actions will affect future drainage and flooding conditions below.

Based on my experiences in restoring wetlands (e.g., Giacomini Wetlands at Point Reyes National Seashore) and California red-legged frog habitat along the Central California coast (e.g., Mori Point ponds), I think it is important to point out that removing the Sharp Park seawall would not preclude frog habitat. Although there would be the introduction of salt water and initial loss of freshwater marsh and pond, coastal estuaries display an ocean-to-land continuum in salinity structure between marine, brackish and freshwater conditions. These habitats are transient, shifting oceanward in response to seasonal rains and freshwater input from inland drainages. In turn, there is a corresponding transition in suitable frog habitat, with frog habitat likely precluded in the high salinity ocean side water but suitable breeding and rearing habitat located a short distance inland. In my experiences at the Giacomini Project in Marin County, CRLF and designated CRLF habitat is found in very close proximity to high salinity waters. Work by Fellers and Kleeman [2] at the Park documented how frogs move seasonally over considerable distances between temporary bodies of water for breeding and nonbreeding habitat. Thus, I think it is important to acknowledge the frog's natural ability to breed on the fringe of tidal wetland areas.

[2] Fellers, G.M., and Kleeman, P.M., 2007, California red-legged frog (*Rana draytonii*) movement and habitat use: implications for conservation. Journal of Herpetology, Vol. 41, No.2, pp. 271-281.

2. **Section 2.2 Project Description – Clarification between Wet and Dry Season Controls Over Wetland Ponding**

Page 4 of the BA states, "The wetlands are believed to be maintained by ground water but are also fed by surface water inflow due to precipitation in the winter. A flood control pump system in HSP affects water levels in that body, and it may affect water levels in LS when the channel connecting the two water bodies creates a surface water connection between them." These sentences should be clarified with respect to both the wet and dry seasons. The first sentence refers to wetland water supply during the summer, when groundwater contributions dominate because there is little to no surface water runoff. With regard to the second sentence, the exchange of water between Horse Stable Pond (HSP) and Laguna Salada (LS) is dramatically different during the wet and dry seasons. For example, through the dry season and after the Horse Stable pumps stop pumping, water levels decline in both ponds due to cessation of surface water inflow, declining groundwater inflow and increased evaporation. The highest measured elevation in the bed of the connector channel between HSP and LS is approximately 6.2-feet NAVD88. When water levels in either pond fall below this elevation, HSP and LS are segregated from each other and behave as two independent water bodies. The lowest observed stage in Laguna Salada that I am aware of is about 6.0-feet NAVD88 (Figure 6 in KHE 2009 report).

The BA project proposes, "Removal of sediment and emergent vegetation that impedes water flow and reduces habitat suitability for CRLF in selected locations with the connecting channel and culverts that link HSP and LS. This removal work would not exceed 480 cubic yards of removed sediment and vegetation within an area of approximately 6,500 square feet or 0.15 acres." (second bullet on page 7 of BA). If the BA action lowers the elevation of the bed of the channel that connects HSP and LS, it is possible that these water bodies will remain in hydraulic connection longer during the dry times of the year or at water levels below 6.2-feet in elevation. However, it is important to point out that during our 2008-2009 hydrologic investigation we measured the invert (lowest point) elevation of the culvert used to accommodate a golf cart path over the connector channel culvert at an elevation of 6.0-feet NAVD88. Thus, without lowering the culvert elevation, the hydraulic connection between the ponds can't be lowered below 6.0-feet NAVD88.

During winter high flows, the existing hydraulic connection between HSP and LS is much more dynamic. As part of our 2008-2009 hydrologic and hydraulic investigation of Sharp Park, we developed a calibrated numerical model that simulates water movement into and through the HSP-LS-Sharp Park complex. Our model was developed and calibrated using data collected during the storm of November 1, 2008, when we estimate a little over one inch of rainfall occurred. Using this model, we evaluated the effects of removing the vegetation and associated channel roughness that inhibits flow through the connector channel pursuant to the proposed BA project. This analysis included simulation of the November 1, 2008 storm and 24-hour storms having recurrence intervals of 2- and 5-years. Under existing conditions, we calibrated the numerical model using a connector channel roughness value of 0.15 (see pages 26-27 of KHE, 2009). In

order to simulate the effects of vegetation removal from the connector channel, we modified the numerical model by lowering the roughness coefficient to 0.035).[3]

The results of the three modeled storm simulations for existing and proposed BA project conditions are provided in Figures 1 through 3 and discussed below. The simulation results of each storm are presented on each Figure with two graphs of information per Figure. The upper graph on each Figure presents the existing and proposed BA project water levels in HSP, LS and connector channel over the storm period. The lower graph on each page presents the associated water flow rates out of HSP, flow at a point within the middle of the connector channel, flow rate into LS, and the cumulative pumping rate out of HSP to the Pacific Ocean. A negative flow rate in the lower graphic indicates that the flow direction through the connector channel is from HSP towards LS (i.e., water level in HSP is higher than LS). A positive flow rate on the lower graph indicates that low is from LS to HSP (i.e., water levels in LS are higher than HSP).

Based on watershed mapping, field reconnaissance and runoff monitoring, we estimate that the amount of runoff to HSP during any given storm is approximately twice the magnitude as the runoff total to LS. In addition, the storage volume of HSP for any increment in water level rise is significantly less than that of LS. Thus, during the initiation and rising limb of a storm hydrograph, the water level in HSP rises much more quickly than the water level in LS. Because the water level in HSP is higher that LS, water then starts to drain out of HSP through the connector channel into LS. This phenomenon is observed even during the 1-inch storm event before water levels trigger the pump in HSP to start discharging water to the Pacific Ocean. Simulation results for the 2- and 5-year storm events indicate that inflow rates to HSP far exceed the discharge pump capacity, leading to higher incremental rises in water level and longer durations of flow from HSP into LS[4]. The main findings of the proposed BA project model simulations are as follows:

- Removing vegetation from the connector channel will increase the flow rate from HSP to LS during the early parts of storm events, causing the water level in LS to reach a maximum level sooner under BA conditions than currently exists.

- The maximum simulated water level attained in LS under BA project conditions reaches a water level elevation about 0.2-feet higher than during the existing condition simulation for a one inch storm event. This means that the extent of flooded area within LS and near the golf course associated with a one inch rainfall

[3] It's important to note that we did not alter (deepen or widen) the channel geometry in an attempt to emulate changes associated with sediment removal because the BA does not provide sufficient detail regarding this type of work. However, based on our modeling and understanding of the water level responses to changes in channel conveyance capacity, I don't believe there would be any significant change in the rate of water level change if the channel were widened and/or deepened. Deepening the channel would allow Laguna Salada to be drained to a lower and comparable depth via pumping from Horse Stable Pond.

[4] Simulations of pumping from HSP follow the pump operation "rules" implemented in 2008/09. Review of modeling results suggest that doubling the pump rate from HSP would roughly equal the inflow to HSP during the 2-year storm, but inflow during a 5-year storm would still overwhelm the system.

storm event will be larger under proposed BA project conditions than existing conditions.

- The maximum simulated 2- and 5- year storm water levels attained in LS during the proposed BA project conditions reach the same elevation that water levels reach under existing conditions, just sooner. This means that the extent of flooded area associated with these storm events remains virtually the same between existing and BA project conditions.

- Simulation results indicate that removal of vegetation from the connector channel does not lead to faster drainage of water or reduced duration of inundation in LS and the golf course area between existing and proposed BA project conditions. Therefore, the associated conversion of cover habitat to breeding habitat for CRLF would not provide any reduction in the extent or duration of flooding in LS and the surrounding golf course.

3. 2.2.1 Construction Action – Loss of Hydraulic Connection

On page 7 of the BA it states, "Because there is no surface water connection between these areas and LS, they cannot sustain CRLF through metamorphosis." This sentence is a bit unclear. Are the authors suggesting that it's the golf cart path that is limiting habitat or is it the available hydrology? In addressing the later, it is simply untrue that there is no surface water connection between the golf cart path area and Laguna Salada. The loss of hydrologic connectivity is a direct result of pumping from HSP. In the absence of pumping from HSP there would be a significant increase in the duration of flooding that would maintain connectivity in these areas over significant breeding periods. Based on Vandivere's Sharp Park Golf Course Inundation Area Map[5], the golf cart path area becomes inundated when water levels reach between 7 and 8-feet NAVD88 or higher. Vandivere's map also indicates that when water levels reach this level, LS, the connector channel and HSP are all hydraulically connected. Our modeling simulation results support this interconnected condition at water levels of 7- to 8-feet and also indicate that this has the chance of occurring once every two years under the 2008/09 pumping regime, but likely more often. It is only through pumping from HSP that waters recede quickly and ponded cart path areas become isolated from the connector channel, LS and HSP. If no pumping were occurring at all from HSP, the areas within the elevation range in question would surely be inundated annually and for durations likely exceeding the metamorphosis period.

[5] Vandivere, W. 2011. Declaration of William Vandivere, P.E. in Support of Defendants' Opposition to Plaintiffs' Motion for Preliminary Injunction. *Wild Equity Institute, et al., v. City and County of San Francisco, et al.*, Case No. C 11-CV-00958-SI. 30 pp.

4. 2.2.1 Construction Action and Impact to Habitat Quality

On page 11 of the BA it states, "Repairs to the cart paths will involve moving the paths away from the wetland and into the golf course, installing interlocking pavers to support the downslope embankment and backfilling the area with drain rock to raise elevations." This description of work is very vague and unclear. Regardless, any fill placed in the area that raises the ground surface elevation will effectively reduce the frequency and duration of flooding at that raised area. Although it might only be a small change, it still would be a change reducing CDFG habitat. Areas covered in drain rock, even if they remain at the current elevation, may alter the substrate in a way that precludes emergent vegetation used to secure egg masses. As an aside, this area may be designated wetland by the Coastal Commission and the path relocation could constitute filling of wetland.

5. 3.2 Watershed Boundaries and Drainage Patterns

On page 31, the BA states, "The connecting channel between LS and HSP allows for water exchange at surface elevations greater than 6.2 feet (NAVD 88). Water exchange between the two water bodies is reduced by the hydraulic friction created by dense cattail growth (Kamman 2009). In some areas surrounding the wetlands and on the golf course, ponds or swales may form, which do not appear to have surface water connection to LS, HSP and the connecting channel. These ponds form immediately after rainfall events and may last for several days to several months." Again, like my response in item 2. above, the impact of vegetation on flow conveyance through the connector channel is really dependant on the water depth within the connector channel. Water depth in the connector channel depends on the season (wet or dry) and pumping from HSP. During periods when the water depth is well contained and shallow within the connector channel, the effects of vegetation on reducing flow conveyance are greatest. However, during these periods, there is no flooding of the golf course and no need to move water between LS and HSP any faster than already occurs. It is during the winter floods when water levels are approaching flood level of the golf course that are of concern. As demonstrated from our hydrologic modeling of storm events (see Figures 1 through 3) when water levels rise to an elevation of around 8-feet NAVD88, the saturated flow area and conveyance capacity within the connector channel increases to a level that far exceeds the rate of pumping from the HSP discharge pump, even with vegetation choked channels. In short, increasing the potential flow rate between LS and HSP when the golf course is at flood level makes no difference when the discharge pump from HSP can't keep up with the flows that are already delivered to the pump intake. Again, our modeling results indicate that even with a vegetation free channel, the depth and duration of flooding in Sharp Park will not change in response to the proposed BA project. Vegetation free channels will not change the frequency or area of pond/swale formation when the discharge capacity of the system can not keep up with the volume of inflow, even with improved water exchange between LS and HSP.

Our analyses indicate that the objective of restricting the formation of ponded areas and swales can't be accomplished through implementation of the proposed BA project.

Therefore, frogs and egg-masses will continue to populate the ponds and swales equally under existing and proposed BA project conditions. The best available approach towards protecting and enhancing existing frog habitat, given existing infrastructure, is a reduced pumping regime from HSP that stops dewatering the ponded areas and swales given they will continue to form at an uninterrupted frequency. In essence, this approach works to preserve frog habitat by maintaining the ponds/swales instead of dewatering them.

6. 3.4.4 Wetland Dredging and Flood Hazard Reduction

Page 33 of the BA states, "Over the last several decades, the extent of this vegetation has increased, replacing the open water." Dredging tules from LS will convert certain areas from frog cover habitat to open water habitat. However, based on my analyses and understanding of the project site, it is my opinion that this action would not result in any meaningful or significant relief from flooding. Specifically, I don't believe that dredging tules from LS will lead to a significant reduction in flooded golf coarse area or flood duration.

If you have any questions or wish to discuss these opinions and conclusions further, please feel free to contact me.

Sincerely,

Gregory R. Kamman, PG, CHg
Principal Hydrologist

cc:

U.S. Army Corps of Engineers: Cameron Johnson, Ian Liffmann

U.S. Fish and Wildlife Service: Susan Moore, Jan Knight, Eric Tattersall, Cay Goude, Chris Nagano, and Josh Hull

California Coastal Commission: Renee Ananda and Karen Geisler

Figure 1: Flood model simulation results for project area for November 1, 2008 storm. Graphs plot results for densely and lightly vegetated connector channel simulations.

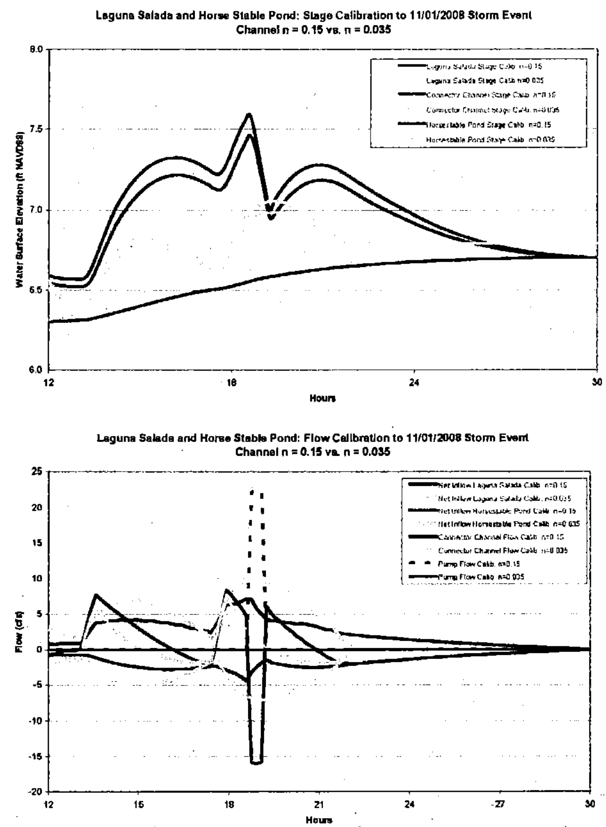


Figure 2: Flood model simulation results for project area for 2-Year storm. Graphs plot results for densely and lightly vegetated connector channel simulations.

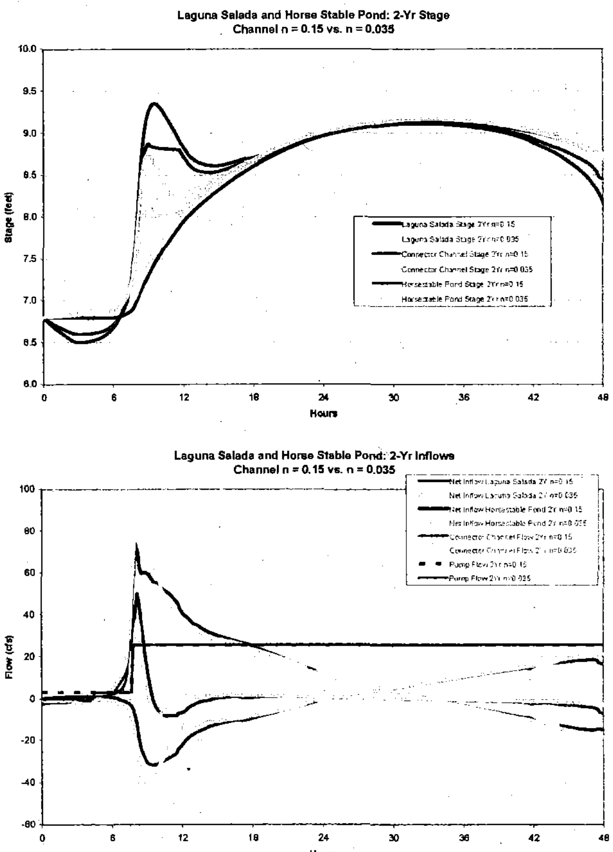
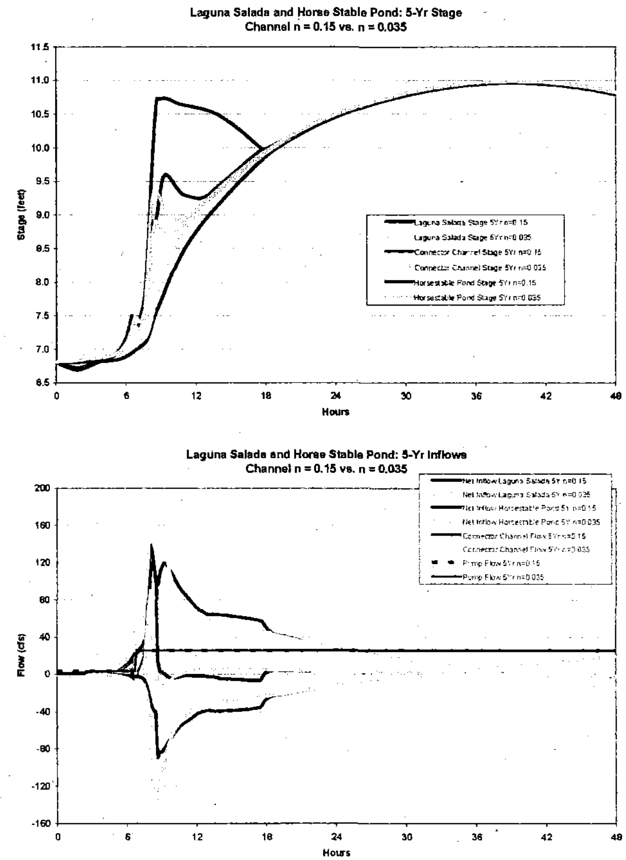


Figure 3: Flood model simulation results for project area for 5-Year storm. Graphs plot results for densely and lightly vegetated connector channel simulations.



UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
NORTHERN DIVISION

WILD EQUITY INSTITUTE, a non-profit corporation, *et al.* Plaintiffs, v. **CITY AND COUNTY OF SAN FRANCISCO,** *et al.,* Defendants.	Case No.: **3:11-CV-00958 SI** **GREG KAMMAN EXPERT REPORT**

1. I am submitting this expert report on behalf of plaintiffs in this case.

BACKGROUND AND QUALIFICATIONS

2. I am a hydrologist with over twenty five years of technical and consulting experience in the fields of geology, hydrology, and hydrogeology. I have been providing professional hydrology services in California since 1991 and routinely manage projects in the areas of surface- and ground-water hydrology, water supply, water quality assessments, water resources management, and geomorphology. Most of my work is located in the Coast Range watersheds of California, including the Northern and Southern San Francisco Bay Counties. My areas of expertise include characterizing and modeling watershed-scale hydrologic and geomorphic processes; evaluating surface- and ground-water resources/quality and their interaction; assessing hydrologic, geomorphic, and water quality responses to land-use changes in watersheds and causes of stream channel instability; and designing and implementing field investigations characterizing surface and subsurface hydrologic and water quality conditions. I co-own and operate the hydrology and engineering consulting firm Kamman Hydrology & Engineering, Inc. in San Rafael, California (established in 1997). I earned a Master of Science in Geology, specializing in Sedimentology and Hydrogeology, as well as an A.B. in Geology from Miami University, Oxford, Ohio. I am a Certified Hydrogeologist (CHg) and a registered Professional Geologist (PG). My CV summarizing my qualifications, along with a list of publications from the past 10 years, are attached as Ex. A. I am charging plaintiffs $100 per

hour for the time I spend reviewing materials and providing deposition and trial testimony in this matter. I have not been deposed or served as an expert witness in the past four years.

3. I am very familiar with Sharp Park. In 2009, my firm was retained by Tetra Tech of Portland, Oregon on behalf of the San Francisco Recreation and Parks Department to prepare a hydrological report for Sharp Park, attached as Ex. B. While producing this report, I reviewed a previous study of Sharp Park and Laguna Salada, entitled "Laguna Salada Resource Enhancement Plan," prepared by Philip Williams Associates in 1992. Our report expanded upon Philip Williams Associates' earlier study by reflecting current conditions on the site and by preparing a suite of analytical models that could be used to a) evaluate current hydrologic and drainage conditions, and b) design marsh, pond, and stream restoration alternatives that would benefit the California red-legged frog and the San Francisco gartersnake on the property. Our report included a hydrologic assessment, a salinity assessment, and a storm response model for Sharp Park. In writing this report, I studied historic rainfall records, local surface runoff, pumping operations, and the water storage capacity of Laguna Salada, Horse Stable Pond, Sanchez Creek, and Sharp Park as a whole. Our report considers, in part, the anticipated water levels that can be expected in Sharp Park during various winter rain scenarios under current pumping operations from Horse Stable Pond.

4. My expert testimony in this report is based on the resources described above, along with water level monitoring data for Horse Stable Pond and Laguna Salada collected by my firm, the Horse Stable Pond pump house log provided by the City and County of San Francisco in this litigation, egg mass survey data collected by the City and County of San Francisco from 2005-07, egg mass monitoring reports prepared by the GGNRA covering the years 2003-2005, and 2006-2009, water quality data for Sharp Park, the declaration provided by Dr. Marc Jennings in opposition to plaintiffs' motion for preliminary injunction, Docket No. 68, and the associated exhibits, and the declaration of William Vandivere in opposition to plaintiffs' motion for preliminary injunction, Docket No. 66-2, and the associated exhibits. A list of all materials I have relied upon in preparing this report is attached as Ex. C.

REQUESTED TESTIMONY

5. Plaintiffs have requested that I provide my expert opinion and testimony regarding six questions. First, plaintiffs have asked me to describe the geologic and hydrologic forces that cause Sharp Park Golf Course to flood on a regular basis. Second, plaintiffs have asked me to explain why Sharp Park Golf Course's pumping operations have not been able to prevent flooding. Third, plaintiffs asked me to determine if Sharp Park's pumping operations cause water levels to recede below elevations that California red-legged frog egg masses have been laid in the past. Fourth, plaintiffs asked me to determine the water levels that must be retained at Sharp Park to ensure that known California red-legged frog breeding areas remain hydrologically connected to the Laguna Salada wetland complex for six weeks, presuming no further water inputs occur during the six-week period. Fifth, plaintiffs asked me to compare typical flooding events at Sharp Park to the water levels at which I determine are necessary to keep known frog breeding areas hydrologically connected to Laguna Salada for six weeks. Finally, plaintiffs asked me to determine if ceasing pumping at Sharp Park when California red-legged frog eggs and tadpoles are present will cause flooding in surrounding communities.

SHARP PARK GOLF COURSE IS UNIQUELY PRONE TO FLOODING

6. Sharp Park Golf Course floods in the winter on a regular basis. It is especially prone to flooding because of the Golf Course's location within it's watershed, the sea wall which blocks natural freshwater outflow from Sanchez Creek, and other factors that ensure that large portions of the golf course remain under water for several days in all but the driest years. This is true even when Sharp Park's pumps are in full operation.

7. Flooding is a chronic and persistent issue at Sharp Park. Historically, Sharp Park has experienced severe flooding due to intense storm runoff and sea wall overtopping in April 1958, January 1978 and January 1983 (Geomatrix, 1987; FEMA, 1987).

8. Flooding continues to be persistent in modern times. For example, flooding of the golf course is reported in the Horse Stable Pond pump house log on February 20, 2011. Many of the log's gauge recordings indicate that even when the Horse Stable Pond pumps are in full operation, water levels reach between 9- and 10-feet in elevation (NAVD88) every year (2007

through 2011). Based on review of the available site topographic map (Lee, Inc., 2008) and the inundation map presented in the Vandivere declaration, water levels above 9-feet NAVD88 extend well into the western margins of the golf course. Water levels may reach up to 10-12 NAVD 88 in response to large storm events (see Ex. B, Figure 12).

PUMPING HAS NOT PREVENTED FLOODING AT SHARP PARK

9. The golf course attempts to drain Sharp Park using two pumps stationed at Horse Stable Pond, one referred to as the large pump and the second referred to as the small pump. The maximum discharge rates for these pumps are designed for approximately 10,000 gallons per minute (gpm) and 1,500 gpm. I have reviewed the Pump house log book and the deposition transcript of pump house stationary engineer John Ascariz, and although the pumps expel massive amounts of water from Sharp Park, the golf course continues to flood.

10. In order to translate the staff gauge readings from the Pump house log into water level elevations consistent with the Lee, Inc. 2008 topographic maps (NAVD88 datum), the Horse Stable Pond staff gauge recordings in the Pump house log were converted to the NAVD88 datum elevations by adding 5.9-feet to staff gauge measurements. This conversion was derived by comparing Pump house log staff gauge recordings to our continuous Pond water level measurements collected in 2008 and 2009. Our continuous water level record was tied to the NAVD88 vertical datum through an elevation survey of an associated pond staff plate installed and monitored at our recording instrument. Ex. D presents a plot of the converted Pump house log water level recordings versus our 2008/09 continuous Pond water level recordings, and these data are in close agreement. The continuous water level record for the December 13, 2008 through February 3, 2009 period is missing due to instrument error over this period.

11. In order to compare Horse Stable Pond pumping rates and water levels, I converted the remainder of the Pump house log gauge records to the NAVD88 datum and plotted concurrent water levels and cumulative pumped volumes from Horse Stable Pond during the past four winters (2007/08, 2008/09, 2009/10 and 2010/11). This graph is provided as Ex. E. The diamonds plotted on Ex. E represent Pump house log water elevations in feet NAVD88. The cumulative large, small and combined (large +small) pump water volumes for each individual

winter period are also plotted as the multi-colored lines on Exhibit E. Rising water levels and cumulative pump volumes indicate periods of increased surface runoff to the Laguna and Pond in response to winter rain storms. The cumulative total pumped water over any given winter reflects the total amount of runoff entering the project area. For example, the lesser cumulative pump volume during the winter of 2008/09 as compared to the volume pumped during the winter of 2010/2011 indicates 2008/09 was a noticeably drier year than 2010/11. As indicted above, flooding of the golf course occurs between 8- and 9-feet in elevation, and water levels during each winter monitored between 2007 and 2011 exceed this level. This lead to extensive flooding onto Sharp Park Golf Course.

12. Only when winter rains slow or cease can floodwaters at Sharp Park be pumped faster than the rains fall. Indeed, based on my own records and the Sharp Park Pump house log, it is apparent that the pumps often must operate for hours or even days after rain events to drain water from Sharp Park.

PUMPING OPERATIONS CAUSE EGG MASS STRANDINGS AT SHARP PARK

13. While pumping has limited utility in preventing Sharp Park Golf Course from flooding, it has caused California red-legged frog egg masses to strand and desiccate.

14. I have reviewed the Recreation and Park Department's maps of California red-legged frog egg-mass locations at Sharp Park for the past several winters. Based on these maps it is apparent that the vast majority of California red-legged frog egg masses have been laid in the same general areas at Sharp Park. Frogs have breed in these areas under a variety of winter rain conditions, during dry winters (2008/09) to wet years (2010/11).

15. I have also reviewed elevation data for Sharp Park's lagoon, pond and golf course. At 8-feet in elevation, Figure 1 of Exhibit 2 of the Vandivere declaration depicts all of Laguna Salada—including the areas that are considered "isolated" when water levels fall below 7-feet in elevation—as one large, contiguous, hydrologically connected water body. By comparing the egg mass locations to the elevation data, the elevation of these breeding areas can be ascertained and compared to water levels at Sharp Park. Based on my review of available maps indicating egg mass observation in 2003 through 2011, the vast majority of egg masses were located at

elevations between 7.0- and 8.0-feet NAVD88. (Ex. F). Historically, pumping operations have caused these egg masses to strand, as pumping lowers the water level below this elevation range (Ex. E).

16. It is also my professional opinion that pumping operations at Horse Stable Pond have caused egg masses to become stranded and desiccated at Sharp Park over the past four years in response to storm water pumping. This occurs when pond water levels rise rapidly in response to storm events and increased runoff that out-paces the ability of the pumps to maintain a constant pond water level. As the storm passes and runoff recedes, pond water levels drop rapidly as pumps draw the pond back down to a pre-set level. In order to minimize rapid cycling of the pumps on/off, a common practice is to set the pump to turn on at a predetermined water level and then to turn off at a lower predetermined level. For example, the Pump house log for January 31, 2008 indicates that a pump "on" level is set at a gauge height of 3.9 and pump "off" at 3.3. During these water level fluctuations, frogs will lay eggs during the high stand in water level and eggs become stranded above the water when levels are drawn down by pumping. Based on a comparison of egg mass monitoring notes and Pump house log entries, an example of this type of egg stranding occurred during a storm on or around February 20, 2011. For the week prior to the storm on the 20th, pond water levels were maintained around an elevation of 8.4-feet. In response to the increased storm runoff outpacing the pumps, water levels rose almost a foot to 9.3-feet. Within two or three days after the storm, water levels were pumped back down to 8.4-feet where they remained for several weeks. This stranding event was opportunistically observed by plaintiffs' members. See Docket No. 60-2, Ex. 4; 60-7, Ex. 26. An egg mass was discovered at risk on February 21, Docket No. 60-2, Ex. 4, and then stranded on February 22 through February 24, *id.*; Docket No. 60-7, Ex. 26, which could only have occurred if the frogs laid their eggs during the short highstand associated with storm flooding and subsequent dewatering.

17. Over the past four winters, notes in the Pump house log have indicated an increased effort to reduce impacts to frog egg masses. As a result, there has been an increased frequency in visits (as determined by increased frequency in Pump house log entries) to monitor and adjust

pumping levels, which has progressively reduced the variability in the range of pond water levels between 2007 and 2011 (see Ex. E). However, there continue to be periods of higher water levels followed by rapid drawdown by pumping, which lead to egg stranding events such as the one described for the February 20, 2011 storm event above.

18. It is not likely that strandings are caused by shallow depressions in Sharp Park's landscape independent of the golf course pumping operations. Based on Defendants' shaded relief map presented as Figure 1 of Exhibit 2 of the Vandivere declaration, Docket No. 66-2, isolated pond areas only occur when water levels drop below approximately 8-feet in elevation. Historically, pumping operations targeted maintaining water levels below 8-feet in elevation (see Ex. E). However, over the winter of 2010/11, water levels reached and were maintained above 8-feet in elevation for long periods. This was made possible due to the constant and extended period of rainfall and runoff that supplied the pond through the winter and spring months. The result of this extended surface water runoff supply, combined with the pumping of the pond down to only an elevation around 8.4-feet, allowed the known frog egg mass breeding areas between 7- 8-feet to remain hydrologically connected to the Laguna Salada wetland complex for long periods of time, significantly reducing, if not eliminating, the opportunity for stranding and desiccation of eggs laid at or below 8-feet in elevation. Although water levels at Sharp Park remained high enough to keep the Laguna Salada complex hydrologically connected during the 2010/11 winter, the City's rapid drawdown of the complex immediately after the February 20, 2001 storm caused an egg mass to strand.

19. Historically, runoff to the pond did not last as late into the season as it did the winter of 2010/11. In addition, historic pumping durations were shorter and the decline in pond water levels was more rapid and occurred much earlier in the year (Exhibit E), leading to water levels falling below 8-feet in elevation. Moreover, wet years like 2010/11 are unique and not a normal or predictable occurrence. This winter, for example, has been fairly dry until recently. The low rainfall should caution the City to be judicious in its pumping operations to ensure that egg masses are not stranded between 7- and 8-feet, as they have been in many previous years.

20. However, I have reviewed photographs of the Sharp Park Pump gauge taken on January 18, 2012 that indicate the City recently drained Horse Stable Pond to 7.1 feet NAVD in anticipation of upcoming storms. If egg masses are laid during the storm's highstand and water levels subsequently fall back to 7.1 feet NAVD, there is a high probability that stranding events will occur.

21. It is my opinion that a reasonable and conservative approach towards protecting frog eggs from stranding and desiccation is to initiate a pumping and pond management strategy that maintains egg inundation for a sufficient length of time at locations and elevations where frogs have repeatedly laid eggs. As indicated above, the majority of historic egg masses observed stranded or relocated were found at elevations between 7.0- and 8.0-feet NAVD88. Sustaining viable egg masses at an elevation of 8-feet requires a sufficient supply of water to keep them inundated for a reasonable duration of time. Since surface water runoff is an unpredictable supply, which is further complicated by dewatering by pumps, it seems prudent to provide a sufficient level of ponded water above the 8-foot elevation so that even with no further surface runoff into the Laguna/Pond system, egg masses at or below 8-feet in elevation would remain inundated. Such a scenario and water level would not be lowered by pumping and would need to account for losses and declines associated with evaporation, seepage and subsurface outflow.

<u>WATER LEVELS MUST REMAIN AT 10.2-FEET NAVD88 OR HIGHER IN ORDER TO PREVENT STRANDING OF EGG MASSES AT SHARP PARK</u>

22. It is my understanding that a conservative estimate of the duration needed for California red-legged frog egg-masses to hatch and tadpoles to become strong enough to swim to deeper waters in cool climates like Pacifica is approximately 6 weeks. (ESA/PWA 2011, Appendix C, Table 1).

23. To determine the water level needed to ensure hydrologic connection and six weeks of saturation in the portions of Sharp Park where California red-legged frogs have traditionally laid eggs (generally areas with elevations between 7- and 8-feet NAVD88), I've completed a simple pond recession analysis (spreadsheet model) similar to the groundwater seepage computation

presented in Vandivere's declaration. However, my analysis was improved in several ways, providing more accurate information.

24. First, after reviewing the Vandivere declaration, I realized that his calculation contained a conversion error. Lines 9-10 on page 6 indicates the upper elevation of the seepage face at the edge of the Pacific Ocean is 6-ft *NAVD88*. But Figure 4 of Exhibit 5 of Vandivere's declaration indicates this elevation at 6-ft *NGVD29* – a different measurement unit that has a 2.1-foot conversion factor. This inconsistency leads to an incorrect hydraulic gradient (i) calculation. This error is corrected in my seepage computations, yielding a steeper initial gradient (0.0126 ft/ft when the Laguna water level is 12-ft NAVD88) along the seepage front and higher groundwater outflow rates.

25. Second, Vandivere uses a hydraulic conductivity (K) value of 10,000 gallons per day per ft^2 (gpd/ ft^2) for the assumed homogeneous and clean beach sands that groundwater seeps through under the western levee. This value is biased towards the highest K-values published for sand. Ex. G presents published ranges for K as reported from a number of different publications related to groundwater flow hydraulics. For purposes of my pond recession analysis, the 10,000 gpd/ft^2 rate was used but it should be recognized that a more conservative or median value would yield much slower seepage rates causing a longer recession in ponded water levels after flooding.

26. Third, Vandivere's analysis only considers groundwater outflow, yet there is a significant component of groundwater inflow to Laguna Salada wetland as documented in our report, Ex. B, p. 7, and the PWA 1992 report. In order to account for this groundwater inflow, we assume the following: a constant hydraulic gradient (i) of 0.0058 ft/ft (calculated from seasonal groundwater elevations presented on Figure 24 of the PWA 1992 report; a constant saturated area of 12,000 ft2 (saturated aquifer thickness of 6-feet and seepage front of 2000 linear feet); and initial hydraulic conductivity of 100 gpd/ft2 for the upgradient "medium grained sand" aquifer as reported on Figure 22 of PWA's 1992 report (see Ex. H).

27. By incorporating known groundwater inflows into the model and fixing the conversion error, it is my professional judgment that my pond recession analysis is more accurate than

those presented by Defendants in this matter. Furthermore, because I use the same (K) rate as Defendants' experts—which as explained above is biased towards the highest rates published in the relevant literature—it is likely that the model creates conservative estimates.

28. The analysis assumes an initial Laguna Salada water level of 10.2-feet. The results of the pond recession analysis are presented in Ex. I and include: daily Laguna volumes and ponded surface areas; ending daily Laguna water levels; and ponded volume and area after accounting for seepage losses/gains. The hydraulic gradient and saturated thickness of the seepage front are recalculated each day based on the adjusted water volumes and associated water surface elevation. Seepage calculations were performed for a 365-day period. Ex. J presents the water level-volume-surface area relationships used to translate between Laguna water level, volume and surface area. These values were calculated from the project topographic map completed by Lee, Inc. for Tetra Tech, Inc. as part of the Sharp Park Conceptual Restoration Alternatives Report (Tetra Tech, 2009). The groundwater seepage model is validated to some extent by the equilibration of the late season Laguna water levels at an elevation between 6.0- and 6.5-feet, the approximate static pond level observed during PWA's monitoring in 1990-91 and KHE's monitoring in 2008.

29. Ex. K presents the recession analysis results as a plot of changing water surface elevation and ponded area versus days since the water level reached 10.2-feet NAVD 88 at Sharp Park. This analysis targets providing 6-weeks of inundation to eggs at or below 8-feet in elevation and assumes no further inflows or pumping after the peak rain event. Highlights of these results include:

- Day 1 flooding to an elevation of 10.2-feet yields 40-acres of ponded area;
- Ponding recedes to 9-feet and 32-acres after 18 days;
- Ponding recedes to 8.0-feet and 26-acres after 42 days (6 weeks);
- Ponding recedes to 7.0-feet and 19-acres after 103 days;
- Ponding recedes to 6.5-feet and 15-acres after 217 days.

30. These results indicate that ceasing pumping after attaining a water level elevation of 10.2-feet NAVD 88 would allow eggs and tadpoles at 8-feet in elevation to remain submerged

in waters hydrologically connected to the deeper areas of Laguna Salada for more than six weeks, even if no further rain or other water inputs are provided.

THE NECESSARY WATER LEVELS ARE SIMILAR TO WATER LEVELS THAT OCCUR AT SHARP PARK ON A REGULAR BASIS

31. An inundation level of 10.2-feet is not out of the ordinary at Sharp Park. Based on the historic pumping volumes recorded in the Pump house log, there is sufficient surface water supply to reach this level during all but critically dry years as long as pumping is reduced or temporarily curtailed. The Pump house log indicates water levels have reached between 9- and 10-feet in elevation over the past four winters even with operational pumping. Hydraulic modeling of a pond with a starting water level of 6.8-feet under maximum pumping conditions would be flooded to the 10.2-foot elevation during a storm having a recurrence interval between 2- and 5-years (Figure 10 of Ex. B). Much smaller winter storms lead to more frequent flooding to 10.2-feet when the pond level starts at an elevation of 8-feet NAVD88. The main difference in providing ponding relief to frog eggs would be the duration of ponding between 8- and 10.2-feet; currently water is pumped down from this level whereas ponding would be sustained above 8-feet for a minimum of 6-weeks under the frog egg relief scenario.

MAINTAINING WATER LEVELS THAT DO NOT STRAND RED-LEGGED FROG EGG MASSES WILL CREATE NO FURTHER APPRECIABLE FLOOD RISK ON THE SURROUNDING COMMUNITY

32. It is my professional opinion that a water level at or below 10.2-feet NAVD 88 can be maintained in Sharp Park without pumping water from Horse Stable Pond.

33. In the event water levels exceed 10.2-feet, mobile pumps can be used along Clarendon Road and Lakeside Avenue (near the Northeast Corner of Sharp Park's western unit) to pump water from Sharp Park. Mobile centrifugal pumps that can provide relief from flooding are readily available for purchase or rent in the Bay Area. It is my understanding that mobile pumps are already used in this area during heavy winter rains, see Ex. L, when waters already extend beyond the Sharp Park boundaries.

34. Consequently, it is my professional opinion that there is relatively low incremental increase in existing flood hazards beyond the boundaries of Sharp Park this winter associated

with cessation of pumping of water from Horse Stable Pond and implementation of adequate mobile pumping along Clarendon Road and Lakeside Avenue (near the Northeast Corner of Sharp Park's western unit).

CONCLUSION

35. Even with pumps operating at full capacity, Sharp Park golf course floods on an annual basis. Rapid changes in pond water levels are a byproduct of current pump operations, even under diligent monitoring and maintenance. In turn, rapid changes in pond levels, especially those that accompany winter storms, lead to egg stranding and desiccation. Holding pond levels at or above 8.0-feet in elevation would maintain saturated conditions in segregated depressions and shallow channels for a period of six weeks along the margins of Laguna Salada, common areas where frog like to lay eggs. An inundation level of 10.2-feet after eggs are laid would provide a minimum six weeks of incubation and hatching for eggs laid at an elevation of 8-feet or less even if no further rain inputs occur after eggs are laid. Maintaining ponding above 8-feet is also important to maintain connectivity for tadpoles between shallow channels and depressions and the main Laguna water body. Any increased flood hazards associated with reducing the floodwater storage capacity of the project area (by maintaining a 10.2-foot elevation) can be mitigated through the use of mobile pumps.

01/20/12 — Date

[signature] Greg Kamman

EXHIBIT A

Greg Kamman, PG, CHG
Principal Hydrologist

EDUCATION	1989	M.S. Geology - Sedimentology and Hydrogeology Miami University, Oxford, OH
	1985	A.B. Geology Miami University, Oxford, OH
REGISTRATION	No. 360 No. 5737	Certified Hydrogeologist (CHG.), CA Professional Geologist (PG), CA
PROFESSIONAL HISTORY	1997 - Present	Principal Hydrologist/Vice President Kamman Hydrology & Engineering, Inc. San Rafael, CA
	1994 - 1997	Senior Hydrologist/Vice President Balance Hydrologics, Inc., Berkeley, CA
	1991 - 1994	Project Geologist/Hydrogeologist Geomatrix Consultants, Inc., San Francisco, CA
	1989 - 1991	Senior Staff Geologist/Hydrogeologist Environ International Corporation, Princeton, NJ
	1986 - 1989	Instructor and Research/Teaching Assistant Miami University, Oxford, OH

SKILLS AND EXPERIENCE

As a hydrologist with over twenty years of technical and consulting experience in the fields of geology, hydrology, and hydrogeology, Mr. Kamman routinely manages projects in the areas of surface- and ground-water hydrology, stream and wetland habitat restoration, water supply, water quality assessments, water resources management, and geomorphology. Areas of expertise include: stream and wetland habitat restoration; characterizing and modeling basin-scale hydrologic and geologic processes; assessing hydraulic and geomorphic responses to land-use changes in watersheds and causes of stream channel instability; evaluating surface- and ground-water resources and their interaction; and designing and implementing field investigations characterizing surface and subsurface conditions. In addition, Mr. Kamman commonly works on projects that revolve around sensitive fishery, wetland, animal and/or riparian habitat issues and problems. Thus, Mr. Kamman is accustomed to working within a multi-disciplined team and maintains close collaborative relationships with biologists, engineers, planners, architects, lawyers, and various agency staff.

PROFESSIONAL SOCIETIES & AFFILIATIONS	American Geological Institute Society for Ecological Restoration International California Native Plant Society

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EXHIBIT C

GREG KAMMAN EXPERT REPORT
EXHIBIT C
MATERIALS RELIED ON IN FORMING EXPERT REPORT OPINIONS

REFERENCES

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LIST OF DATA OBTAINED AND REVIEWED

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***LagunaSalada HSP water levels*, Excel spreadsheet, April 4, 2008 – May 4, 2009.**

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Memorandum to David Munro from S. Higgins and G. Kamman, *Preliminary Summary of Monitoring Data from the Laguna Salada*, December 12, 2008.

Stage-Storage Relationships

Terrain analysis of topographic and hydrographic survey data collected by Lee Incorporated, 2008. Area and volume measurements completed in GIS.

Rainfall

National Weather Service station at Pacifica (NWS Coop ID: 46599) (see page 11 of KHE, Inc., *Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study: Laguna Salada Wetland System, Pacifica, California*, March 30, 2009). This reference used to describe climate and to obtain mean annual precipitation estimate for surface water inflow calculations (see below).

November 1, 2008 rainfall event, first storm of monitoring period, 1.3 inches of rainfall. (see page 16 of KHE, Inc., *Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study: Laguna Salada Wetland System, Pacifica, California*, March 30, 2009). Data also from observed historical rainfall events measured at weather stations published for Pacifica, California on Weather Underground website

Design storm hydrographs used depth-duration-frequency data for San Francisco Bay region to develop 24-hour storm rainfall totals for recurrence intervals between 2- and 100-years (with base flow added as a percentage of peak flow rate).
(Rantz, S.E., 1971. Precipitation Depth-Duration-Frequency Relations for the San Francisco Bay

Surface Water Flows

Mean annual runoff estimated from a percentage of mean annual precipitation (from NWS rainfall data) and based on a regional rainfall-runoff relation developed for SF Bay area (Rantz, S.E., 1974. Mean Annual Runoff in the San Francisco Bay Region, California, 1931-70., U.S. Geological Survey Miscellaneous Field Studies Map 613.)

Seasonal distribution of surface inflow is derived from mean monthly stream flow data at USGS gaging station on Pescadero Creek (St ID: 11162500) and modified to reflect lack of sustained baseflow to project site during months of low rainfall. (

see pages 11-12 of KHE, Inc., *Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study: Laguna Salada Wetland System, Pacifica, California*, March 30, 2009).

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Surface Water Outflows

Excess water is drained by the pump station in Horse Stable Pond, and controlled by adjustment of probes which activate the pumps at a given water level. Water budget modeling (prior to obtaining pump log) assumed that the pumping station maintained water levels at 6.9 feet NAVD88 at the beginning of winter; water level is adjusted in February to maintain water levels at 7.3 feet.

(see page 12 of KHE, Inc., *Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study: Laguna Salada Wetland System, Pacifica, California,* March 30, 2009)

Pump probe settings provided by Sean Sweeney in email communication on 11/4/2008. (Table 4, page 27 of KHE, Inc., *Report for the Hydrologic Assessment and Ecological Enhancement Feaslbility Study: Laguna Salada Wetland System, Pacifica, California,* March 30, 2009).

Annotated Pump house log

Evapotranspiration and Groundwater

Both discussed in (page 13 of KHE, Inc., *Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study: Laguna Salada Wetland System, Pacifica, California,* March 30, 2009).

Water Quality Data

Salinity (specific conductivity and temperature) collected via legelogger from 4/7/2008 – 8/26/2008. Additional discrete samples collected via multi-probe system. Measurements taken from Laguna Salada, Horse Stable Pond, monitoring wells on GGNRA property near Mori Point and from ponded water in the drainage channel near Sanchez Creek.

Exhibits and Dockets

Horse Stable Pond pump house log provided by the City and County of San Francisco

Egg mass survey data collected by the City and County of San Francisco from 2005-07,

Egg mass monitoring reports prepared by the GGNRA covering the years 2003-2005, and 2006-2009,

Declaration provided by Dr. Marc Jennings in opposition to plaintiffs' motion for preliminary injunction, Docket No. 68, and the associated exhibits

Declaration of William Vandivere in opposition to plaintiffs' motion for preliminary injunction, Docket No. 66-2, and the associated exhibits

Deposition transcript of pump house stationary engineer John Ascariz

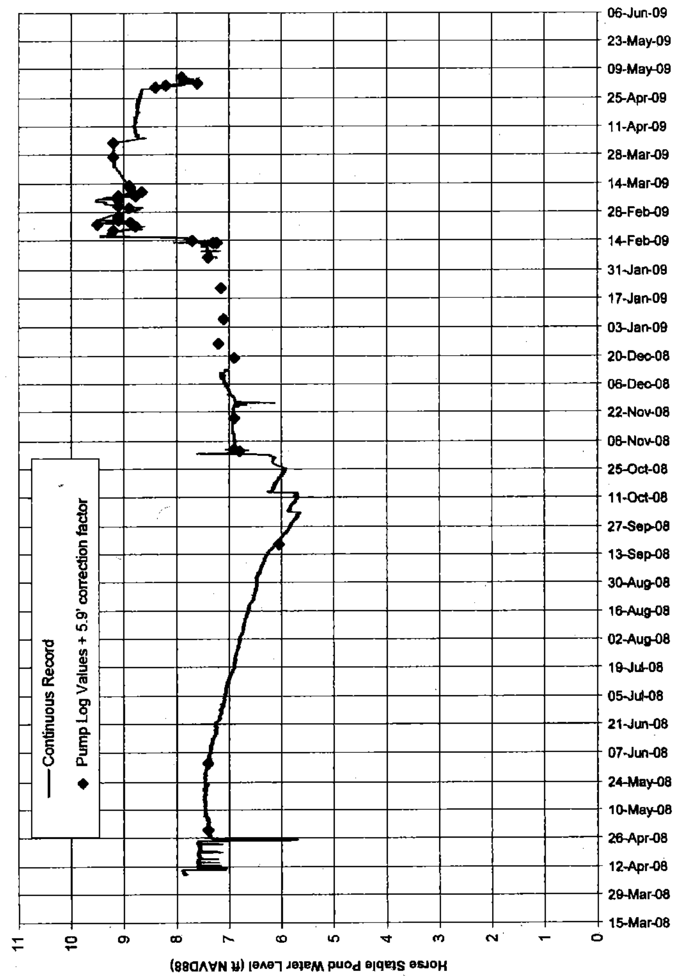
1. Source of hydraulic conductivity values used in water budget – see exhibit

Declaration of Jewel Snavely in Support of Plaintiffs Motion for a Preliminary Injunction, Docket No. 60-2, Ex. 4, and all associated exhibits.

Declaration of John Bowie in Support of Plaintiffs' Motion for a Preliminary Injunction, Docket No. 60-7, Ex. 26, and all associated exhibits.

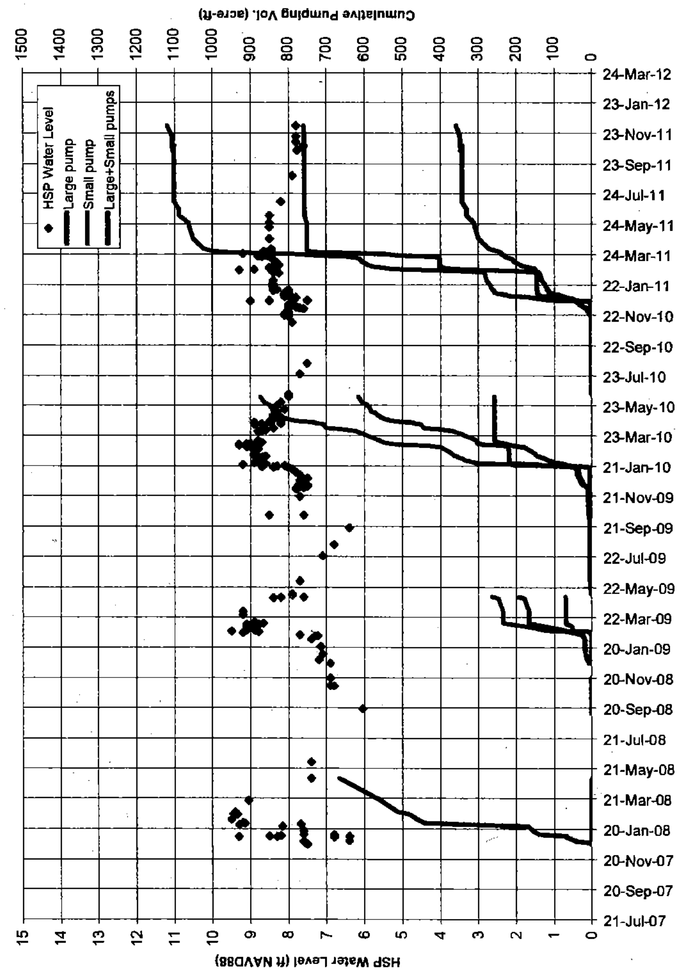
Photos of Horse Stable Pond Pump house 1/18/12.

EXHIBIT D



Continuous Record
Pump Log Values + 5.9' correction factor
Horse Stable Pond Water Level (ft NAVD88)
11
10
9
8
7
6
5
4
3
2
1
0
06-Jun-09
23-May-09
09-May-09
25-Apr-09
11-Apr-09
28-Mar-09
14-Mar-09
28-Feb-09
14-Feb-09
31-Jan-09
17-Jan-09
03-Jan-09
20-Dec-08
06-Dec-08
22-Nov-08
08-Nov-08
25-Oct-08
11-Oct-08
27-Sep-08
13-Sep-08
30-Aug-08
16-Aug-08
02-Aug-08
19-Jul-08
05-Jul-08
21-Jun-08
07-Jun-08
24-May-08
10-May-08
26-Apr-08
12-Apr-08
29-Mar-08
15-Mar-08

EXHIBIT E



Cumulative Pumping Vol. (acre-ft)
HSP Water Level (ft NAVD88)
HSP Water Level
Large pump
Small pump
Large+Small pumps
24-Mar-12
23-Jan-12
23-Nov-11
23-Sep-11
24-Jul-11
24-May-11
24-Mar-11
22-Jan-11
22-Nov-10
22-Sep-10
23-Jul-10
23-May-10
23-Mar-10
21-Jan-10
21-Nov-09
21-Sep-09
22-Jul-09
22-May-09
22-Mar-09
20-Jan-09
20-Nov-08
20-Sep-08
21-Jul-08
21-May-08
21-Mar-08
20-Jan-08
20-Nov-07
20-Sep-07
21-Jul-07

EXHIBIT G

	gpd/ft^2 lower	gpd/ft^2 upper
1 Freeze & Cherry, 1979: clean sand	10.00	60,000
2 USGS, 1987: clean sand	10.00	8,000
3 Driscoll, 1986; fine to coarse sand	0.80	30,000
4 ASCE, 1996; fine to coarse	0.25	24,537
5 Domenico & Scwartz, 1990; coarse sand	1.91	12,720
6 Domenico & Scwartz, 1990; medium sand	1.91	1,060
7 Domenico & Scwartz, 1990; fine sand	0.42	424

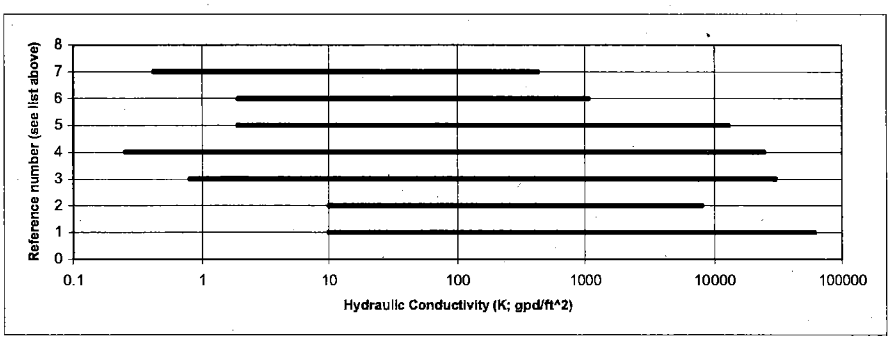
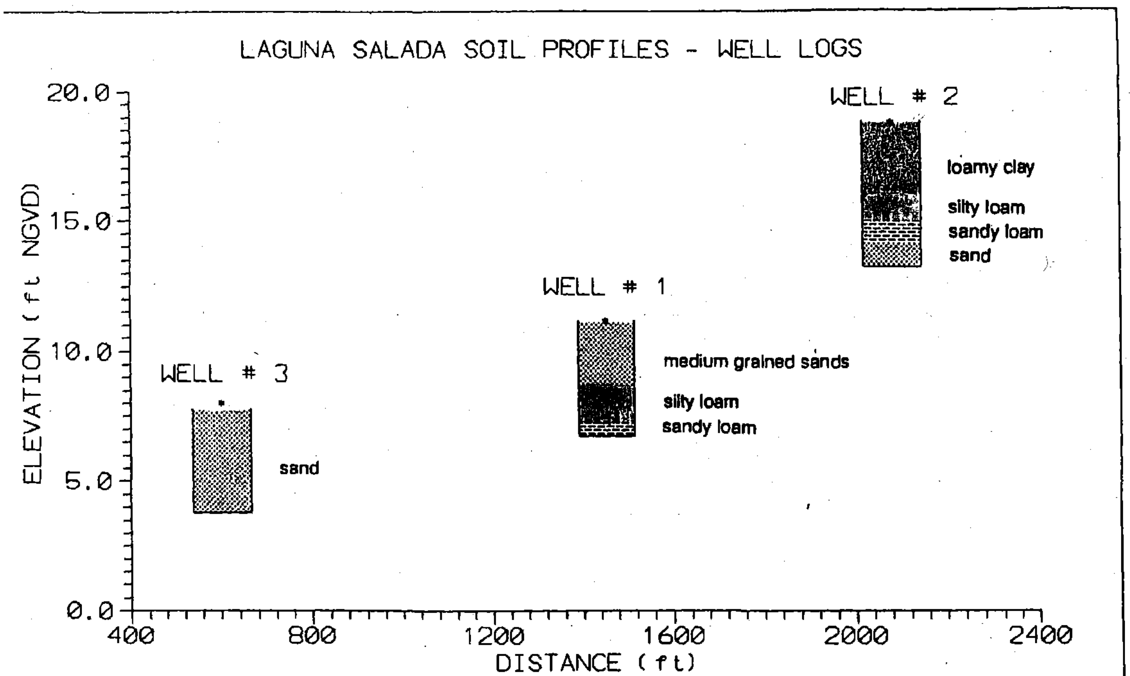


EXHIBIT H



Philip Williams & Associates, Ltd.
Pier 35, The Embarcadero
San Francisco, CA 94133

Figure 22

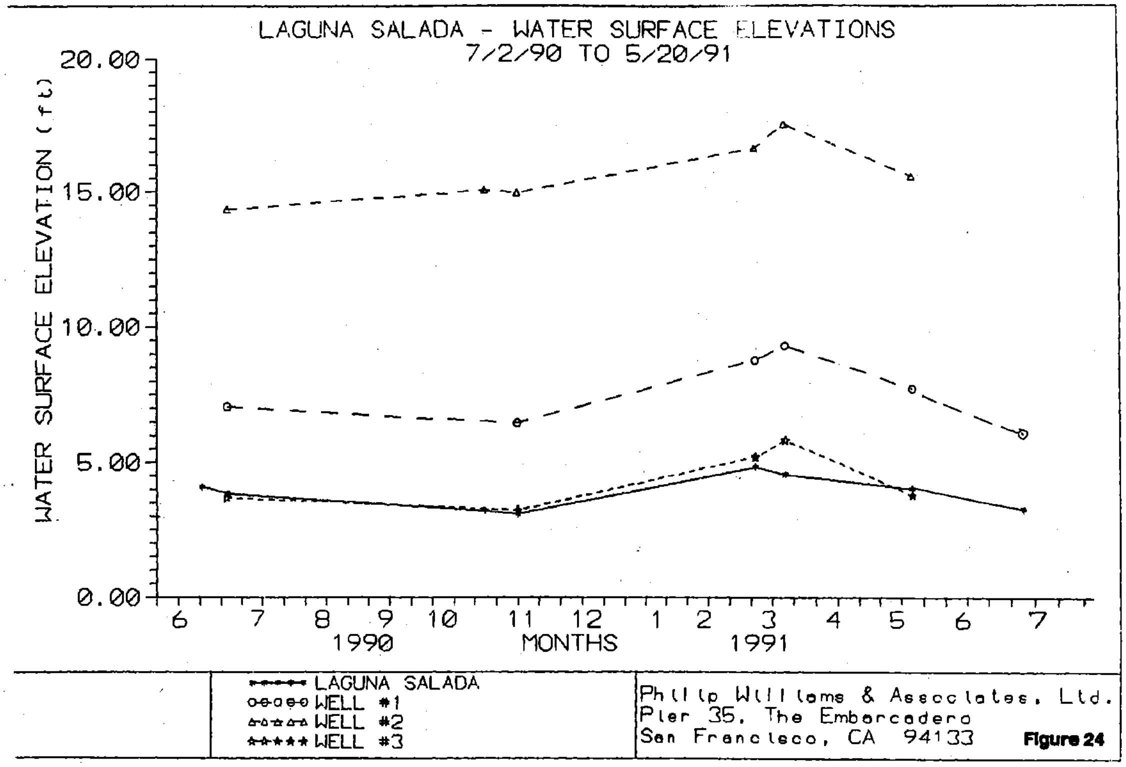


Figure 24

EXHIBIT I

day	Start Pond Level (feet)	Start Volume (AF)	Start Wetted Area (Ac)	GW Outflow - Beach Seepage area (ft^2)	gradient	seepage (AF)	GW Inflow (AF)	End Volume (AF)	End Pond Level (feet)	End Wetted Area (Ac)
1	10.20	135.4	40.2	12,390	0.0088	3.36	0.02	132.1	10.12	39.5
2	10.12	132.1	39.5	12,150	0.0087	3.23	0.02	128.8	10.04	38.9
3	10.04	128.8	38.9	11,919	0.0085	3.11	0.02	125.8	9.96	38.3
4	9.96	125.8	38.3	11,677	0.0083	2.99	0.02	122.8	9.87	37.7
5	9.87	122.8	37.7	11,422	0.0082	2.86	0.02	120.0	9.79	37.1
6	9.79	120.0	37.1	11,177	0.0080	2.74	0.02	117.2	9.71	36.6
7	9.71	117.2	36.6	10,944	0.0078	2.62	0.02	114.6	9.63	36.0
8	9.63	114.6	36.0	10,719	0.0076	2.52	0.02	112.1	9.56	35.5
9	9.56	112.1	35.5	10,505	0.0075	2.42	0.02	109.7	9.49	35.0
10	9.49	109.7	35.0	10,298	0.0073	2.32	0.02	107.4	9.42	34.6
11	9.42	107.4	34.6	10,100	0.0072	2.23	0.02	105.2	9.36	34.1
12	9.36	105.2	34.1	9,909	0.0071	2.15	0.02	103.1	9.30	33.7
13	9.30	103.1	33.7	9,726	0.0069	2.07	0.02	101.1	9.24	33.2
14	9.24	101.1	33.2	9,549	0.0068	2.00	0.02	99.1	9.18	32.8
15	9.18	99.1	32.8	9,379	0.0067	1.93	0.02	97.2	9.12	32.5
16	9.12	97.2	32.5	9,215	0.0066	1.86	0.02	95.3	9.07	32.1
17	9.07	95.3	32.1	9,057	0.0065	1.80	0.02	93.6	9.02	31.7
18	9.02	93.6	31.7	8,904	0.0064	1.74	0.02	91.8	8.96	31.4
19	8.96	91.8	31.4	8,736	0.0062	1.67	0.02	90.2	8.90	31.0
20	8.90	90.2	31.0	8,563	0.0061	1.61	0.02	88.6	8.85	30.7
21	8.85	88.6	30.7	8,398	0.0060	1.54	0.02	87.1	8.79	30.4
22	8.79	87.1	30.4	8,238	0.0059	1.49	0.02	85.6	8.74	30.1
23	8.74	85.6	30.1	8,085	0.0058	1.43	0.02	84.2	8.69	29.9
24	8.69	84.2	29.9	7,937	0.0057	1.38	0.02	82.8	8.64	29.6
25	8.64	82.8	29.6	7,795	0.0056	1.33	0.02	81.5	8.60	29.3
26	8.60	81.5	29.3	7,658	0.0055	1.28	0.02	80.3	8.55	29.1
27	8.55	80.3	29.1	7,526	0.0054	1.24	0.02	79.1	8.51	28.8
28	8.51	79.1	28.8	7,398	0.0053	1.20	0.02	77.9	8.47	28.6
29	8.47	77.9	28.6	7,275	0.0052	1.16	0.02	76.7	8.43	28.4
30	8.43	76.7	28.4	7,156	0.0051	1.12	0.02	75.6	8.39	28.2
31	8.39	75.6	28.2	7,041	0.0050	1.09	0.02	74.6	8.35	28.0
32	8.35	74.6	28.0	6,930	0.0049	1.05	0.02	73.5	8.31	27.8
33	8.31	73.5	27.8	6,822	0.0049	1.02	0.02	72.5	8.28	27.6
34	8.28	72.5	27.6	6,717	0.0048	0.99	0.02	71.6	8.24	27.4
35	8.24	71.6	27.4	6,616	0.0047	0.96	0.02	70.6	8.21	27.2
36	8.21	70.6	27.2	6,518	0.0047	0.93	0.02	69.7	8.18	27.0
37	8.18	69.7	27.0	6,423	0.0046	0.90	0.02	68.9	8.15	26.8
38	8.15	68.9	26.8	6,331	0.0045	0.88	0.02	68.0	8.12	26.7
39	8.12	68.0	26.7	6,241	0.0045	0.85	0.02	67.2	8.09	26.5
40	8.09	67.2	26.5	6,154	0.0044	0.83	0.02	66.4	8.06	26.3
41	8.06	66.4	26.3	6,069	0.0043	0.81	0.02	65.6	8.03	26.2
42	8.03	65.6	26.2	5,987	0.0043	0.79	0.02	64.8	8.00	26.0
43	8.00	64.8	26.0	5,907	0.0042	0.76	0.02	64.1	7.97	25.8
44	7.97	64.1	25.8	5,809	0.0041	0.74	0.02	63.3	7.94	25.5
45	7.94	63.3	25.5	5,712	0.0041	0.71	0.02	62.7	7.90	25.3
46	7.90	62.7	25.3	5,618	0.0040	0.69	0.02	62.0	7.87	25.1
47	7.87	62.0	25.1	5,528	0.0039	0.67	0.02	61.3	7.84	24.9
48	7.84	61.3	24.9	5,440	0.0039	0.65	0.02	60.7	7.82	24.7
49	7.82	60.7	24.7	5,355	0.0038	0.63	0.02	60.1	7.79	24.5
50	7.79	60.1	24.5	5,273	0.0038	0.61	0.02	59.5	7.76	24.3
51	7.76	59.5	24.3	5,194	0.0037	0.59	0.02	58.9	7.73	24.1
52	7.73	58.9	24.1	5,117	0.0037	0.57	0.02	58.4	7.71	23.9
53	7.71	58.4	23.9	5,042	0.0036	0.56	0.02	57.9	7.68	23.7
54	7.68	57.9	23.7	4,970	0.0035	0.54	0.02	57.3	7.66	23.5
55	7.66	57.3	23.5	4,899	0.0035	0.53	0.02	56.8	7.64	23.4
56	7.64	56.8	23.4	4,831	0.0034	0.51	0.02	56.3	7.62	23.2
57	7.62	56.3	23.2	4,765	0.0034	0.50	0.02	55.9	7.59	23.0
58	7.59	55.9	23.0	4,700	0.0034	0.48	0.02	55.4	7.57	22.9
59	7.57	55.4	22.9	4,638	0.0033	0.47	0.02	55.0	7.55	22.7
60	7.55	55.0	22.7	4,577	0.0033	0.46	0.02	54.5	7.53	22.6
61	7.53	54.5	22.6	4,518	0.0032	0.45	0.02	54.1	7.51	22.4
62	7.51	54.1	22.4	4,460	0.0032	0.44	0.02	53.7	7.49	22.3
63	7.49	53.7	22.3	4,404	0.0031	0.42	0.02	53.3	7.47	22.2
64	7.47	53.3	22.2	4,350	0.0031	0.41	0.02	52.9	7.46	22.0
65	7.46	52.9	22.0	4,296	0.0031	0.40	0.02	52.5	7.44	21.9
66	7.44	52.5	21.9	4,245	0.0030	0.39	0.02	52.1	7.42	21.8

day	Start Pond Level (feet)	Start Volume (AF)	Start Wetted Area (Ac)	GW Outflow - Beach Seepage area (ft^2)	gradient	seepage (AF)	GW Inflow (AF)	End Volume (AF)	End Pond Level (feet)	End Wetted Area (Ac)
67	7.42	52.1	21.8	4,194	0.0030	0.39	0.02	51.8	7.41	21.7
68	7.41	51.8	21.7	4,145	0.0030	0.38	0.02	51.4	7.39	21.5
69	7.39	51.4	21.5	4,097	0.0029	0.37	0.02	51.1	7.37	21.4
70	7.37	51.1	21.4	4,050	0.0029	0.36	0.02	50.7	7.36	21.3
71	7.36	50.7	21.3	4,004	0.0029	0.35	0.02	50.4	7.34	21.2
72	7.34	50.4	21.2	3,960	0.0028	0.34	0.02	50.1	7.33	21.1
73	7.33	50.1	21.1	3,916	0.0028	0.34	0.02	49.8	7.31	21.0
74	7.31	49.8	21.0	3,874	0.0028	0.33	0.02	49.5	7.30	20.9
75	7.30	49.5	20.9	3,832	0.0027	0.32	0.02	49.2	7.29	20.8
76	7.29	49.2	20.8	3,792	0.0027	0.31	0.02	48.9	7.27	20.7
77	7.27	48.9	20.7	3,752	0.0027	0.31	0.02	48.6	7.26	20.6
78	7.26	48.6	20.6	3,713	0.0026	0.30	0.02	48.3	7.25	20.5
79	7.25	48.3	20.5	3,675	0.0026	0.30	0.02	48.0	7.23	20.4
80	7.23	48.0	20.4	3,638	0.0026	0.29	0.02	47.7	7.22	20.3
81	7.22	47.7	20.3	3,602	0.0026	0.28	0.02	47.5	7.21	20.2
82	7.21	47.5	20.2	3,566	0.0025	0.28	0.02	47.2	7.20	20.1
83	7.20	47.2	20.1	3,531	0.0025	0.27	0.02	47.0	7.19	20.1
84	7.19	47.0	20.1	3,497	0.0025	0.27	0.02	46.7	7.17	20.0
85	7.17	46.7	20.0	3,464	0.0025	0.26	0.02	46.5	7.16	19.9
86	7.16	46.5	19.9	3,431	0.0024	0.26	0.02	46.3	7.15	19.8
87	7.15	46.3	19.8	3,399	0.0024	0.25	0.02	46.0	7.14	19.7
88	7.14	46.0	19.7	3,368	0.0024	0.25	0.02	45.8	7.13	19.7
89	7.13	45.8	19.7	3,337	0.0024	0.24	0.02	45.6	7.12	19.6
90	7.12	45.6	19.6	3,307	0.0024	0.24	0.02	45.4	7.11	19.5
91	7.11	45.4	19.5	3,278	0.0023	0.24	0.02	45.1	7.10	19.4
92	7.10	45.1	19.4	3,249	0.0023	0.23	0.02	44.9	7.09	19.4
93	7.09	44.9	19.4	3,220	0.0023	0.23	0.02	44.7	7.08	19.3
94	7.08	44.7	19.3	3,192	0.0023	0.22	0.02	44.5	7.07	19.2
95	7.07	44.5	19.2	3,165	0.0023	0.22	0.02	44.3	7.06	19.2
96	7.06	44.3	19.2	3,138	0.0022	0.22	0.02	44.1	7.05	19.1
97	7.05	44.1	19.1	3,112	0.0022	0.21	0.02	43.9	7.05	19.0
98	7.05	43.9	19.0	3,086	0.0022	0.21	0.02	43.7	7.04	19.0
99	7.04	43.7	19.0	3,061	0.0022	0.21	0.02	43.6	7.03	18.9
100	7.03	43.6	18.9	3,036	0.0022	0.20	0.02	43.4	7.02	18.9
101	7.02	43.4	18.9	3,012	0.0021	0.20	0.02	43.2	7.01	18.8
102	7.01	43.2	18.8	2,988	0.0021	0.20	0.02	43.0	7.00	18.7
103	7.00	43.0	18.7	2,964	0.0021	0.19	0.02	42.9	7.00	18.7
104	7.00	42.9	18.7	2,938	0.0021	0.19	0.02	42.7	6.99	18.6
105	6.99	42.7	18.6	2,907	0.0021	0.19	0.02	42.5	6.98	18.5
106	6.98	42.5	18.5	2,878	0.0021	0.18	0.02	42.4	6.97	18.4
107	6.97	42.4	18.4	2,848	0.0020	0.18	0.02	42.2	6.96	18.3
108	6.96	42.2	18.3	2,820	0.0020	0.17	0.02	42.1	6.95	18.3
109	6.95	42.1	18.3	2,792	0.0020	0.17	0.02	41.9	6.94	18.2
110	6.94	41.9	18.2	2,765	0.0020	0.17	0.02	41.8	6.93	18.1
111	6.93	41.8	18.1	2,738	0.0020	0.16	0.02	41.6	6.92	18.0
112	6.92	41.6	18.0	2,712	0.0019	0.16	0.02	41.5	6.91	18.0
113	6.91	41.5	18.0	2,687	0.0019	0.16	0.02	41.3	6.90	17.9
114	6.90	41.3	17.9	2,662	0.0019	0.16	0.02	41.2	6.89	17.8
115	6.89	41.2	17.8	2,638	0.0019	0.15	0.02	41.1	6.89	17.7
116	6.89	41.1	17.7	2,614	0.0019	0.15	0.02	41.0	6.88	17.7
117	6.88	41.0	17.7	2,590	0.0018	0.15	0.02	40.8	6.87	17.6
118	6.87	40.8	17.6	2,568	0.0018	0.14	0.02	40.7	6.86	17.6
119	6.86	40.7	17.6	2,545	0.0018	0.14	0.02	40.6	6.86	17.5
120	6.86	40.6	17.5	2,523	0.0018	0.14	0.02	40.5	6.85	17.4
121	6.85	40.5	17.4	2,502	0.0018	0.14	0.02	40.4	6.84	17.4
122	6.84	40.4	17.4	2,481	0.0018	0.13	0.02	40.2	6.83	17.3
123	6.83	40.2	17.3	2,460	0.0018	0.13	0.02	40.1	6.83	17.3
124	6.83	40.1	17.3	2,440	0.0017	0.13	0.02	40.0	6.82	17.2
125	6.82	40.0	17.2	2,420	0.0017	0.13	0.02	39.9	6.81	17.1
126	6.81	39.9	17.1	2,401	0.0017	0.13	0.02	39.8	6.81	17.1
127	6.81	39.8	17.1	2,381	0.0017	0.12	0.02	39.7	6.80	17.0
128	6.80	39.7	17.0	2,363	0.0017	0.12	0.02	39.6	6.79	17.0
129	6.79	39.6	17.0	2,344	0.0017	0.12	0.02	39.5	6.79	16.9
130	6.79	39.5	16.9	2,326	0.0017	0.12	0.02	39.4	6.78	16.9
131	6.78	39.4	16.9	2,309	0.0016	0.12	0.02	39.3	6.78	16.8
132	6.78	39.3	16.8	2,291	0.0016	0.11	0.02	39.2	6.77	16.8

day	Start Pond Level (feet)	Start Volume (AF)	Start Wetted Area (Ac)	GW Outflow - Beach Seepage area (ft^2)	gradient	seepage (AF)	GW inflow (AF)	End Volume (AF)	End Pond Level (feet)	End Wetted Area (Ac)
133	6.77	39.2	16.8	2,274	0.0016	0.11	0.02	39.1	6.77	16.7
134	6.77	39.1	16.7	2,258	0.0016	0.11	0.02	39.0	6.76	16.7
135	6.76	39.0	16.7	2,241	0.0016	0.11	0.02	38.9	6.75	16.6
136	6.75	38.9	16.6	2,225	0.0016	0.11	0.02	38.9	6.75	16.6
137	6.75	38.9	16.6	2,209	0.0016	0.11	0.02	38.8	6.74	16.6
138	6.74	38.8	16.6	2,194	0.0016	0.11	0.02	38.7	6.74	16.5
139	6.74	38.7	16.5	2,178	0.0016	0.10	0.02	38.6	6.73	16.5
140	6.73	38.6	16.5	2,163	0.0015	0.10	0.02	38.5	6.73	16.4
141	6.73	38.5	16.4	2,148	0.0015	0.10	0.02	38.4	6.72	16.4
142	6.72	38.4	16.4	2,134	0.0015	0.10	0.02	38.4	6.72	16.3
143	6.72	38.4	16.3	2,120	0.0015	0.10	0.02	38.3	6.71	16.3
144	6.71	38.3	16.3	2,106	0.0015	0.10	0.02	38.2	6.71	16.3
145	6.71	38.2	16.3	2,092	0.0015	0.10	0.02	38.1	6.70	16.2
146	6.70	38.1	16.2	2,078	0.0015	0.09	0.02	38.1	6.70	16.2
147	6.70	38.1	16.2	2,065	0.0015	0.09	0.02	38.0	6.70	16.2
148	6.70	38.0	16.2	2,052	0.0015	0.09	0.02	37.9	6.69	16.1
149	6.69	37.9	16.1	2,039	0.0015	0.09	0.02	37.9	6.69	16.1
150	6.69	37.9	16.1	2,026	0.0014	0.09	0.02	37.8	6.68	16.0
151	6.68	37.8	16.0	2,014	0.0014	0.09	0.02	37.7	6.68	16.0
152	6.68	37.7	16.0	2,002	0.0014	0.09	0.02	37.7	6.67	16.0
153	6.67	37.7	16.0	1,989	0.0014	0.09	0.02	37.6	6.67	15.9
154	6.67	37.6	15.9	1,976	0.0014	0.09	0.02	37.5	6.67	15.9
155	6.67	37.5	15.9	1,966	0.0014	0.08	0.02	37.5	6.66	15.9
156	6.66	37.5	15.9	1,954	0.0014	0.08	0.02	37.4	6.66	15.8
157	6.66	37.4	15.8	1,943	0.0014	0.08	0.02	37.3	6.65	15.8
158	6.65	37.3	15.8	1,932	0.0014	0.08	0.02	37.3	6.65	15.8
159	6.65	37.3	15.8	1,921	0.0014	0.08	0.02	37.2	6.65	15.8
160	6.65	37.2	15.8	1,910	0.0014	0.08	0.02	37.2	6.64	15.7
161	6.64	37.2	15.7	1,899	0.0014	0.08	0.02	37.1	6.64	15.7
162	6.64	37.1	15.7	1,889	0.0013	0.08	0.02	37.0	6.64	15.7
163	6.64	37.0	15.7	1,879	0.0013	0.08	0.02	37.0	6.63	15.6
164	6.63	37.0	15.6	1,868	0.0013	0.08	0.02	36.9	6.63	15.6
165	6.63	36.9	15.6	1,858	0.0013	0.08	0.02	36.9	6.63	15.6
166	6.63	36.9	15.6	1,848	0.0013	0.07	0.02	36.8	6.62	15.5
167	6.62	36.8	15.5	1,839	0.0013	0.07	0.02	36.8	6.62	15.5
168	6.62	36.8	15.5	1,829	0.0013	0.07	0.02	36.7	6.62	15.5
169	6.62	36.7	15.5	1,820	0.0013	0.07	0.02	36.7	6.61	15.5
170	6.61	36.7	15.5	1,810	0.0013	0.07	0.02	36.6	6.61	15.4
171	6.61	36.6	15.4	1,801	0.0013	0.07	0.02	36.6	6.61	15.4
172	6.61	36.6	15.4	1,792	0.0013	0.07	0.02	36.5	6.60	15.4
173	6.60	36.5	15.4	1,783	0.0013	0.07	0.02	36.5	6.60	15.4
174	6.60	36.5	15.4	1,774	0.0013	0.07	0.02	36.4	6.60	15.3
175	6.60	36.4	15.3	1,766	0.0013	0.07	0.02	36.4	6.60	15.3
176	6.60	36.4	15.3	1,757	0.0013	0.07	0.02	36.3	6.59	15.3
177	6.59	36.3	15.3	1,749	0.0012	0.07	0.02	36.3	6.59	15.3
178	6.59	36.3	15.3	1,741	0.0012	0.07	0.02	36.2	6.59	15.2
179	6.59	36.2	15.2	1,732	0.0012	0.07	0.02	36.2	6.58	15.2
180	6.58	36.2	15.2	1,724	0.0012	0.07	0.02	36.2	6.58	15.2
181	6.58	36.2	15.2	1,716	0.0012	0.06	0.02	36.1	6.58	15.2
182	6.58	36.1	15.2	1,708	0.0012	0.06	0.02	36.1	6.58	15.2
183	6.58	36.1	15.2	1,701	0.0012	0.06	0.02	36.0	6.57	15.1
184	6.57	36.0	15.1	1,693	0.0012	0.06	0.02	36.0	6.57	15.1
185	6.57	36.0	15.1	1,686	0.0012	0.06	0.02	35.9	6.57	15.1
186	6.57	35.9	15.1	1,678	0.0012	0.06	0.02	35.9	6.57	15.1
187	6.57	35.9	15.1	1,671	0.0012	0.06	0.02	35.9	6.56	15.1
188	6.56	35.9	15.1	1,664	0.0012	0.06	0.02	35.8	6.56	15.0
189	6.56	35.8	15.0	1,656	0.0012	0.06	0.02	35.8	6.56	15.0
190	6.56	35.8	15.0	1,649	0.0012	0.06	0.02	35.7	6.56	15.0
191	6.56	35.7	15.0	1,642	0.0012	0.06	0.02	35.7	6.55	15.0
192	6.55	35.7	15.0	1,635	0.0012	0.06	0.02	35.7	6.55	15.0
193	6.55	35.7	15.0	1,629	0.0012	0.06	0.02	35.6	6.55	14.9
194	6.55	35.6	14.9	1,622	0.0012	0.06	0.02	35.6	6.55	14.9
195	6.55	35.6	14.9	1,615	0.0012	0.06	0.02	35.6	6.55	14.9
196	6.55	35.6	14.9	1,609	0.0011	0.06	0.02	35.5	6.54	14.9
197	6.54	35.5	14.9	1,602	0.0011	0.06	0.02	35.5	6.54	14.9
198	6.54	35.5	14.9	1,596	0.0011	0.06	0.02	35.5	6.54	14.8

day	Start Pond Level (feet)	Start Volume (AF)	Start Wetted Area (Ac)	GW Outflow - Beach Seepage area (ft^2)	gradient	seepage (AF)	GW inflow (AF)	End Volume (AF)	End Pond Level (feet)	End Wetted Area (Ac)
199	6.54	35.5	14.8	1,590	0.0011	0.06	0.02	35.4	6.54	14.8
200	6.54	35.4	14.8	1,584	0.0011	0.05	0.02	35.4	6.53	14.8
201	6.53	35.4	14.8	1,578	0.0011	0.05	0.02	35.4	6.53	14.8
202	6.53	35.4	14.8	1,572	0.0011	0.05	0.02	35.3	6.53	14.8
203	6.53	35.3	14.8	1,566	0.0011	0.05	0.02	35.3	6.53	14.8
204	6.53	35.3	14.8	1,560	0.0011	0.05	0.02	35.3	6.53	14.7
205	6.53	35.3	14.7	1,554	0.0011	0.05	0.02	35.2	6.52	14.7
206	6.52	35.2	14.7	1,548	0.0011	0.05	0.02	35.2	6.52	14.7
207	6.52	35.2	14.7	1,542	0.0011	0.05	0.02	35.2	6.52	14.7
208	6.52	35.2	14.7	1,537	0.0011	0.05	0.02	35.1	6.52	14.7
209	6.52	35.1	14.7	1,531	0.0011	0.05	0.02	35.1	6.52	14.7
210	6.52	35.1	14.7	1,526	0.0011	0.05	0.02	35.1	6.52	14.6
211	6.52	35.1	14.6	1,521	0.0011	0.05	0.02	35.0	6.51	14.6
212	6.51	35.0	14.6	1,515	0.0011	0.05	0.02	35.0	6.51	14.6
213	6.51	35.0	14.6	1,510	0.0011	0.05	0.02	35.0	6.51	14.6
214	6.51	35.0	14.6	1,505	0.0011	0.05	0.02	35.0	6.51	14.6
215	6.51	35.0	14.6	1,500	0.0011	0.05	0.02	34.9	6.51	14.6
216	6.51	34.9	14.6	1,494	0.0011	0.05	0.02	34.9	6.50	14.6
217	6.50	34.9	14.6	1,489	0.0011	0.05	0.02	34.9	6.50	14.5
218	6.50	34.9	14.5	1,485	0.0011	0.05	0.02	34.9	6.50	14.5
219	6.50	34.9	14.5	1,480	0.0011	0.05	0.02	34.8	6.50	14.5
220	6.50	34.8	14.5	1,475	0.0011	0.05	0.02	34.8	6.50	14.5
221	6.50	34.8	14.5	1,468	0.0010	0.05	0.02	34.8	6.50	14.5
222	6.50	34.8	14.5	1,461	0.0010	0.05	0.02	34.7	6.49	14.5
223	6.49	34.7	14.5	1,454	0.0010	0.05	0.02	34.7	6.49	14.4
224	6.49	34.7	14.4	1,448	0.0010	0.05	0.02	34.7	6.49	14.4
225	6.49	34.7	14.4	1,442	0.0010	0.05	0.02	34.7	6.49	14.4
226	6.49	34.7	14.4	1,435	0.0010	0.05	0.02	34.6	6.48	14.4
227	6.48	34.6	14.4	1,429	0.0010	0.04	0.02	34.6	6.48	14.4
228	6.48	34.6	14.4	1,423	0.0010	0.04	0.02	34.6	6.48	14.4
229	6.48	34.6	14.4	1,417	0.0010	0.04	0.02	34.6	6.48	14.3
230	6.48	34.6	14.3	1,411	0.0010	0.04	0.02	34.6	6.48	14.3
231	6.48	34.6	14.3	1,405	0.0010	0.04	0.02	34.5	6.47	14.3
232	6.47	34.5	14.3	1,399	0.0010	0.04	0.02	34.5	6.47	14.3
233	6.47	34.5	14.3	1,394	0.0010	0.04	0.02	34.5	6.47	14.3
234	6.47	34.5	14.3	1,388	0.0010	0.04	0.02	34.5	6.47	14.3
235	6.47	34.5	14.3	1,383	0.0010	0.04	0.02	34.5	6.47	14.2
236	6.47	34.5	14.2	1,378	0.0010	0.04	0.02	34.4	6.47	14.2
237	6.47	34.4	14.2	1,372	0.0010	0.04	0.02	34.4	6.46	14.2
238	6.46	34.4	14.2	1,367	0.0010	0.04	0.02	34.4	6.46	14.2
239	6.46	34.4	14.2	1,362	0.0010	0.04	0.02	34.4	6.46	14.2
240	6.46	34.4	14.2	1,357	0.0010	0.04	0.02	34.4	6.46	14.2
241	6.46	34.4	14.2	1,352	0.0010	0.04	0.02	34.3	6.46	14.2
242	6.46	34.3	14.2	1,347	0.0010	0.04	0.02	34.3	6.46	14.1
243	6.46	34.3	14.1	1,342	0.0010	0.04	0.02	34.3	6.45	14.1
244	6.45	34.3	14.1	1,338	0.0010	0.04	0.02	34.3	6.45	14.1
245	6.45	34.3	14.1	1,333	0.0010	0.04	0.02	34.3	6.45	14.1
246	6.45	34.3	14.1	1,328	0.0009	0.04	0.02	34.2	6.45	14.1
247	6.45	34.2	14.1	1,324	0.0009	0.04	0.02	34.2	6.45	14.1
248	6.45	34.2	14.1	1,319	0.0009	0.04	0.02	34.2	6.45	14.1
249	6.45	34.2	14.1	1,315	0.0009	0.04	0.02	34.2	6.44	14.0
250	6.44	34.2	14.0	1,311	0.0009	0.04	0.02	34.2	6.44	14.0
251	6.44	34.2	14.0	1,306	0.0009	0.04	0.02	34.2	6.44	14.0
252	6.44	34.2	14.0	1,302	0.0009	0.04	0.02	34.1	6.44	14.0
253	6.44	34.1	14.0	1,298	0.0009	0.04	0.02	34.1	6.44	14.0
254	6.44	34.1	14.0	1,294	0.0009	0.04	0.02	34.1	6.44	14.0
255	6.44	34.1	14.0	1,290	0.0009	0.04	0.02	34.1	6.44	14.0
256	6.44	34.1	14.0	1,286	0.0009	0.04	0.02	34.1	6.43	14.0
257	6.43	34.1	14.0	1,282	0.0009	0.04	0.02	34.1	6.43	14.0
258	6.43	34.1	14.0	1,278	0.0009	0.04	0.02	34.1	6.43	13.9
259	6.43	34.1	13.9	1,275	0.0009	0.04	0.02	34.0	6.43	13.9
260	6.43	34.0	13.9	1,271	0.0009	0.04	0.02	34.0	6.43	13.9
261	6.43	34.0	13.9	1,267	0.0009	0.04	0.02	34.0	6.43	13.9
262	6.43	34.0	13.9	1,264	0.0009	0.03	0.02	34.0	6.43	13.9
263	6.43	34.0	13.9	1,260	0.0009	0.03	0.02	34.0	6.43	13.9
264	6.43	34.0	13.9	1,257	0.0009	0.03	0.02	34.0	6.42	13.9

day	Start Pond Level (feet)	Start Volume (AF)	Start Wetted Area (Ac)	GW Outflow - Beach Seepage			GW inflow (AF)	End Volume (AF)	End Pond Level (feet)	End Wetted Area (Ac)
				area (ft^2)	gradient	seepage (AF)				
265	6.42	34.0	13.9	1,253	0.0009	0.03	0.02	34.0	6.42	13.9
266	6.42	34.0	13.9	1,250	0.0009	0.03	0.02	34.0	6.42	13.9
267	6.42	34.0	13.9	1,246	0.0009	0.03	0.02	33.9	6.42	13.9
268	6.42	33.9	13.9	1,243	0.0009	0.03	0.02	33.9	6.42	13.8
269	6.42	33.9	13.8	1,240	0.0009	0.03	0.02	33.9	6.42	13.8
270	6.42	33.9	13.8	1,237	0.0009	0.03	0.02	33.9	6.42	13.8
271	6.42	33.9	13.8	1,233	0.0009	0.03	0.02	33.9	6.42	13.8
272	6.42	33.9	13.8	1,230	0.0009	0.03	0.02	33.9	6.42	13.8
273	6.42	33.9	13.8	1,227	0.0009	0.03	0.02	33.9	6.41	13.8
274	6.41	33.9	13.8	1,224	0.0009	0.03	0.02	33.9	6.41	13.8
275	6.41	33.9	13.8	1,221	0.0009	0.03	0.02	33.8	6.41	13.8
276	6.41	33.8	13.8	1,218	0.0009	0.03	0.02	33.8	6.41	13.8
277	6.41	33.8	13.8	1,215	0.0009	0.03	0.02	33.8	6.41	13.8
278	6.41	33.8	13.8	1,212	0.0009	0.03	0.02	33.8	6.41	13.8
279	6.41	33.8	13.8	1,210	0.0009	0.03	0.02	33.8	6.41	13.8
280	6.41	33.8	13.8	1,207	0.0009	0.03	0.02	33.8	6.41	13.7
281	6.41	33.8	13.7	1,204	0.0009	0.03	0.02	33.8	6.41	13.7
282	6.41	33.8	13.7	1,201	0.0009	0.03	0.02	33.8	6.41	13.7
283	6.41	33.8	13.7	1,199	0.0009	0.03	0.02	33.8	6.41	13.7
284	6.41	33.8	13.7	1,196	0.0009	0.03	0.02	33.7	6.40	13.7
285	6.40	33.7	13.7	1,193	0.0009	0.03	0.02	33.7	6.40	13.7
286	6.40	33.7	13.7	1,191	0.0008	0.03	0.02	33.7	6.40	13.7
287	6.40	33.7	13.7	1,188	0.0008	0.03	0.02	33.7	6.40	13.7
288	6.40	33.7	13.7	1,186	0.0008	0.03	0.02	33.7	6.40	13.7
289	6.40	33.7	13.7	1,183	0.0008	0.03	0.02	33.7	6.40	13.7
290	6.40	33.7	13.7	1,181	0.0008	0.03	0.02	33.7	6.40	13.7
291	6.40	33.7	13.7	1,179	0.0008	0.03	0.02	33.7	6.40	13.7
292	6.40	33.7	13.7	1,176	0.0008	0.03	0.02	33.7	6.40	13.7
293	6.40	33.7	13.7	1,174	0.0008	0.03	0.02	33.7	6.40	13.7
294	6.40	33.7	13.7	1,172	0.0008	0.03	0.02	33.7	6.40	13.6
295	6.40	33.7	13.6	1,169	0.0008	0.03	0.02	33.6	6.40	13.6
296	6.40	33.6	13.6	1,167	0.0008	0.03	0.02	33.6	6.39	13.6
297	6.39	33.6	13.6	1,165	0.0008	0.03	0.02	33.6	6.39	13.6
298	6.39	33.6	13.6	1,163	0.0008	0.03	0.02	33.6	6.39	13.6
299	6.39	33.6	13.6	1,160	0.0008	0.03	0.02	33.6	6.39	13.6
300	6.39	33.6	13.6	1,158	0.0008	0.03	0.02	33.6	6.39	13.6
301	6.39	33.6	13.6	1,156	0.0008	0.03	0.02	33.6	6.39	13.6
302	6.39	33.6	13.6	1,154	0.0008	0.03	0.02	33.6	6.39	13.6
303	6.39	33.6	13.6	1,152	0.0008	0.03	0.02	33.6	6.39	13.6
304	6.39	33.6	13.6	1,150	0.0008	0.03	0.02	33.6	6.39	13.6
305	6.39	33.6	13.6	1,148	0.0008	0.03	0.02	33.6	6.39	13.6
306	6.39	33.6	13.6	1,146	0.0008	0.03	0.02	33.6	6.39	13.6
307	6.39	33.6	13.6	1,144	0.0008	0.03	0.02	33.6	6.39	13.6
308	6.39	33.6	13.6	1,142	0.0008	0.03	0.02	33.5	6.39	13.6
309	6.39	33.5	13.6	1,140	0.0008	0.03	0.02	33.5	6.39	13.6
310	6.39	33.5	13.6	1,139	0.0008	0.03	0.02	33.5	6.39	13.6
311	6.39	33.5	13.6	1,137	0.0008	0.03	0.02	33.5	6.38	13.5
312	6.38	33.5	13.5	1,135	0.0008	0.03	0.02	33.5	6.38	13.5
313	6.38	33.5	13.5	1,133	0.0008	0.03	0.02	33.5	6.38	13.5
314	6.38	33.5	13.5	1,131	0.0008	0.03	0.02	33.5	6.38	13.5
315	6.38	33.5	13.5	1,130	0.0008	0.03	0.02	33.5	6.38	13.5
316	6.38	33.5	13.5	1,128	0.0008	0.03	0.02	33.5	6.38	13.5
317	6.38	33.5	13.5	1,126	0.0008	0.03	0.02	33.5	6.38	13.5
318	6.38	33.5	13.5	1,125	0.0008	0.03	0.02	33.5	6.38	13.5
319	6.38	33.5	13.5	1,123	0.0008	0.03	0.02	33.5	6.38	13.5
320	6.38	33.5	13.5	1,121	0.0008	0.03	0.02	33.5	6.38	13.5
321	6.38	33.5	13.5	1,120	0.0008	0.03	0.02	33.5	6.38	13.5
322	6.38	33.5	13.5	1,118	0.0008	0.03	0.02	33.5	6.38	13.5
323	6.38	33.5	13.5	1,116	0.0008	0.03	0.02	33.4	6.38	13.5
324	6.38	33.4	13.5	1,115	0.0008	0.03	0.02	33.4	6.38	13.5
325	6.38	33.4	13.5	1,113	0.0008	0.03	0.02	33.4	6.38	13.5
326	6.38	33.4	13.5	1,112	0.0008	0.03	0.02	33.4	6.38	13.5
327	6.38	33.4	13.5	1,110	0.0008	0.03	0.02	33.4	6.38	13.5
328	6.38	33.4	13.5	1,109	0.0008	0.03	0.02	33.4	6.38	13.5
329	6.38	33.4	13.5	1,107	0.0008	0.03	0.02	33.4	6.37	13.5
330	6.37	33.4	13.5	1,106	0.0008	0.03	0.02	33.4	6.37	13.5

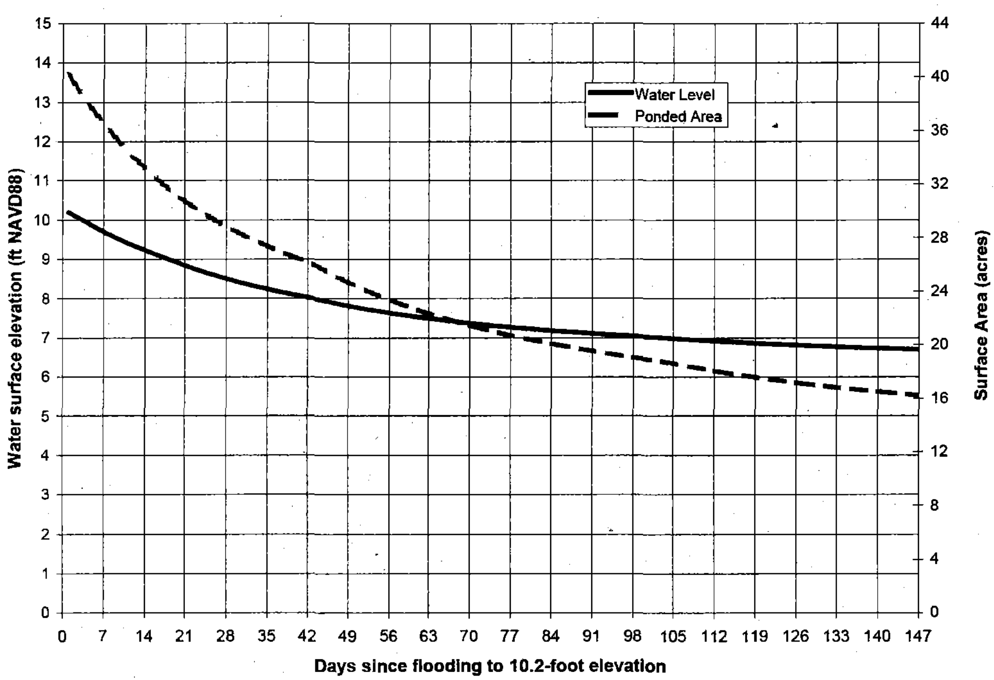
day	Start Pond Level (feet)	Start Volume (AF)	Start Wetted Area (Ac)	GW Outflow - Beach Seepage			GW inflow (AF)	End Volume (AF)	End Pond Level (feet)	End Wetted Area (Ac)
				area (ft^2)	gradient	seepage (AF)				
331	6.37	33.4	13.5	1,105	0.0008	0.03	0.02	33.4	6.37	13.5
332	6.37	33.4	13.5	1,103	0.0008	0.03	0.02	33.4	6.37	13.5
333	6.37	33.4	13.5	1,102	0.0008	0.03	0.02	33.4	6.37	13.5
334	6.37	33.4	13.5	1,100	0.0008	0.03	0.02	33.4	6.37	13.4
335	6.37	33.4	13.4	1,099	0.0008	0.03	0.02	33.4	6.37	13.4
336	6.37	33.4	13.4	1,098	0.0008	0.03	0.02	33.4	6.37	13.4
337	6.37	33.4	13.4	1,096	0.0008	0.03	0.02	33.4	6.37	13.4
338	6.37	33.4	13.4	1,095	0.0008	0.03	0.02	33.4	6.37	13.4
339	6.37	33.4	13.4	1,094	0.0008	0.03	0.02	33.4	6.37	13.4
340	6.37	33.4	13.4	1,093	0.0008	0.03	0.02	33.4	6.37	13.4
341	6.37	33.4	13.4	1,091	0.0008	0.03	0.02	33.4	6.37	13.4
342	6.37	33.4	13.4	1,090	0.0008	0.03	0.02	33.3	6.37	13.4
343	6.37	33.3	13.4	1,089	0.0008	0.03	0.02	33.3	6.37	13.4
344	6.37	33.3	13.4	1,088	0.0008	0.03	0.02	33.3	6.37	13.4
345	6.37	33.3	13.4	1,087	0.0008	0.03	0.02	33.3	6.37	13.4
346	6.37	33.3	13.4	1,085	0.0008	0.03	0.02	33.3	6.37	13.4
347	6.37	33.3	13.4	1,084	0.0008	0.03	0.02	33.3	6.37	13.4
348	6.37	33.3	13.4	1,083	0.0008	0.03	0.02	33.3	6.37	13.4
349	6.37	33.3	13.4	1,082	0.0008	0.03	0.02	33.3	6.37	13.4
350	6.37	33.3	13.4	1,081	0.0008	0.03	0.02	33.3	6.37	13.4
351	6.37	33.3	13.4	1,080	0.0008	0.03	0.02	33.3	6.37	13.4
352	6.37	33.3	13.4	1,079	0.0008	0.03	0.02	33.3	6.37	13.4
353	6.37	33.3	13.4	1,078	0.0008	0.03	0.02	33.3	6.36	13.4
354	6.36	33.3	13.4	1,076	0.0008	0.03	0.02	33.3	6.36	13.4
355	6.36	33.3	13.4	1,075	0.0008	0.03	0.02	33.3	6.36	13.4
356	6.36	33.3	13.4	1,074	0.0008	0.03	0.02	33.3	6.36	13.4
357	6.36	33.3	13.4	1,073	0.0008	0.03	0.02	33.3	6.36	13.4
358	6.36	33.3	13.4	1,072	0.0008	0.03	0.02	33.3	6.36	13.4
359	6.36	33.3	13.4	1,071	0.0008	0.03	0.02	33.3	6.36	13.4
360	6.36	33.3	13.4	1,070	0.0008	0.03	0.02	33.3	6.36	13.4
361	6.36	33.3	13.4	1,069	0.0008	0.03	0.02	33.3	6.36	13.4
362	6.36	33.3	13.4	1,068	0.0008	0.03	0.02	33.3	6.36	13.4
363	6.36	33.3	13.4	1,067	0.0008	0.02	0.02	33.3	6.36	13.4
364	6.36	33.3	13.4	1,067	0.0008	0.02	0.02	33.3	6.36	13.4
365	6.36	33.3	13.4	1,066	0.0008	0.02	0.02	33.3	6.36	13.3

EXHIBIT J

stage (ft)	volume ft^3	area ft^2	volume AF	area acres
0	0	0	0.0	0.0
1	6,000	42,100	0.1	1.0
2	97,000	157,200	2.2	3.6
3	293,000	227,700	6.7	5.2
4	551,000	289,600	12.6	6.6
5	874,000	358,200	20.1	8.2
6	1,271,000	449,400	29.2	10.3
6.5	1,517,000	632,400	34.8	14.5
7	1,870,000	814,700	42.9	18.7
8	2,820,000	1,133,000	64.7	26.0
9	4,048,000	1,376,100	92.9	31.6
10	5,540,000	1,680,500	127.2	38.6
11	7,329,000	2,035,100	168.3	46.7
12	9,510,000	2,459,300	218.3	56.5
13	12,100,000	2,854,800	277.8	65.5
14	15,090,000	3,214,400	346.4	73.8
15	18,440,000	3,553,700	423.3	81.6
16	22,100,000	3,778,500	507.3	86.7
17	25,960,000	3,953,600	596.0	90.8

EXHIBIT D
Reply Declaration of Greg Kamman
Stage-Volume-Surface Area Relationships for
Laguna Salada Project Area

EXHIBIT K



Water Level
Ponded Area
Water surface elevation (ft NAVD88)
Surface Area (acres)
Days since flooding to 10.2-foot elevation
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0 4 8 12 16 20 24 28 32 36 40 44
0 7 14 21 28 35 42 49 56 63 70 77 84 91 98 105 112 119 126 133 140 147

EXHIBIT L

EXHIBIT
Greg Kamman Declaration
Mobile Pumping at Sharp Park Near Lakeside Avenue and Clarendon Road
Sharp Park Golf Course

EXHIBIT G

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

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attention: Kei Zushi - (415) 575-9036 kei.zushi@sfgov.org

via email

October 18, 2013

SUBJECT: Notification of Availability and Intent to Adopt Mitigated Negative Declaration, September 18, 2013, Case No 2012.1427E, Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project; concerns regarding potential environmental effects

To the San Francisco Planning Department:

I would like to submit the following comments on the proposed Mitigated Negative Declaration for the Sharp Park Enhancement Project. These comments follow my scoping comments submitted on January 29, 2013, which are incorporated by reference.

1. **Project purpose of improved lagoon and wetland drainage lacks assessment of significant impacts.**

The project site description on page 3 of the MND explicitly states that the purpose of constructing the 1000 ft long connector channel between Horse Stable Pond (HSP) and Laguna Salada is to drain the lagoon and wetlands within the hydrologically linked wetland complex:

> The Sharp Park Golf Course is located within an 845-acre watershed.1 HSP is located south of LS and consists of an open water pond and a freshwater wetland. It is connected to LS via an approximately **1,000-foot-long channel that was constructed to drain water from the lagoon to HSP, and together these three features form a wetland complex.**
>
> MND p. 3 (emphasis added)

Page 4 of the MND explains that the growth of tules and cattails in the connector channels impairs the drainage of the lagoon by pumps at HSP, consistent with conclusions of Kamman

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(2009). The description of the proposed project activities on page 5 of the MND states that the channel would be cleared of vegetation and sediment to remedy obstruction of flows between HSP and the main pond or lagoon, improving ability to drain water from the lagoon by pumping: "3) removal of sediment and emergent vegetation within HSP and the connecting channel that links HSP with LS". The MND, however, completely fails to assess the hydrological and ecological impacts of increasing drainage of the lagoon by increasing hydraulic connectivity between the main lagoon pond and HSP, even though it is clearly the basic purpose of the action. Any significant change in the duration and depth of flooding or soil saturation in lagoon wetlands has important ecological effects. Increased drainage of wetlands, above baseline (pre-project) conditions is a potentially significant impact I cited in my scoping comments on this project (Baye 2013). My scoping comments appear to be entirely ignored about this most basic modification of lagoon wetland hydrology, and their impacts on further spread of cattails and tules. To reiterate my scoping comments from 29 January 2013 regarding wetland hydrology impacts on wetland vegetation and habitat structure:

Lagoon drainage (pumping) effects

- What are the impacts of lowered lagoon water levels (lagoon drawdown) on the spread of cattails and tules over the lagoon bed? (potential indirect significant impact)

- What are the baseline (pre-project) effects of lagoon drainage (pumping, lowering lagoon levels) on water depths and the spread of cattails and tules on the lagoon bed? (baseline for assessment of potential indirect significant impact)

- What does SFRPD assume to be the critical limiting water depth range, and duration of limiting flood depth, for tules and cattails? (threshold for potential indirect significant impact)

- How long, and in what time of year, would areas of the lagoon be lowered to submergence depths that are shallower than the presumed critical depth for restricting spread of cattails beyond their pre-project extent? (threshold and mechanism for potential indirect significant impact)

- What is the *minimum area* of the lagoon bed that would be maintained at depths beyond the limits of submergence tolerance of cattails and tules? (threshold for potential indirect significant impact)

- What is the *maximum duration* of drawdown (lagoon lowering) to depths shallower than the limit of submergence tolerance of cattails and tules? (threshold for potential indirect significant impact)

- How will maintenance of low lagoon levels prior to storms (lagoon drawdown for stormwater detention capacity) affect the *vulnerability of the lagoon to seawater flooding during oceanic storm overwash events*? How much will drawing down the lagoon prior to storms impair the lagoon's capacity trap heavier seawater overwash flooding at the lagoon bottom by stratification of heavier saltwater under lighter freshwater? How much would lagoon drawdown

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during winter storm season expose the marsh shoreline to potential direct ocean water flooding, or flooding by less diluted seawater, compared with full freshwater-flooded lagoon conditions? (threshold and mechanism for potential indirect long-term significant impact)

- How will maintenance of proposed target lagoon levels affect the *elevation range* of freshwater and fresh-brackish marsh habitat of listed threatened and endangered wildlife species in relation to the elevation range of rising sea level or potential storm oceanic overwash flooding?

The MND completely fails to address potentially significant direct and indirect hydrological impacts of the proposed project's drainage component on Laguna Salada wetlands, despite my detailed scoping comments on this subject. There is no proposed mitigation for increasing the drainage of the lagoon, and making its bed shallower more often than pre-project conditions. Increasing the drainage of the lagoon will increase the spread of cattails and tules over the remaining open water. Cattails and tules are primarily limited by water depth and duration, which is directly affected by drainage and pumping. SFRPD continues to provide no direct evidence of significant recent sedimentation within the main lagoon pond commensurate with the timing, rate or magnitude of cattail and tule spread. The proposed project will likely accelerate the spread of tules and cattails. This will foreseeably result in even more misguided proposals to dredge the lagoon to remedy fictional "sedimentation" problems and "vegetation overgrowth" that is in fact directly related to the drainage of the lagoon.

2. Salinity and seawater sources of sulfur

Oligohaline (fresh-brackish) lagoon salinity is incorrectly reported as "freshwater", inconsistent with Tetra Tech 2009 and Kamman 2009. The project description in the MND on page 3, and subsequently, describes the lagoon as a "freshwater" pond and wetlands. This is incorrect, and is inconsistent with the hydrological assessment of Laguna Salada prepared for SFRPD by Tetra Tech (2009), based on the hydrologic report on Laguna Salada by Kamman (2009; Appendix A in Tetra Tech 2009). The SFRPD's own hydrological studies report salinity range between 0.7 and 2.5 parts per thousand (ppt). This salinity range is also correctly stated on p. 94 of the MND. This salinity range is oligohaline, not "freshwater", and is physiologically and ecological significant. It indicates a persistent dilution of salts from seawater either seeping through the Salada Beach, residual salinity in the bed sediments. Seawater sources of salinity include sulfates, a source of sulfur affecting bed sediments and coastal wetland soils. The MND is inconsistent in its statement of lagoon salinity, and incorrect in characterizing it as "freshwater".

Kamman (2009) described "freshwater" as salinity < 1.0 ppt. He reported that the earthen "seawall" eliminates characteristic (natural) episodic tidal exchange between the ocean and lagoon, but it did not state that all hydrologic connectivity is lacking between the lagoon and ocean. On the contrary, Kamman reported evidence of probable groundwater connectivity between lagoon and ocean through beach seepage, and recorded relatively saline groundwater with a salinity of 15 ppt (nearly half seawater salinity concentration) was observed in the sandy flat between Laguna Salada and the earthen seawall. This is also not consistent with the MND's claim of "freshwater" pond and wetlands. Note that cattail and tule marsh vegetation dominance occurs in both freshwater and oligohaline wetlands, and is not diagnostic of freshwater salinity range.

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The incorrect statement of lagoon salinity is important because the MND invalidly relies on the assumption that exclusion seawater salts from the lagoon precludes the occurrence of sulfur from seawater to fuel significant sulfide reduction in organic, anoxic sediments. Obviously, the consistent low salinity in the lagoon indicates seawater salts are always present – including sulfate, the next most abundant anion in seawater after chloride.

3. **Sulfide and acid sulfate biogeochemical impacts and mitigation.**

The explanation of sulfur oxidation-reduction sediment biogeochemistry on page 96 of the MND (water quality) is essentially accurate, but it is inconsistent with the utterly confused explanation on pp. 76-77 of the MND, which garbles hypoxia, pH, and inconsistent oxidation-reduction states associated with aerobic and anaerobic sediments. Acid sulfates are the oxidized forms of sulfur compounds, not the reduced forms (sulfides) associated with hypoxia and anoxia. The temporary suspension of anoxic iron sulfide-rich sediment, and free hydrogen sulfide (rotten egg scent) in the water column is the cause of acute hypoxia. Oxidative formation of acid sulfates and iron oxides is a slow process occurring over many days or weeks in aerobic conditions.
The MND argues on p. 77 that since no acid sulfate conditions were detected in the last episode of dredging 10 years ago, the impact is unlikely. This is utterly fallacious, since no measurements of soil sulfate levels or pH were sampled. An even more ludicrous fallacy on p. 77 is the exclusion of tidal flows precludes the existence of sulfur sources in sediments. Obviously, if salinity range is up to 2.5 ppt, and the only original salinity source is seawater, sulfates (the second most abundant anion in seawater) is present in the oligohaline sediments. Moreover, I provided direct observation of both iron sulfide and hydrogen sulfide in near-surface anoxic sediments of the exposed bed of Laguna Salada in the ESA-PWA report (ESA-PWA 2010). Strongly sulfidic sediments are ubiquitous and conspicuous throughout the lagoon complex, and readily detectible by any qualified wetland ecologist who looks for them. It is disingenuous of the MND, as well as flatly incorrect, to assert that they are "unlikely"

Proposed mitigation M-Bio-2b fails as a CEQA mitigation measure because it provides no objective chemical standard or biological criteria or threshold for sulfide concentrations, pH, Biological Oxygen Demand (a measure of hypoxia in the suspended sediment plum around dredging sites), or redox thresholds for significant biological impacts. It instead relies on purely subjective voluntary submittal of data (not evidence of actual consultation and reply!) with resource agencies, with no evidence that resource agencies have staff resources or commitments to comply with the mitigation measure. The mitigation measure is vague, programmatic, and unenforceable. Dredge sediments are routinely sampled for aquatic impacts throughout the San Francisco Bay area. It is seldom that dredging occurs in nontidal wetlands with endangered species (for good reason), but the analytic methods for assessing aquatic impacts of hypoxic sediment plumes during dredging are established. They are not cited by the MND. Nor does the MND show any evidence of consultation with the RWQCB – SFB for appropriate dredge sediment and water quality protocols adapted to the distinctive setting of Laguna Salada, including specific criteria for water column hypoxia and sulfide toxicity during dredging. Hypoxia and sulfide toxicity are not the same chemical phenomenon, even though they are physically related by suspension of reduced iron sulfide-rich sediment.
The MND is deficient in basic understanding of acid sulfate soils, sulfur oxidation-reduction sediment processes, and ecotoxicity. Below is a limited sample of relevant scientific literature to support improved understanding.

Bagarinao, T. 1992. Sulfide as an environmental factor and toxicant–Tolerance and adaptations in aquatic organisms. *Aquat.Toxicol.* 24:21–62. doi: 10.1016/0166-445X(92)90015-F

Beauchamp, R.O., Bus, J.S., Popp, J.A., Boreiko, C.J., Andjelkovich, D.A., and Leber, P. 1984. A critical review of the literature on hydrogen sulfide toxicity. *Crit. Rev. Toxicol.* 13, 25–97.doi: 10.3109/10408448409029321

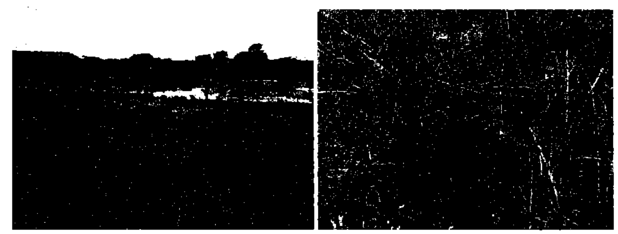
Connell, W.E., and Patrick, W.H. Jr. 1968. Sulfate reduction in soil: effects of redox potential and pH. *Science* 159, 86–87.doi:10.1126/science.159.3810.86

Dent, D. 1986. Acid Sulphate Soils: a Baseline for Research and Development. Wageningen: ILRI Publ. http://www2.alterra.wur.nl/Internet/webdocs/ilri-publicaties/publicaties/Pub39/pub39-h1.0.pdf

Dent, D. and Dawson, B. undated. The Acid Test: an expert system for acid sulfate soils. http://www.isric.org/sites/default/files/AcidSKit/identman.pdf

Lamers, L.P.M., Tomassen, H.B.M., and Roelofs, J.G.M. 1998. Sulfate- induced eutrophication and phytotoxicity in freshwater wetlands. *Environ. Sci. Technol.* 32, 199–205.

Lamers, Leon P.M., Josepha M.H. van Diggelen, Huub J.M. Opden Camp, Eric J.W. Visser, Esther C.H.E.T. Lucassen, Melanie A. Vile, Mike S.M. Jetten, Alfons J.P. Smolders and Jan G.M. Roelofs. 2012 Microbial transformations of nitrogen, sulfur, and iron dictate vegetation composition in wetlands: a review. Frontiers in Microbiology 26:1-12. *doi: 10.3389/fmicb.2012.00156*



Iron oxide surface films and iron sulfide accumulation of muds exposed by artificial lagoon drawdown at Laguna Salada, 2010. Iron oxide (orange-brown mineral films indicative of oxidation of iron sulfide and acid sulfates in brackish coastal sediments subject to alternating strong hypoxia and oxidation) are apparent in drawdown-emergent muds at the northeast end of Laguna Salada (left). Organic-rich sediment immediately below the iron oxide-stained surface sediment film is deep black (right), indicative of toxic iron sulfide, formed under strong anoxic bottom conditions, exposed at the marsh surface by artificial drawdown of the lagoon.

4. **Archaeological resources and significant impacts.**

The MND on page 30 states that the project could have significant impacts on buried archaeological resources, given the location of known midden sites, and the depth of proposed excavation. The proposed mitigation to reduce this significant impact to less than significant levels relies entirely on excavation equipment operators with no expertise in detection of archeological artifacts (such as shells, bones, heat-altered rocks, bone or stone tools, or flaked stone) to detect "accidental discovery" in excavated jet-black iron sulfide-stained organic much during excavation, and in time to cease excavation and disturbance upon detection. This is not a credible or feasible mitigation measure. I have ample experience over two decades observing excavation and dredging of coastal wetland and aquatic sediments, including strongly organic and sulfidic muds like those that occur in Horse Stable Pond. Organic and iron-sulfide staining of bulk sediment removal would render any small midden artifacts utterly undetectable in the absence of sorting (sieving) and washing. The mitigation measure proposed is infeasible. Advance assessment of archeological resources (a sampling plan prepared by a qualified archeologist) at proposed dredging sites would be required to detect buried archeological resources in organic, iron sulfide-stained fine sediments.

Sincerely,

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Literature Cited

Baye, P. 2013. Scoping comment letter in response to Notification of Project Environmental Review dated January 15, 2013, Case No 2012.1427E, Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project; concerns regarding potential environmental effects . submitted January 29, 2013.

ESA-PWA, Peter Baye, and Dawn Reis. 2010. Preliminary Ecosystem Restoration Feasibility Assessment, Laguna Salada, Pacifica, CA. Report prepared for Wild Equity.

Kamman, G. 2009. Sharp Park Conceptual Restoration Alternatives Report. APPENDIX A: HYDROLOGICAL REPORT. In: Tetra Tech (2009).

Tetra Tech, K. Swaim, and Nickels Golf Group. 2009. Sharp Park Conceptual Alternatives Report. Prepared for San Francisco Recreation and Parks Department.

CRITICAL REVIEW OF THE BIOLOGICAL ASSESSMENT for the "SHARP PARK SAFETY, INFRASTRUCTURE IMPROVEMENT AND HABITAT ENHANCEMENT PROJECT" (MAY 2012), Pacifica, San Mateo County, California

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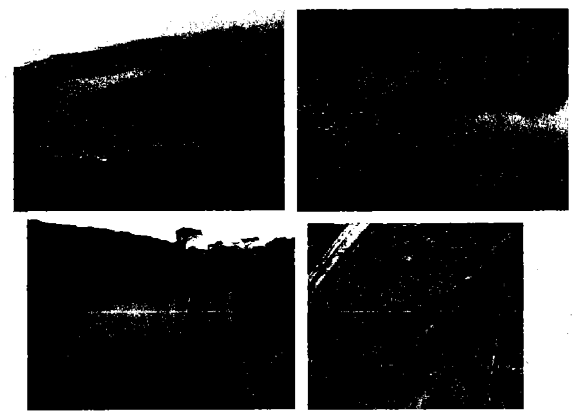


Prepared for Wild Equity Institute, Oakland, California
June 2012

1.0. Introduction

The purpose of this critical review is to provide an independent assessment of the following aspects of the Biological Assessment (BA) for the Sharp Park (...Infrastructure...) Project, prepared by the San Francisco Recreation and Parks Department , March 2012, revised May 2012:

- ecological validity and accuracy of the BA's assumptions and findings
- critical omissions of ecological information presented in the BA
- feasibility of the proposed take minimization measures
- consistency of BA proposals with recovery plans for the two listed species featured, San Francisco garter snake (SFGS) and California red-legged frog (CRLF)
- internal consistency of the BA, and consistency with other SFRPD background documents on Sharp Park/Laguna Salada wetlands and endangered species
- consistency with ESA regulations regarding biological assessments and preparation of BAs by designated non-federal representatives of the lead Federal agency

My qualifications to provide critical scientific and regulatory review of the BA are based on my professional experience (over 30 years) in coastal wetland and terrestrial ecology, my academic background in coastal ecology (Ph.D. University of Western Ontario), and my experience preparing and reviewing biological assessments and conducting formal and informal Section 7 ESA consultations for the U.S. Army Corps of Engineers (USACE) and U.S. Fish and Wildlife Service (USFWS), as well as preparing endangered species recovery plans (coastal wetland and terrestrial ecosystems) for USFWS. One of my areas of specialization is restoration and management of fresh-brackish coastal California lagoons. I was lead ecologist co-author of two California State Parks lagoon management/restoration plans supporting California red-legged frogs in the central coast region (Laguna Creek and Pilarcitos Creek lagoons), and I have provided consulting services and peer review for on coastal lagoon enhancement and restoration projects in

State Parks and National Parks jurisdiction in this region (Rodeo Lagoon, Crissy Field (Presidio) Lagoon, Big Lagoon, Scott Creek Lagoon, Waddell Creek Lagoon). I was lead ecologist and co-author of a 2011 technical report on Laguna Salada wetland restoration alternatives (ESA-PWA 2011), and I was an invited speaker to the Sharp Park advisory working group convened by San Francisco Recreation and Parks Department in November 2010, where I presented an introduction to California coastal lagoon wetlands, with an emphasis on Laguna Salada and similar lagoons.

I have reviewed in detail both the BA and its principal supporting documents, including the San Francisco Recreation and Parks Department (SFRPD) alternatives report on Sharp Park (Tetra Tech et al. 2009), including appendix reports on hydrology (KHE 2009) and special-status wildlife (Swaim 2008). As indicated in the comprehensive Laguna Salada ecosystem restoration report I co-authored (ESA-PWA et al. 2011, not cited in the BA), I have detailed, first-hand knowledge of the Laguna Salada barrier beach and backbarrier wetland complex.

My critical review of the BA is presented below, organized by sections emphasizing scientific, feasibility, and regulatory issues of specific BA proposals (Section 2.0), followed by more general review of key scientific and technical issues in or omitted by the BA (Section 3.0), section-specific corrections of erroneous information in the BA (Section 4.0), and conclusions and recommendations (Section 5.0).

2.0. Critical review of specific key Biological Assessment proposals

2.1. The BA proposes dredging of anoxic, high-sulfide lagoon bed and marsh sediments without standard prior sediment testing or mitigation for hypoxia and sulfide toxicity due to suspended anoxic sediments.

The BA proposes to dredge sulfidic anoxic sediments in the primary breeding habitat (HSP) of LS. The BA does not include any proposals to conduct routine dredge sediment testing toxic sulfide and ammonia sediment concentrations, or redox potential, even though the environment is a coastal lagoon immediately behind a barrier beach with a long history of fresh-brackish (marine sulfur enriched) hydrology and organic sediment to fuel microbial reduction to sulfide. Hydrogen sulfide is readily detectible by scent in disturbed bed sediments at Horse Stable Pond, and the color of sediment 1 mm below the surface is jet-black with iron sulfide. There is no question that these sediments are highly reduced, anoxic and sulfidic. There is also no question that sulfidic sediments oxidize to form acid sulfates and iron oxide (rust-colored sediment) when exposed to aerobic environments. Yet the BA fails to disclose or mitigate *forseeable* significant potential local impact of hypoxia events due to dredge-induced resuspension of anoxic, highly reduced (sulfidic) bottom sediment. Hypoxia, and associated pulses of toxic ammonia and sulfides in anoxic sediment dispersed in suspended sediment plumes are potentially lethal to CRLF tadpoles during and following dredging (ESA-PWA et al. 2011). The small size and lack of refuge from suspended sediment plumes in the small, enclosed HSP lagoon may intensify this foreseeable impact. The proposal to dredge anoxic, sulfidic coastal lagoon sediments without dredge sediment testing, particularly at HSP, the sub-region of Laguna Salada where Swaim (2009) found relatively higher frequency of egg masses, is an undisclosed significant source of potential incidental take that is not minimized by any proposed measures.

2.2. The BA proposes dredging of marsh as "enhancement" without evidence or other rational ecological basis.

The BA falsely proposes dredging to "enhance" CRLF habitat at Horse Stable Pond which it reports is nearly 50% open water and marsh. The BA provides no evidence that the relatively high proportion of open water, and high linear extent of freshwater marsh and open water, are currently limiting factors for CRLF breeding success at HSP, and are contradicted by SFRP's own data on the frequency of egg masses (Swaim 2009), which indicated relatively higher egg mass deposition at HSP at least in 2008. The BA fails to provide any evidence-based analysis of limiting factors for reproductive success of CRLF at Laguna Salada, and relies on selective and subjective judgment that arbitrarily excludes evidence from a contemporary comprehensive analysis of wetland degradation (PWA 2011). The BA fails to cite any precedent (previous USFWS-authorized CLRF habitat enhancement project for recovery of the species, or recovery plan guidance) or

other rational basis for dredging anoxic fresh-brackish sulfidic marsh substrate as an alleged "enhancement" for CRLF. The BA arbitrarily leaps to the conclusion that dredging, which the applicant desires for the independent purpose of pumping and draining the lagoon and its wetlands, has sufficient independent utility as an "enhancement" for CRLF habitat, without an analysis of risks (see discussion of anoxic and sulfidic lagoon bed sediments and lack of sediment testing, above).

The implicit rationale for dredging Laguna Salada to "enhance" habitat appears to be based on a false (partial) analogy with an entirely different marsh habitat supporting CRLF and SFGS: San Francisco International Airport's West of Bayshore marsh, where marsh excavation has been authorized to increase interspersed open water and marsh habitat for SFGS. The Bayshore freshwater marsh, unlike Laguna Salada, *exhibited clear evidence of terrestrial sediment deposition and infilling of the marsh*, and loss of interspersed open water/emergent (cattail) marsh edge due to significant terrestrial sediment accretion from urban flood control and storm drainage channels that discharge directly into the marsh. The Bayshore marsh is *not artificially drained by pumps with 10,000 gpm capacity that cause water level drawdown* causing cattails and tules to grow in what would otherwise be excessively deep water. Shallow water depths at Bayshore favoring cattails are caused by urban stormwater sedimentation. Bayshore marsh is passively drained by gravity through flapgates. In contrast, Laguna Salada, is drained by a 10,000 gpm pump that causes rapid drawdown and is the primary control of sustained low water levels (KHE 2009) – year-round drawdown – that promote cattails and tules invasion over the artificially shallow lagoon bed. There is no evidence presented in the BA or supporting documents for any significant current or recent terrestrial sediment discharge from Sanchez Creek into Laguna Salada/ Horse Stable Pond. Sanchez Creek discharges into a large willow thicket and broad marsh before it discharges into HSP, and its banks are densely vegetated, lacking sediment deposits. *Permanent drawdown of lagoon water levels*, not substrate elevation change, are what drive tule-cattail marsh vegetation encroachment of Laguna Salada (ESA-PWA et al. 2011).

There is no dispute that pumping out freshwater from Laguna Salada controls the low lagoon levels all year round, regardless of drought or high rainfall, and the low level of variability in lagoon water levels. The SFRPD's own hydrology report (KHE 2009, Appendix A in Tetra Tech et al. 2009) states:

> Inter-annual variability of water levels in the wetlands is low due to the operation of the pumping station. Early spring water levels in the pond areas are consistent between dry, normal, and wet water year types because water level is controlled by the pumping station. (KHE 2009 p. 5)

The BA does not explain that the lagoon would fill (submerging marsh) naturally even in dry years, but for the pumps that maintain drawdown of the lagoon:

> Results from a water budget investigation reveal that the *system is supplied with adequate water to fill the ponds even in dry years*. (KHE 2009, p. 5)

The BA (and Tetra Tech 2009 report) *neither provides nor cites evidence of significant terrestrial sedimentation or bed substrate elevation change at Laguna Salada*. There is no such evidence: the bed surface is fine aquatic muck produced by decomposing algae and vascular plant detritus. That is a fundamental hydrogeomorphic difference between Bayshore and Laguna Salada wetland habitats of CRLF and SFGS. The remedy for habitat degradation at Bayshore's overgrown, overfilled cattail marsh does not apply to Laguna Salada, which has a former deepwater lagoon bed overgrown with cattail and tule because it is excessively drained of freshwater inflows and made shallow by high capacity pumps. In essence, the BA proposes to increase open water/marsh edge by lowering lagoon bed elevations artificially, rather than allow the fresh water levels to rise naturally in winter, so the lagoon remains in a state of permanent drawdown all year round. This is a radical contrast with Bayshore marsh.

2.3. The BA-proposed permanent program of CRLF egg mass translocation is not take minimization, and is apparently not consistent with the approved recovery plan for CRLF.

The BA proposes permanent egg mass translocation program that appears to be

inconsistent with the approved recovery plan for CRLF, and requests authorization of "incidental" take that is not incidental, but primary purpose of translocation. The proposed annual "relocation"of egg masses *in perpetuity*, with USFWS consultation appears to *conflict with the Service's approved final recovery plan for CRLF, which states that relocation is ineffective even for single event relocation of adults* (cited under "inadequate regulatory mechanisms" in the Recovery Plan). Egg mass relocation is not "incidental take" caused by some other permitted activity regulated by the Corps of Engineers permit. It appears to be a request for authorization of direct take of CRLF that is for a stand-alone purpose of allowing the City to drain the lagoon's fringing wetlands so golf can be played in wetland portions of the golf course in winter, and not a valid recovery purpose. This is an extraordinary precedent for "incidental" take authorization (and precedent for mitigation of CRLF impacts) that appears to be inconsistent with the recovery plan of the species. It is a particularly problematic "incidental take minimization" request because it is made in the absence of any assessment of feasible alternate actions to avoid mass stranding of egg masses due to rapid wetland drainage and drawdown.

The proposal to "minimize" incidental take by instituting a program of annual egg mass translocation in perpetuity with USFWS authorization is essentially unenforceable in the absence of any criteria for receptor habitat selection, or proposed quantitative monitoring and reporting of

- egg survivorship following translocation,
- tadpole recruitment and survivorship following translocation
- "control" (reference) group egg survivorship and tadpole recruitment
- estimated carrying capacity of receptor habitat,
- within-year and long-term populations trends
- water surface elevation thresholds and drawdown rates

The BA is essentially proposing a permanent policy of CRLF egg mass translocation without even minimum monitoring to provide the Service with a reasonable basis for evaluating its efficacy at minimizing take, or causing long-term decline of the CRLF population. This is inconsistent with the monitoring recommendations of the CRLF recovery plan, and is an unreasonable and scientifically invalid approach for take minimization.

2.4 Proposed gopher management impacts and "take" of SFGS and CRLF.

The BA proposes to set gopher traps and reduce gopher abundance in uplands bordering Laguna Salada. The BA fails to identify the risk of incidental "take" of SFGS or CRLF due to gopher traps, or *provide any measures for monitoring or minimizing potential take due to traps*. The recovery plans for both listed species, as well as the SFRPD's own supporting documents cited in the BA identify small mammal burrows as potential important foraging habitat for SFGS, and potential moisture refuges for their amphibian prey species (tree frogs and CRLF). The BA appears to provide insufficient information to support the BO's effects analysis of the risk of incidental "take" of SFGS or CRLF due to gopher burrow destruction or suppression. The BA provides no support to the BO regarding meaningful monitoring or assessment of either take or impacts of gopher suppression on listed species.

2.5 "Survey" methods based on disturbance of endangered species and habitat: "take" equivalent of hazing and habitat degradation activities proposed as survey method.

The BA's so-called "take minimization" measure at 2.3.8 proposes to "survey" for SFGS and CRLF in uplands bordering Horse Stable Pond by *mowing vegetation to a height of 4 inches*, reducing cover and exposing listed species to active disturbances and hazards of injury from mowing. Vegetation mowing in presumed occupied habitat of SFGS and CRLF is n*ot a survey method consistent with either the recovery plans of the two listed species, or take minimization,* and it is not rational: the "survey" method would itself reduce the likelihood of subsequent occurrence of the target species, which itself suggests

the primary and undisclosed purpose of this extraordinary and unwarranted "survey" method. This measure has the appearance of hazing and affirmative habitat degradation rationalized as monitoring.

2.6 The BA fails to assess any reasonable alternatives with less adverse cumulative impact and "take" of endangered species.

The Service's ESA regulations at Section 402.12(f) (recommended contents of biological assessment) advise that the BA contain "results of on-site inspection, 2 views of recognized experts on species at issue, 3. Review of the literature and other information…4. analysis of effects of the action, including cumulative effects" and "5. An *analysis of alternate actions* considered by the Federal agency for the proposed action. . . The BA contains no discussion of any alternatives whatsoever. It arbitrarily excludes the most recent and comprehensive scientific assessment of Laguna Salada's wetland ecology, historical ecology, hydrology, coastal processes, and endangered species biology (ESA-PWA 2011) that identifies both short-term and long-term alternative actions that substantially reduce take and adverse impacts to listed species, and promotes their recovery. A copy of this report is included as an attachment.

The ESA-PWA report (2011) includes views of a recognized expert on CRLF ecology in coastal brackish lagoons of the San Mateo-Santa Cruz coast, Dawn Reis. The failure to provide the ESA-PWA report (2011) findings on alternatives and cumulative impacts to endangered species habitats is apparently inconsistent with the ESA statutory standard of utilizing the "best available commercial and scientific data" to support the endangered species consultation process. The ESA-PWA 2011 report was supplied directly to the SFRPD and most of its principal findings were presented in an invited oral presentation to City representatives, including one co-author of the BA in November 2010.

The interim (phased) restoration measures proposed by ESA-PWA et al. (2011) that were ignored by the BA are simple and feasible, and directly address the primary hydrological impairment of ecological function specific to CRLF and SFGS habitat. They do not depend on dredging of anoxic sediments or perpetual manual translocation of CRLF egg masses each breeding season. The interim (near-term, prior to long-term ecosystem restoration adapting habitats of listed species for climate change resilience) feasible restoration measures recommended are simply:

- *cessation of mowing emergent perennial fresh-brackish marsh on the landward shore of the lagoon (ending conversion of marsh to turf, marsh encroachment by mowing);*
- *leaving an adequate upland buffer of transition zone (seasonal wetland) vegetation above the former mown marsh;*
- *allowing seasonal shallow flooding of the upper (currently mown) marsh and relatively flat topography of the transition zone, so that rapid pumping does not draw down suitable seasonal wetland pools and strand egg masses there.*

The SFRPD's own hydrology report (KHE 2009) confirms that there are sufficient freshwater inflows to Laguna Salada to fill its ponds even in dry years. Accommodating seasonal wetland pools and CRLF breeding in this zone would not require actual flooding of actual uplands. It would require flooding only within wetlands that are mown to function as turfgrass (seasonal wetlands located within the annual floodplain of the lagoon), to flood; see items 3.2, 3.2 of this report, below. In effect, this alterative measure simply requires that the applicant cease mowing and draining existing wetlands that are seasonally occupied by CRLF and used as breeding habitat. The BA's suggestion that "flooding of uplands" is occurring routinely is flatly incorrect, and contradicts own statement (BA section 2.2.1) that "Portions of the golf cart paths along the eastern side of LS regularly flood, even during drought years." This is because the seasonally flooded areas are not uplands, but in fact *wetlands with perennial marsh habitat that is mown down to function as golf turf* – misleadingly called "uplands" (see item 3.2 below).

3.0. General critical review of the BA

3.1 Failure to disclose long-term consequences of the basic hydrologic management (pumping) regime on listed species. The BA proposals constitute a short-term

infeasible "fix" based on its inaccurate and apparently biased diagnostic assessment of wetland degradation that ignores the *primary causes* of long-term and short-term endangered species/wetland habitat degradation. The *primary* causes of endangered species habitat decline at Laguna Salada are the direct, indirect, and cumulative effects of artificial hydrologic management (pumping regime) that the BA proposals support and continue in perpetuity, without which the BA proposals would have no independent justification.

The artificial water management regime at Laguna Salada *maintains the depressed wetland elevation range at precariously low elevations* (perennial marsh below +8 NAVD), making them artificially vulnerable to cumulative effects of sea level rise, and submergence with seawater during extreme storm overwash events like 1982-83 El Niño event. Contrary to the claims of SFRPD (Tetra Tech et al. 2009, Swaim 2008), the pump-induced drawdown of the lagoon and "seawall" do not protect the lagoon wetlands from catastrophic seawater flooding impacts; on the contrary, they *prevent* the wetlands from rising to naturally higher elevation ranges and locations that would adjust them to rising sea levels, and buffer them and make them *safer* from the effects of storm surges and overwash flooding (ESA-PWA et al. 2011). The artificially low lagoon maintains the habitat of CRLF and SFGS at depressed topographic positions that are *most vulnerable* to complete submergence by marine overwash impounded by the earthen berm, which lacks any potential natural (gravity-drained) sand outlet. In natural backbarrier fresh-brackish lagoons, barrier beaches impound lagoon water surface elevations *above* tides, and raise marsh elevations *above* reach of normal wave runup. The artificial water management regime at Laguna Salada prevents the lagoon from naturally impounding its freshwater discharges and raising marsh elevations above tide and overwash elevation range.

The ongoing pumping regime also prevents *normal, naturally higher seasonal (winter) lagoon water surface elevations* from forming *and maintaining* seasonal pools at the margins of the lagoon's wetlands, suitable for CRLF breeding. The water management regime at Laguna Salada also facilitates saltwater seepage (saline groundwater inflows) from the sandy (permeable) barrier beach as sea level rises. This hydrologic regime is not sustainable for long-term survival of CRLF and its predator, SFGS.

The BA proposal *maximizes* impacts of artificial wetland drainage (and mowing; see 3.2 below) to degrade eliminate seasonal wetland breeding habitat and *preclude* breeding in natural peripheral seasonal wetlands of the lagoon ecosystem, as a method of "avoiding" take of CRLF eggs and tadpoles. This is an apparent contradiction: The BA proposes extensive "take" (draining of whole seasonal wetland pools along the landward (eastern) upland edge that routinely attract egg mass deposition, and which would otherwise persist *but for* pumping and artificial drainage) in order to "minimize incidental take" of individual egg masses. More significantly, these seasonal breeding pools are located at the *landward*, most naturally freshwater-influenced (least saline) end of the wetland complex, and farthest from influence of rare storm overwash and seawater flooding. In other words, the current regime drains the most defensible long-term CRLF breeding habitat locations that could survive sea level rise and increased storm overwash of the 21st century. Breeding habitats along the back of the barrier beach (seaward end of the wetland complex) are inherently vulnerable to increased risk of overwash and salinity intrusion as sea level rises. Inevitable "coastal squeeze" due to sea level rise puts a long-term conservation premium on the breeding habitat locations on the landward end of the lagoon wetland system. HSP, in contrast, is in a precarious long-term position directly behind the beach, right where it naturally breached even in the 19th century (ESA-PWA et al. 2011).

The essential features of the proposal are to excavate a canal to more rapidly and efficiently drain Laguna Salada into the pumping basin/forebay called Horse Stable Pond, and operate pumps to drain seasonal wetland pools so rapidly that they minimize opportunities for egg deposition. This does not appear to be "incidental" take: the primary purpose of the drainage is to preclude formation of normal seasonal (winter) breeding pools in regularly flooded wetlands. This appears to constitute direct take rather than incidental take: it deliberately and actively degrades seasonal wetland pools (potential

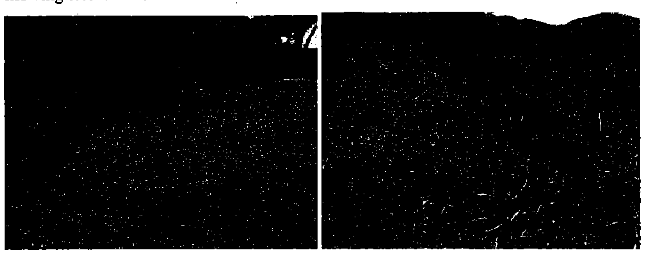
suitable breeding habitat) as though they were inherently "attractive nuisance" habitat, instead of suitable wetland habitat deliberately drained and mown to exclude frog breeding in areas desired for golf recreation activities.

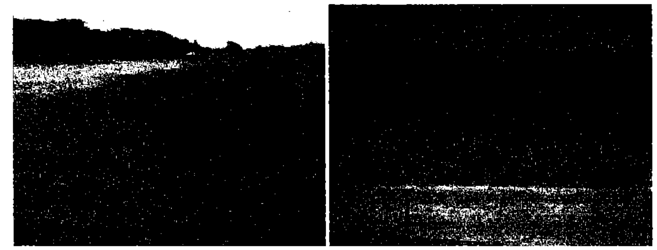
The BA appears to rationalize ecological "enhancement" purposes for activities that are essentially engineering proposals in support of recreational golf and pump maintenance. The BA invokes non-existent causes of environmental degradation without any evidence, such as "soil deposition from the uplands…entering the waterway" (the site is surrounded by sand beach deposits and wetland soil and has a continuously vegetated border) to justify features such as a retaining wall in endangered species habitat. See also discussion of (lack of evidence of) terrestrial sediment deposition in item 2.2 above.

The BA also rationalizes erroneous and misleading ecological causes of endangered species habitat degradation to justify marsh dredging instead of beneficial water level and hydroperiod management to avoid take of CRLF egg masses. The BA (following Tetra Tech et al. 2009 and Swaim 2008) fails to provide any rational argument or evidence for the causes of excessive marsh vegetation growth that it invokes (again, without evidence) as the leading limiting factor for CRLF reproductive success at Laguna Salada. See item 2.2 above (Bayshore marsh comparison). The BA ignores all local data on hydroperiods, topography and water depths that clearly show that the pumping regime maintains Laguna Salada at permanently low levels with shallow (subcritical) water depths within the flooding tolerance of tules and cattails across most of the lagoon bed. The BA ignores water quality data showing relatively nutrient-enriched (total nitrogen; the typical limiting nutrient for marsh primary production) eutrophic condition, including nitrate levels that are within effects range for red-legged frog tadpole adverse impacts (ESA-PWA et al. 2011). The BA also fails to provide any quantitative data on cumulative nitrogen and phosphorus loads due to golf fertilizer, and instead emphasizes largely irrelevant non-quantitative information about "organic" types of fertilizer use as a "best management practice". The BA completely fails to asssess the relationship between shallow marginal water depths maintained by pumping to maximize golf turgrass area, and the aggressive encroachment of the former bed of Laguna Salada by solid stands tules and cattails.

3.2. Failure to disclose or assess mowing of fresh-brackish marsh to provide extension of functional turfgrass area.

The BA fails to disclose the extent and ecological (vegetation) zone in which routine mowing occurs. Mowing clearly extends into saturated soils dominated by obligate and facultative-wet dominated vegetation identical with the adjacent marsh (ESA-PWA et al. 2011). The golf course mows marsh vegetation to the height of turf and drains it, converting it seasonally to functional turf composed of marsh vegetation. This marsh vegetation (coast bulrush, silverweed, bentgrass) mowed is seasonally submerged and is otherwise suitable habitat for CRLF and SFGS. The BA does not assess the effects on loss of cover, the relationship of the mowed marsh zone and water surface elevation in winter (during CRLF breeding) or the effect mowing has on location of egg mass deposition. The BA-proposed "no mow" zone discussion does not address the marsh mowing issue. These are critical omissions.





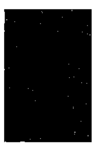
Marsh mowing: golf maintenance impacts. The golf turf mowing encroaches marsh at the northeast end of Laguna Salada, extending directly into perennial fresh-brackish marsh and riparian woodland zones. The apparent golf turf is composed of the same fresh-brackish marsh species shown at the left, *Schoenoplectus pungens, Potentilla anserina, Agrostis stolonifera,* and *Cotula coronopifolia.* The seasonally flooded outer marsh and its terrestrial ecotone are replaced by turf even with pumped drawdown of the lagoon. The natural floodplain (unimpaired maximum lagoon elevations) would include a much wider floodplain area. All wildlife cover is eliminated, exposing travel corridors of SF Garter snakes and eliminating suitable mammal burrow foraging habitats. All potential buffers for fertilizer impacts are eliminated by encroachment of golf turf into the marsh. Above: June 10, 2010. Below: August 3, 2010.

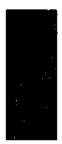
3.3. Misleading representation of seasonally flooded wetlands as 'flooded uplands" to be drained.

The BA's account of the "normal wetland hydrology", even in drought years, includes inconsistent and inaccurate reference to "floodwaters" in seasonal wetlands. Areas that are repeatedly flooded even in drought years (as well as in summer dry seasons!) enough to sustain CRLF egg deposition are clearly not "uplands" in any biologically meaningful way, in context of Section 7 consultation. The lowland zones bordering the emergent Laguna Salada marsh that at are artificially drained and mown to function as golf turfgrass are seasonal and perennial wetlands. The so-called "uplands" are mown encroachments of marsh (see 3.2 above).

3.4. Sediment chemistry and dredging/post-dredging impacts.

The BA does not identify the nature of the sediments it proposes to dredge in occupied endangered species habitat, including the larval life-history stages of CRLF that cannot escape the water column. The BA presents no monitoring data on sediment quality, water quality, or CRLF impacts from previous dredging episodes at HSP, and thus provides the BO with no information to support an analysis of direct, indirect, or cumulative effects. The BA does not identify or assess potential impacts of suspended anoxic, sulfidic sediment from the warm brackish (sulfide-rich) bed of Laguna Salada, even though these readily detected (rotten egg scent of sulfides; jet-black ferrous sulfide) sediments are widespread in organic-rich muck in marsh and open water lagoon bottom sediments. The BA proposes no measures to contain anoxic suspended sediment plumes or minimize hypoxia effects in a small, closed basin in which CRLF tadpoles must be presumed to be present. The BA fails to identify any potential refuges for CRLF tadpoles affected by a hypoxia event due to dredging suspended sediment plumes. Similarly, the BA does not evaluate any other predictable water and sediment chemistry changes associated with dredging anoxic organic sediments, such as ammonia pulses, post-aeration nitrate pulses, and formation of acid sulfates. The BA proposes to place sulfidic sediments in uplands presumed occupied by CRLF and SFGS, where they should be expected to form acid sulfates. The lack of sediment testing as a basic, standard component of wetland dredging is not explained in the BA.





Iron oxide surface films and iron sulfide accumulation of muds exposed by artificial lagoon drawdown. Iron oxide (orange-brown mineral films indicative of oxidation of iron sulfide and acid sulfates in brackish coastal sediments subject to alternating strong hypoxia and oxidation) are apparent in drawdown-emergent muds at the northeast end of Laguna Salada. Organic-rich sediment immediately below the iron oxide-stained surface sediment film is deep black (lower left), indicative of toxic iron sulfide, formed under strong hypoxic bottom conditions, exposed at the marsh surface by artificial drawdown of the lagoon.

3.5. Origin and types of pre-golf Laguna Salada wetlands: misleading and inaccurate account of golf course creation of freshwater marsh habitat for CRLF and SFGS.

The BA, relying in the 2009 SFRPD Sharp Park Alternatives Report (Tetra Tech 2009), uncritically adopts the unsupported and unsound assumption that the original condition of Laguna Salada was a homogenous saline lagoon unsuitable as habitat for the California red-legged frog and San Francisco Garter snake (BA section 3.1), rather than the typical fresh-brackish lagoon wetland gradients that prevail even today along the coast of San Mateo, Santa Cruz, and Marin Counties. This fallacy appears to originate with the (now obsolete) 1992 PWA report (ESA-PWA et al. 2011), which inferred a saline lagoon merely from the folk-name "Salada", indicating some degree of at least brackish salinity; there was no evidence or historical ecology analysis in the 1992 PWA report or the 2009 Tetra Tech report that supported the conclusion that the pre-golf condition of the lagoon, or the pre-European "natural" condition of the lagoon was a saline nontidal or tidal (marine salinity) lagoon. There is strong direct local historical evidence (herbarium records, historical photographs and maps) that the pre-golf lagoon wetlands ranged from fresh-brackish (oligohaline) to brackish, like most seasonally or intermittently non-tidal coastal lagoons of the Central Coast region that support populations of California red-legged frogs and garter snakes (including SFGS) at the landward (fresher) ends of their wetland gradients today.

The strongest and most direct local evidence of the pre-golf salinity regime and vegetation at the landward end of Laguna Salada prior to golf construction is a ground-level historical photograph taken during the agricultural land use phase, dated approximately in 1928. This photograph appears in the 2011 PWA report appendix on historical ecology of Laguna Salada (ESA-PWA et al. 2011, Appendix A, Figure A-1), and is also publicly featured as part of a natural interpretive display sign erected on Mori Point by the National Parks Service. The photograph shows clearly identifiable prevalence of marsh plant species that are physiologically intolerant of marine salinity to brackish salinity (polyhaline conditions) – specifically, California tule, cattails, and bulrushes – the same relatively salt-intolerant perennial marsh plant species that are dominant today along Laguna Salada. The open water appears to be covered by floating mats of sago pondweed, a fresh-brackish submerged vascular plant typically associated with salinity regimes supporting tule-cattail-bulrush marsh. California red-legged frogs use sago pondweed stands as breeding habitat at Laguna Creek Lagoon in Santa Cruz. The tule-cattail-bulrush marsh assemblage in the pre-golf photo essentially the same as the typical vegetation bordering most California red-legged frog breeding habitat sites in other coastal lagoons in the region. Other freshwater marsh species intolerant of even moderately brackish salinity at Laguna Salada appear in early 20th century herbarium collections. Exhibit A, p. 85 (ESA-PWA 2011 et al. Appendix A, Table A-1).

There is no evidence of any salt marsh plant species in the circa 1928 photograph of pre-golf Laguna Salada at the landward lagoon shore location. The lack of salt marsh vegetation is particularly significant because other aerial and ground photographs of Laguna Salada from the 1920s and earlier show that artificial breach canals were cut through the beach, apparently to drain the lagoon at low tide, so that the lagoon would act as a sump for agricultural drainage of flood-prone lowland croplands of the adjacent

valley. Artificial breaching of the barrier beach during the growing season would allow seawater to enter the lagoon before wave action sealed the artificial, unstable breach with sand. Even with artificial breaching to increase growing-season seawater influxes to the lagoon, the landward edge of the lagoon is dominated with cattail, tule, and bulrush marsh vegetation that indicates prevalent fresh-brackish (oligohaline) rather than saline (polyhaline to euhaline) conditions in the landward fringing marshes of the lagoon in the long-term.

The folk-name "Laguna Salada" indicates only that the aqueous salinity of the lagoon was sufficiently brackish (for potable or agricultural irrigation water, readily detectable by taste above 2 parts per thousand salt concentration) to be distinguished from predominantly freshwater lagoons with no appreciable salinity (less than 2 ppt). Botanists and geographers in the 19th century, like authors of place-names, did not make the distinction between "brackish" (a term that was brought into widespread scientific descriptive use in the 20th century) and "saline". Other early historical place-names suggest that salinity-descriptive nomenclature like "Freshwater Bay" used by early navigators of Suisun Bay (actually estuarine: brackish in summer, nearly fresh in winter, contrasting with saline San Francisco Bay) reflected seasonal (like "Arroyo Seco", dry creek) rather than permanent salinity or hydrological regimes, as well as contrasts with nearby waterbodies. Thus, a naïve literal interpretation of "Laguna Salada" as "Saline Lake" is inconsistent with early maps, early 20th century photos prior to golf construction. (ESA-PWA 2011 Appendix F).

Equally naïve and unsupported by historical and scientific evidence is the popular belief (repeated uncritically by some environmental professionals) that golf course construction "created" the fresh-brackish lagoon wetlands at Laguna Salada. There is no evidence from aerial photos that golf construction contributed additional marine overwash flood protection structures to Laguna Salada's natural barrier beach, and certainly not beyond any minor changes that may have been inherited from the agricultural land use era.

Fresh-brackish vegetation is typical of the landward edges of central California coastal lagoons where freshwater stream deltas slightly above high tide elevations intergrade with lagoon fringing wetlands. This is exactly the structure represented in the mid-19th century U.S. Coast Survey map of Laguna Salada: the marsh map symbol is restricted to the southwest corner of the lagoon where three small channels, oriented like marsh distributary channels of the freshwater Sanchez Creek, intersect the marsh. (ESA-PWA et al. 2011, Figure A-11). The three distributary channels are shown as artificially channelized seasonal arroyos (freshwater seasonal creek) in the 1897 U.S. Geological Survey map of Laguna Salada. The 19th and 20th century US Coast Survey and subsequent U.S. Geological Survey maps all represent Laguna Salada as a <u>closed lagoon with no open tidal inlet to sustain high salinity</u>. This is consistent with other coastal lagoons with full exposure to Pacific swell and exhibit mostly ephemeral outlets for freshwater overflowing from the lagoon side of the barrier beach – not tidal inlets. Analysis of wave power and lagoon discharge (potential tidal prism or water volume) relationships (ESA-PWA et al. 2011) confirms that tidal inlets would be inherently unstable and prone to closure Laguna Salada.

Salt marshes and saline coastal lagoons in northern and central California are associated with the seaward ends of lagoons with at least seasonally stable tidal inlets. All other coastal stream mouth lagoons south and north of Laguna Salada in Marin to Santa Cruz counties exhibit fresh-brackish marsh or freshwater-dependent riparian woodland at their landward ends, in both modem and historical conditions. Many of these lagoons also support persistent populations of California red-legged frogs in the fresh-brackish landward portions of lagoon wetland gradients

4.0. Section-by-section critical review of the BA.

Sections of the BA discussed are shown in italics. Bullets indicate relevant BA text.

1.1 DOCUMENT PURPOSE

- Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project.

Project name and description do not explain "safety improvement", and do not disclose the essential compensatory mitigation purpose of the "habitat enhancements" enabling wetland drainage to be sufficient to maintain the existing lowest elevations of the golf course to encroach into wetlands that are seasonally flooded. If the basic purpose is habitat enhancement, then a range of alternatives that optimize hydrology and water quality for listed wetland-dependent species should have been included, not just dredging and existing water levels.

- "This BA has been prepared in conformance with Final Rule regarding Interagency Cooperation (50 CFR pt. 402)"

The BA was not prepared by the lead federal action agency (USACE), but by the applicant, and without any reference to designation of a non-federal representative for informal consultation or a biological assessment (50 CFR Sect. 402.08). This omission suggests that the BA fails to comply with 50 CFR Part 402. The lead agency (USACE) would need to have reviewed and supervised the BA as well as designate the applicant and consultants as non-federal representatives to comply with the Interagency Cooperation regulations of ESA.

1.2 LISTED SPECIES CONSIDERED

- "No other listed or proposed species have the potential to occur on the Project site."

This statement appears to be incorrect. Since Caspian and Forsters terns forage on fish in LS, and since CA Least Terns rangewide occupy barrier beaches and lagoons, there is potential (though not likely) for occurrence of CA least terns at Laguna Salada. CLT have colonized even less typical artificial oligohaline (near-freshwater) sand/lagoon habitats remote from their primary maritime distribution at Montezuma Wetlands, at the lower Sacremento River. The BA cites no bird data from Sharp Park to determine whether CLT occur there as vagrants or seasonal users.

1.4 PREVIOUS CONSULTATIONS

- "Biological Opinion for the Pacifica Recycled Water Project (81420-2008-1-1643), ...This project, which will provide recycled water to Sharp Park, was determined to have potential direct and indirect effects on CRLF and SFGS."

This consultation appears not to have considered the cumulative impact of wastewater nutrient loading cumulative impacts with annual total golf fertilizer nutrient loads on Laguna Salada (both water quality for CRLF tadpoles and indirect effects on habitat through vegetation growth and structure), and the BA fails to supplement it with any quantitative analysis. The current consultation's effects analysis would need basic data on the total nutrient (primarily total N, P) loads from (a) recycled water inflows, (b) total annual golf course fertilizer load, and (c) watershed nutrient load in order to estimate cumulative impacts of eutrophication on marsh vegetation (habitat of CRLF) and direct water quality (nitrate, ammonia) impacts on CRLF tadpoles. See ESA-PWA et al. 2011.

2.1 PROJECT LOCATION

The description of project location omits essential and relevant information on the coastal backbarrier setting of the lagoon, its adjacency to three constructed freshwater GGNRA ponds/fringing marsh at S edge of Laguna Salada (inhabited by CRLF breeding and foraging habitat; SFGS detected present). The description lacks essential contextual information relevant to endangered species, such as surrounding habitats, land uses, distance to nearest potential CRLF and SFGS populations (isolation, potential for recolonization after population crash or extirpation). The setting is not described until 2.2.2.2, where key relevant information about habitat sustainability is omitted, such as drainage of lagoon below wave runup elevations and high tidal elevations)

2.2 PROJECT DESCRIPTION

- "The wetlands complex is composed of Laguna Salada (LS), Horse Stable Pond (HSP), a channel that connects the two water bodies, and adjacent wetlands. A seawall on the western boundary of Sharp Park eliminated the historic hydrologic connection between the Pacific Ocean and the wetlands…"

This is an inaccurate geographic description. *All* wetlands at Sharp Park occur *within the bed of historic Laguna Salada*; they are the drained lagoon bed, not separate distinct wetlands (ESA-PWA et al. 2011). Horse Stable Pond is the historic outlet channel of Laguna Salada (recurrent natural breach location allowing outflows of impounded freshwater) (ESA-PWA et al. 2011). "Channel" is artificial ditch completely infilled with tule & cattail. The "seawall" is not a structural seawall, but an *earthen berm* with partial boulder armor perched on the original natural barrier (sand) beach. T*here is no seawall structure or foundation*. The "seawall" does not eliminate all hydrologic connection between Pacific Ocean and LS: it restricts only *surface* flows (overwash and ephemeral outflows, temporary storm breaches) but is no barrier to groundwater exchange from beach to lagoon, and saline subsurface seeps are evident in both the western golf course and the west shore of the lagoon (KHE 2009, ESA-PWA et al. 2009). This indicates the long-term potential for salinization of the lagoon as sea level rises even if the earthen berm remains intact, as long as lagoon levels are kept below beach groundwater elevations (set up by wave runup "pumping" seawater above tide elevations; (ESA-PWA et al. 2011)).

- "wetlands are believed to be maintained by *ground water* but are *also* fed by surface water inflow due to precipitation in the winter."

This BA statement is incorrect and inconsistent with the project's own hydrology report (KHE 2009, not cited in BA), which states that winter *surface flows* are the primary water source for Laguna Salada, and are drained away by the pumps:

> *Surface water inflows* associated with winter storm events provide the *primary* source of water to the wetland system….Drainage from and water levels in the Laguna Salada wetlands are presently maintained by the operation of a pumping station located at the southern extent of Horse Stable Pond…. *Drainage* from and water levels in the Laguna Salada wetlands are presently *maintained by the operation of a pumping station* located at the southern extent of Horse Stable Pond. The pumping station contains two pumps; a large pump with a flow capacity of 10,000 gallons per minute (GPM) and a smaller pump with a flow capacity of 1,500 GPM… (KHE 2009 p. 4-5; emphasis added)

KHE states merely that groundwater *contributes* to the lagoon because inflows exceed outflows. Groundwater sources include saline groundwater from the beach (KHE 2009). The lagoon is maintained by *channelized surface inflows of fresh water*; supplemental groundwater is subordinate:

> Groundwater inflow exceeds groundwater outflow (seepage); as a result, groundwater inflows *contribute to* the overall water budget of the system. As a result of groundwater contributions, dry season *water level recession* occurs at a *slightly slower rate* than would be expected due to evapotranspiration losses alone.

- "Operation of the flood control pump system is necessary to manage floodwaters both on the Property and on adjacent properties. During *normal rainfall* years, floodwaters into Laguna Salada back up onto the golf course path." …"Portions of the golf cart paths along the eastern side of LS regularly flood, even during drought years."

"*Normal* rainfall" filling of lagoon *by definition* is not "floodwater". Normal means normal re-occupation of the drained lagoon to normal levels; it's the mowing of marsh to function as turfgrass (see items 3.2, 3.3 above) that give the false and paradoxical appearance of "normal" and even dry-year flooding. The description inverts the nature of the wetlands, uplands, and flooding. Drought-year flooding is an oxymoron, and clear evidence of wetland topography and hydrology. Drainage of lagoon not necessary to protect adjacent properties, which can be protected by a separate small berm (ESA-PWA et al. 2011).

2.2.1 Construction Action

- "Currently, two factors adversely affect the operation of the pumps. First, pump operation is adversely affected by sediment buildup and vegetation growth around the pump intake structure and along the connecting channel between LS and HSP. Second, pump operation is adversely affected by the buildup of vegetation on the pump intake screens."

There is no "vegetation growth" obstructing screens or around the pump intake. See cover photo of this report (2010). There is a narrow fringe of coast bulrush on the uppers shoreline west of the pump intake, and tules many meters away; the forebay in front of th pump is all open water. Neither the BA nor the Tetra Tech et al. 2009 report provide any objective or quantitative evidence of sediment "buildup" -- no elevation information or sedimentation rate data. The SFRPD hydrology report (KHE 2009) does not report sediment accumulation as a factor adversely affecting pumps. There are no sources of sediment inputs and no sediment budget, nor is there any evidence of surface sediment accretion. The fringing marsh vegetation (tule, cattail, saltgrass) occurs more than 5 m away from the screens, and can be managed without dredging (cutting below mud level). Debris accumulation (plant litter) is not controlled by dredging.

- "...removal of sediments and emergent vegetation within the HSP wetland near the intake structure in order to reduce obstructions to water flow to the pump intake and to enhance breeding habitat for the CRLF." Approximately 2,350 square feet (0.05 acres) of this 5,900 square foot area is occupied by cattails and bulrush; the remaining area is open water.... Removal of sediment and emergent vegetation that impedes water flow and reduces habitat suitability for CRLF in select locations..."

The BA fails to provide any evidence or analysis for the project's claimed purpose of "enhancement" of existing open water and fringing tule-cattail marsh habitat of CRLF or SFGS. There is not even facial evidence for "reduced habitat suitability" of *nearly 50% open water area* at HSP (photo). HSP has the highest measured egg mass deposition frequency of LS reported by Swaim (2008). "Bulrush" in HSP is tule, (*Schoenoplectus californicus*), not bulrush (*Schoenoplectus pungens*).

- "..installation of steps leading down the slope from the access road to the pumphouse and the intake structure (approximately 47 square feet or 0.001 acres). A fence with a locking gate will restrict access to the steps and boardwalk."

The steps may improve terrestrial predator access (raccoons and feral cats not deterred by fence) to CRLF habitat, but impacts are not assessed.

- "Replacement of the failing wooden retaining wall next to the pumphouse (at the base of the levee slope between the uplands and the wetland) with a concrete retaining wall to prevent further soil deposition from the uplands from entering the waterway."

There is no evidence for any "soil deposition from the uplands" of the adjacent levee or slope fills, which are entirely vegetated. The marsh surface is composed of fine-grained sulfidic and organic muck (autochthonous, accreted in situ), not alluvium eroded from adjacent upland slopes. The BA provides no evidence of erosion or deposition at the pumphouse (no evidence from on-site inspection, recommended for BA in 50 CFR 402.12). The purpose of a concrete retaining wall cannot reasonably be justified by erosion or habitat enhancement.

- "Excavation of sediments and vegetation will be conducted from the golf course uplands wherever possible, thus minimizing impacts to the wetlands. The sediment and vegetation removal along the connecting channel between HSP and LS can be accomplished with little or no impact to the adjacent wetland. ...sediment and vegetation removal from HSP would be to use a compact multi-purpose aquatic vessel (i.e., an Aquamog) or similar equipment with long boom and clam shell or bucket type attachment...will be placed in an elevated dewatering container located in an adjacent cleared upland or placed directly into a dump truck and hauled to either the organic dump or reclaimed rifle range east of the PCH"

See BA comments at 3.4 (dredging impacts). No locations are shown for "cleared upland" in what is presumed SFGS habitat; no impacts assessed. This is potential "take".

2.2.2 Golf Course Maintenance and Operations

- "The SFRPD currently employs seven staff members who perform the year-round operation and maintenance) of the golf course. These activities include mowing; application of water for irrigation; application of fertilizers"

See BA comments on mowing in marsh and fertilizer impacts (and lack of quantification of cumulative lagoon nutrient loading (lb/area/yr, total area = nutrient load) and fertilizer composition (N, P). See ESA-PWA et al. 2011.

2.2.2.3 Integrated Pest Management

- Today, only organic fertilizers are used at Sharp Park...

Misleading and irrelevant to nutrient loading quantification. BA fails to provide quantification of annual nutrient load from fertilizer. "Organic" nutrient (N, P) pollution of LS is no different from non-organic; eutrophication depends on rate of nutrient loading, not "organic" label.

- Gophers are common on golf courses. Gopher mounds may damage mowers, and gophers can damage turf roots as well as other plants. SFRPD staff manage gopher populations by raking down gopher mounds. Mounds are raked away from the opening of the hole. If an active burrow is present on the fairway, greens, tees or roughs, traps may be set by removing a clump of dirt from the ground such that the middle of a main tunnel is exposed. A U-shaped wire sprung gopher trap (MacAbee trap) is placed in the burrow on either side of the hole. The access hole is then immediately filled in with the clump of turf that had been removed. Typically the traps are checked and removed before the end of the work day.

See BA comment at 2.4. Traps = snake take risk; no take minimization proposed. Raking mounds does not "manage" gopher population. gopher burrows = estivation and moisture refuge habitat for tree frog (prey of SFGS), CRLF. Suppression of mammal burrows in adjacent uplands is impact to habitat potential impact to SFGS and CRLF.

2.2.3 Natural Areas Restoration

- "...these areas are to be managed and restored for their biodiversity. Maintenance activities, such as hand removal of vegetation within and adjacent to HSP, LS and the connecting channel, contribute to the preservation and enhancement of habitat for the species."

This is a key area of dispute that should be resolved in the biological opinion's analysis of cumulative effects including interrelated and interdependent actions: *dredging does not address the larger issue of permanent drainage and mowing impacts of the lagoon.* The characterization of dredging openings in drained marsh so the lagoon can be drained low enough to allow golf mowing in wetlands is doubtful "enhancement" of endangered species wetland habitat. See BA comments at 3.1, 3.3, 3.4, etc.

- "The activities would include the removal of vegetation overhanging and shading the wetlands such as acacia, Monterey cypress, as well as vegetation within the wetlands such as cattails and bulrush that reduce the quality of CRLF breeding habitat and therefore reduce prey availability and foraging habitat quality for SFGS. In areas where appropriate, native plants and erosion control measures would be installed to replace and augment the wildlife habitat and reduce soil loss."

Cattail and bulrush overgrowth is due primarily to pumping and water depth reduction to less than 4 ft all year round over most of the lagoon bed (most of fringing marsh occupies water depth less than 3 ft deep), and stabilization of water level. This is a basic flaw in analysis of causes of habitat decline. There is no evidence of "soil loss" in uplands: the west shore is all sand, and the east and north shore are mown marsh and golf turf; the south end is solid marsh backed by riparian woodland (willow grove).

2.3 MINIMIZATION AND MITIGATION MEASURES

Alternate actions (alternatives) are missing from this section, as is any assessment of consistency with recovery objectives and tasks for the two listed species.

- 2.3.5 During dredging and vegetation removal activities, if required, up to three (3) biological monitors will be present to 1) monitor the area of vegetation or sediment removal, 2) observe the material as it transferred to the shoreline and 3) to inspect material as it is loaded into a container/dump bed that will allow the water in the excavated sediment to drain out before removal from the site.

See comments on failure to test sediment prior to dredging or assess dredging impacts, comments at 2.1.

- 2.3.8 Terrestrial vegetation in undisturbed areas around HSP and the connecting channel will be cleared by manual means to a height of 4 inches (or a height that allows visibility of the ground) under the supervision of an approved biological monitor and checked for the presence of CRLF and SFGS.

This "survey" method is in itself a potential source of incidental take, and is not justified or shown to be consistent with recovery plan survey methodology or USFWS approved protocols. Mowing/clearing vegetation is a source of habitat degradation (loss of cover).

- 2.3.13 Erosion control best management practices (silt fences, coir rolls, straw bales) would be employed as part of the dewatering of sediments after removal and while soils are exposed. The erosion control measures will not include netting, plastic or natural monofilament netting or other materials that may entrap frogs or snakes.

There is no evidence for any "soil deposition from the uplands" of the adjacent levee or slope fills, which are entirely vegetated. The marsh surface is composed of fine-grained sulfidic and organic muck (autochthonous, accreted in situ), not alluvium eroded from adjacent upland slopes. The BA provides no evidence of erosion or deposition at the pumphouse. There is no description of location of sediment dewatering of potential acid sulfate (oxidized sulfidic) sediment.

- 2.3.16 During and following completion of the Project, the water pumps will be operated pursuant to the following criteria: Appropriate water levels will be determined by conducting visual surveys of CRLF egg masses in potential habitat areas around HSP, LS and the connecting channel. During the visual surveys, data on the CRLF egg masses including attachment type, water depth, size of egg mass, and Gosner stage will be taken, and a determination of potential stranding will also be made.

It is not feasible to determine "appropriate water levels" without measuring surface and water elevations at locations at issue; subjective "data" of visual surveys are not verifiable or reportable and cannot support data interpretation.

- Pump levels will be set relative to the CRLF egg mass with the least amount of water around it; in other words, the pumps will be set to a level to protect the most vulnerable egg masses in HSP, LS and the connection channel.

This measure in infeasible because water surface elevations differ between HSP (pump location) and Laguna Salada because of friction and slope of water surface (KHE 2009).

There is an inherent spatial lag in water surface drawdown between HSP and LS, and an inherent temporal lag between pump activation/deactivation and water level adjustments. The constraints of "fine-tuning" water levels with the pumps and these lags in relation to the sensitivity of egg mass stranding are not analyzed; it is left to subjective judgment that is not accompanied by quantitative monitoring of water surface elevations, substrate elevations, egg mass attachment elevations, and real time. The BA proposal appears to be both infeasible and unenforceable for this reason.

- Once all the CRLF eggs have hatched and the tadpoles are no longer aggregating about the egg mass, the water level will be lowered incrementally and the dewatering of HSP, LS and the connecting channel is monitored to ensure that CRLF tadpoles are not stranded by receding waters.

This measure to "lower incrementally" water levels does not specify limit on maximum rate of drawdown or pumping; it is not enforceable without it. The constraints of "fine-tuning" water levels with the pumps and these lags in relation to the sensitivity of egg mass stranding are not analyzed; it is left to subjective judgment that is not accompanied by quantitative monitoring of water surface elevations, substrate elevations, egg mass attachment elevations, and real time.

- 2.3.17 During and following completion of the Project, if CRLF egg masses are determined to be at risk because they are deposited in ephemeral swales or in other conditions that are not sustainable, an SFRPD biological monitor with the Natural Areas Program will apprise USFWS of the situation and propose a relocation plan to the USFWS for review and approval. Such a relocation plan will describe....

See BA comments at 2.3. Egg mass translocation annually in perpetuity does not appear to be consistent with CRLF Recovery Plan. No monitoring data, thresholds or performance criteria are proposed; the plan is not even a potentially enforceable take minimization measure (even if consistent with recovery plan) without monitoring and performance criteria.

- 2.3.18 During and following completion of the Project, mowing will occur pursuant to the following criteria: The area to be mowed will be the minimum required to maintain the golf course. A no-mow zone area, which includes the roughs adjacent to the wetlands, will be identified with stakes or other markers on the ground (see Figure 2-5). Golf staff will be instructed not to mow in these areas.

See BA comments at 3.2. This measure fails to provide a minimum buffer around endangered species habitat and allows direct encroachment of mowing into wetlands.

- 2.3.19 During and following completion of the Project, only organic fertilizers, such as pro-biotics, blood meal, lime, and compost tea, will be used at Sharp Park

Misleading and irrelevant to nutrient loading quantification. BA fails to provide quantification of annual nutrient load from fertilizer. "Organic" nutrient (N, P) pollution of LS is no different from non-organic; eutrophication depends on rate of nutrient loading, not "organic" label.

5.3 & 5.4 – [Interrelated and interdependent and cumulative effects]

The effects analysis lacks any meaningful assessment of the long-term consequences of proposed water level management on marsh elevations, salinity intrusion, sea level rise, as they affect of CRLF and SFGS population viability and habitat sustainability (ESA-PWA et al. 2011; see BA comments at 2.0, 3.0).

5.0 Conclusions and recommendations.

The BA appears not to comply with the general ESA standard of providing the "best available scientific and commercial data" regarding the scientific account of ecosystem inhabited by listed species in the project action area. It apparently fails to provide a reasonably complete and accurate scientific assessment of direct, indirect, and cumulative impacts of proposed actions. The BA proposes some very high-risk, potential high impact actions offered as "take minimization" measures that commit serious omissions of basic data – particularly (a) dredge sediment testing data for sulfidic, anoxic (ecotoxic) brackish marsh sediments, and potential for hypoxia events and subsequent acid sulfate formation, and (b) the permanent CRLF egg translocation program that appears to conflict with the CRLF recovery plan. The BA is acutely deficient in failing to identify reasonable alternatives (alternate actions of reasonable and prudent measures with less impact and take of listed species), based on comprehensive assessment of the ecosystem. The BA appears to rationalize recreation-priority land and water management activities as benign or even beneficial to listed species, and systematically ignores the fundamental hydrologic threats they impose in the long-term. The BA, therefore, does not appear to provide a sound scientific or regulatory basis on which the formal Section 7 consultation may reasonably rely for scientific analysis of "effects of the action" or formulation of reasonable and prudent measures or alternatives.

I recommend that the deficiencies of the BA be corrected, at least in the final BO if not a revised BA, by:

- requiring dredge sediment testing data by independent qualified experts, with a specific assessment of potential ecotoxicity of hypoxic sediment plumes during dredging, and post-dredging water quality for CRLF tadpoles, including mortality risks.
- requiring an analysis of ongoing and proposed long-term water management at Laguna Salada by independent, unbiased qualified experts, with focus on long-term groundwater salinity changes and marsh elevation range in relation to vulnerability to storm overwash flooding, including gradual sea level rise interactions.
- requiring an unbiased analysis of alternative interim and long-term alternate actions, including reasonable modifications of seasonal water levels favorable for CRLF breeding (including any appropriate small-scale hydrologic barriers bordering true upland areas), cessation of mowing marsh vegetation, and creation of adequate upland buffers with suitable vegetation cover and basking sites.
- requiring review and reference to relevant portions of the ESA-PWA report (2001) to satisfy the general ESA statutory standard of "the best scientific and commercially available scientific data".
- (most importantly) providing a rigorous analysis of the feasibility of long-term management of CRLF by a permanent program of egg mass translocation in response to artificial rapid drawdown due to pumping to maintain a fixed range of low lagoon levels, and the consistency of such a program with the approved final recovery plan for CRLF, including possible precedents for future Section 7 consultations based on single-event or perennial CRLF translocation to "minimize" take.

References

KHE (Kamman Hydrology & Engineering, Inc.). 2009. Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study: Laguna Salada Wetland System Pacifica, California *Prepared For:* Tetra Tech, Inc. San Francisco, California

ESA-PWA (Environmental Science Associates - Philip Williams and Associates) 2011. Conceptual ecosystem restoration plan and feasibility assessment: Laguna Salada, Pacifica, California. Prepared for: Wild Equity Institute. Prepared by:ESA PWA with Peter Baye and Dawn Reis Ecological Studies. 65 pp + appendices

Swaim, K. 2008. Sharp Park wildlife surveys and special reptile and amphibian restoration recommendations. Prepared for Tetra Tech Inc. Portland, OR by Swaim Biological Incorporated Livermore, CA. Appendix C in Tetra Tech 2009.

Tetra Tech, Inc., Swaim Biological, and Nickels Golf Group. 2009. Sharp Park Conceptual Restoration Alternatives. Prepared for San Francisco Recreation and Parks Department. November 2009.

EXHIBIT H

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
NORTHERN DIVISION

WILD EQUITY INSTITUTE, a non-profit corporation, *et al.* Plaintiffs, v. **CITY AND COUNTY OF SAN FRANCISCO**, *et al.*, Defendants.	Case No.: **3:11-CV-00958 SI** **DR. MARC HAYES EXPERT REPORT**

QUALIFICATIONS AND BACKGROUND

1. I am submitting this expert report in support of plaintiffs' position in this litigation that activities at the Sharp Park Golf Course ("Sharp Park") are resulting in the "take" of the California Red-legged Frog ("CRLF"; *Rana draytonii*) and the San Francisco Garter Snake ("SFGS"; *Thamnophis sirtalis tetrataenia*), and their position that in the absence of judicial relief such take will continue. I have the requisite credentials to offer expert opinions on these issues, as well as other matters on which I will opine in this expert report.

2. For nearly four decades, I have worked professionally as a research and field ecologist and herpetologist, studying reptiles and amphibians in California, Oregon, Washington, Mexico, Costa Rica, and Florida. During this time, I have supervised over 70 projects addressing the ecology and habitat needs of the herpetofauna in these areas, working with the California Department of Fish and Game, the United States Fish and Wildlife Service, the California Academy of Sciences, and diverse other public and private entities. I am a member of the following professional scientific organizations: American Society of Ichthyologists and Herpetologists (life member), The Herpetologist's League (life member), The Wildlife Society (associate member), Society for Northwestern Vertebrate Biology (life member), Society for Conservation Biology (life member), Society for Integrative Biology (life member), Societas Europea Herpetologica (life member), Society for the Study of Amphibians and Reptiles (life

member), Desert Tortoise Council (life member), and the Association of Zoos and Aquariums (associate member).

3. I received my Bachelors degree in biology in 1972 from U.C. Santa Barbara, my Masters in Biological Sciences in 1975 from California State University, Chico, and my PhD in Herpetological Ecology in 1991 from the University of Miami, Florida. Currently I serve as an Adjunct Professor at Central Washington University (Ellensburg, WA), Evergreen State College (Olympia, WA), Portland State University (Portland, OR), and the University of Washington (Seattle, WA). I am also an Affiliate Curator in Herpetology at the Burke Museum at the University of Washington, and I serve as a Senior Research Scientist with the Washington Department of Fish and Wildlife ("WDFW"). In 2010, I received the prestigious *Conservation Award* from WDFW—the highest award the department grants—specifically for my work on amphibian conservation. More detailed information about my research can be found in my current curriculum vitae, along with a list of my publications from the past 10 years, which is attached to this report as Exhibit A.

4. My research and my field experience have been particularly focused on California's rare and endangered amphibians and reptiles. In 1994, I co-authored a 255-page report for the California Department of Fish and Game ("CDFG") entitled *Amphibians and Reptiles of Special Concern in California*. That report, which was a compilation of the status and threats facing all rare amphibians and reptiles in the state, was designed to help CDFG decide which of these species were eligible for protection under state or federal law.

5. While researching and writing that report, we discovered that the CRLF was facing severe threats; that it had suffered a marked contraction in its geographic range over the preceding century; and that its remaining populations were at risk due to a suite of factors. Yet it was not protected under federal endangered species law. We therefore submitted a petition to list the species under the federal Endangered Species Act to the United States Fish and Wildlife Service ("FWS"). This petition ultimately led to the current listing of the frog as threatened under the Endangered Species Act.

6. I have also conducted numerous field studies on the CRLF, logging hundreds of hours searching for, identifying, and monitoring the species during all stages of its life cycle. For example, from 1974 to 1983, I studied populations of the CRLF in Corral Hollow (San Joaquin County), Pico Creek (San Luis Obispo County), and Cañada de la Gaviota (Santa Barbara County). From 1988 to 2002, I studied the last remaining CRLF population in southern California south of Los Angeles, located at Cole Creek on the Nature Conservancy's Santa Rosa Plateau Preserve (Riverside County).

7. Besides field research, I have studied historic species accounts, laboratory specimens, and popular writing about California's frogs and snakes, with a particular emphasis on the CRLF. I have reviewed specimens and historic accounts in the American Museum of Natural History in New York; the Burke Museum at the University of Washington; the California Academy of Sciences in San Francisco; the California State University Chico Vertebrate Museum; the Carnegie Museum in Pittsburgh; the Los Angeles County Museum of Natural History; the Museum of Comparative Zoology at Harvard University; the Museum of Vertebrate Zoology at the University of California at Berkeley; the Museum of Zoology at the University of Michigan; the Oregon State University Vertebrate Museum; the Portland State University Vertebrate Museum; the San Diego Museum of Natural History; the Slater Museum at the University of Puget Sound; the Southern Oregon State College Vertebrate Museum; the University of Kansas Vertebrate Museum; and the Smithsonian Institution and its Archives in Washington, D.C.

8. My studies have resulted in over 120 peer-reviewed publications and reports over my career. These include studies that have explained the historic overharvest of CRLF in California, revealing that humans—not American Bullfrogs, as previously supposed—were the primary reason for the decline of the species near the turn of the 19th century. I have also demonstrated that the decline of ranid frogs in the North American west is generally explained by introduced fishes more accurately than introduced American Bullfrogs; and that vocal sac differences were a strong indication that two species (now called California and northern red-

legged frogs) existed within what was formerly considered one species (simply called red-legged frogs).

9. More generally, I have been active in research and field study of many frog species in the family *Ranidae*, to which the CRLF belongs. These frogs are sometimes called "true frogs." True frogs share many similarities, and therefore, lessons learned from one species can help scientists understand the habitat needs of other ranid frogs, while gaining a better understanding of each species' unique evolutionary path. For example, I have studied the ecology and distribution of the stream-dwelling Foothill yellow-legged frog (*Rana boylii*) in western Oregon. I've shown that this species has also sustained a severe contraction in its geographic range over the last 100 years, and that introduced fishes, especially Smallmouth bass (*Micropterus dolomieu*), better explain this species' regional disappearance than do American Bullfrogs.

10. My research has also addressed reptiles in California, including rare and endangered snakes. For example, I observed and recorded information on the San Francisco gartersnake in the course of my studies of the CRLF at Pescadero Marsh. Those studies suggest that the SFGS is seasonally dependent on CRLF juvenile production as a summer food resource.

11. Through my research and study, I have become an expert in identifying frog and snake species, particularly closely related species, in any and all life stages. I can readily identify egg, larvae, juvenile, and adult phases of all California frog species, and eggs, juveniles, and adults of all California snake species through visual inspection, aural calls (typically only applicable to frogs and toads), habitat range, and habitat characteristics.

12. My research and study has also made me an international expert in the habitat and ecological needs of frogs and snakes, and the types of habitat modifications that threaten these species. I have studied the Oregon spotted frog (*Rana pretiosa*), a formal candidate for listing under the ESA, over much of the last 20 years in the Pacific Northwest. Via extensive surveys, I have shown that this species has probably been extirpated from the Willamette Valley floor in Oregon and across its geographic range in California. I have also shown that the Oregon spotted frog is resistant to the amphibian chytrid fungus, a pathogen known to have decimated

frogs worldwide, but that Oregon spotted frogs are highly vulnerable to predation by introduced American bullfrogs because of their aquatic habits. In the region of Monteverde, Costa Rica, I worked on the entire amphibian and reptile fauna for over three years, and characterized the ecology and distribution of the over 110 species present, demonstrating marked changes in species composition across a rain- to dry-forest gradient.

13. I am personally very familiar with Sharp Park, including its main aquatic habitat features: Laguna Salada, Horse Stable Pond, and Sanchez Creek. I have visited Sharp Park on several occasions throughout my career, most recently on June 25, 2011, and I have observed and studied the CRLF at Sharp Park and at surrounding lands. Based on my personal site visits and my interactions with employees with the National Park Service ("NPS"), I am also familiar with restoration efforts that have occurred at Mori Point, a national park unit adjacent to Sharp Park, and the habitat enhancements that have been implemented there for both the CRLF and SFGS by the NPS. Given my expertise and background, I am well-equipped to offer expert opinions concerning the impact of defendants' activities at Sharp Park on both individual CRLFs and SFGSs, and on the prospects for the survival and recovery of the resident populations of these species.

14. Although I am not an attorney and I have not been asked to provide an opinion on the legal implications of the defendants' activities that affect the CRLF and SFGS, I have had extensive experience in assisting the State of Washington in developing applications for Incidental Take Permits ("ITPs") and associated Habitat Conservation Plans ("HCPs") in accordance with section 10 of the ESA. Accordingly, I am personally very familiar with the kinds of activities for which ITPs/HCPs are prepared, and the process for developing scientifically supportable mitigation and other measures necessary to obtain the FWS's approval for ITPs/HCPs, especially with respect to measures bearing on the survival and recovery of amphibians. For example, I have been directly involved in coordinating the adaptive management science involving the HCP addressing the largest landscape of any HCP in North America—the Forests and Fish HCP in Washington State—which encompasses over 9,000,000 acres of private timberlands and addresses ITPs/HCPs for no fewer than seven species of

amphibians in that landscape. Accordingly, while it is not the principal focus of this expert report, as a Senior Research Scientist with the Washington Department of Fish and Wildlife who has worked closely with the FWS, I do have extensive personal familiarity with, and involvement in preparing applications for, ITPs/HCPs and in pursuing FWS approval of them, and I believe that this practical experience could be of assistance to the Court in evaluating whether defendants' activities at Sharp Park should continue to bypass the formal ITP/HCP process.

15. For my work in preparing this expert report and related materials and in providing deposition and expert testimony, I am charging Plaintiffs at the rate of $120/hour, although given the conservation import of this case I anticipate that I will not ultimately bill plaintiffs for all of the work that will be entailed in carrying out these tasks. I have not been deposed or testified as an expert witness in the past four years.

FACTS OR DATA CONSIDERED IN FORMING OPINIONS

16. I have been asked by plaintiffs to proffer opinions on (1) whether the CRLF and SFGS are present at Sharp Park; (2) whether Sharp Park Golf Course's operations and maintenance activities have taken, are taking, and will continue to take members of these species as the term is defined by the ESA and its implementing regulations (*i.e.*, to encompass direct killing or injuring individual members of the species, as well as harassing and harming them through significant habitat modifications that result in actual death or injury to members of the species); and (3) whether such ongoing impacts are likely having adverse effects on the long-term ability of the species' populations at Sharp Park to survive and recover.

17. In formulating and rendering my opinions on these matters I have relied on my overall background and familiarity with these species and with related species, as well as the official listing, recovery plans, and other published materials concerning these species issued by the FWS; the published, peer-reviewed literature on the species including my published and unpublished fieldwork on the species; and all publicly available reports, studies, and publications regarding the CRLF and SFGS at Sharp Park, and in particular the materials listed in Attachment C. My opinions are also based on my own site inspections at both Sharp Park

and Mori Point; site photographs I have both taken and reviewed (as specified in this report); declarations and other materials filed in connection with plaintiffs' motion for a preliminary injunction (particularly the declarations of Dr. Mark Jennings [hereafter Jennings Decl.], dated October 18, 2011; and Ms. Karen Swaim, [hereafter Swaim Decl.], dated October 21, 2011, both in Case No. 3:11-CV-00958 SI); personal communications I have had with Darren Fong, an Aquatic Ecologist with the Golden Gate National Recreation Area ("GGNRA"); a 2010 GGNRA report senior-authored by Mr. Fong, part of which summarizes data collected at Sharp Park and adjacent Mori Point on the CRLF; personal communications I have had with Mr. Kuhn, a former employee of Swaim Biological Consulting who was directly involved in biological surveys at Sharp Park; a 2010 study performed by Brett DiGregorio and his associates concerning snake mortality at a golf course on the Outer Banks in North Carolina, and personal communications I have had with Mr. DiGregorio concerning that research; and pertinent materials produced in discovery in this case (particularly the survey sheets for CRLF egg masses prepared by Jon Campo and other San Francisco Recreation and Parks Department ("RPD") employees; and the deposition testimony of Mr. Campo, Mr. Ascariz, and Ms. Wayne), as well as other materials identified in the discussion that follows. A list of the materials I relied upon in writing this report is attached as Exhibit B.

OPINIONS AND THE BASIS AND REASONS FOR THEM

I. Sharp Park Is Important, Occupied Habitat For the CRLF and SFGS.

18. It is my professional opinion that Sharp Park is not only occupied by the CRLF and SFGS, but it is also extremely critical recovery habitat for these imperiled species. For imperiled species in general, their long-term survival and recovery depends on maintaining an adequate number of independent populations, to protect against stochastic (or chance) events, disease, or other threats. Avoiding the loss of the populations of these two species at Sharp Park is essential to the long-term viability of existing populations of SFGS and to reestablish populations within the snake's historic range. Preservation and enhancement of Sharp Park is also essential for the CRLF to recover, and if areas like Sharp Park are not preserved and

enhanced for the benefit of the species, and take avoided or at least minimized, the CRLF may never recover.

19. The threatened CRLF faces a wide variety of threats to its continued existence, and if these threats are not arrested and reversed, a high probability exists that the species will one day go extinct. By the mid-1980s, the species had already been lost from 70% of its historic range, and extirpation of a number of populations extant at that time has occurred since then. Destruction and adverse modification of the species' terrestrial and aquatic habitat is the primary reason for these declines, though this has been exacerbated by periodic extreme drought conditions over the last 25 years. The latter conditions are a poorly recognized part of climate change. Within the climate change trajectory under which we currently exist, more extraordinary measures are necessary to protect the terrestrial and aquatic habitat for the CRLF. In particular, this trajectory is characterized by greater frequency of climatic extremes (either drought or precipitation events) that will make it increasingly difficult to prevent or mitigate adverse changes to CRLF and SFGS habitats.

20. The endangered SFGS is critically imperiled: it is the most endangered serpent in North America. The species' natural range, centered on San Mateo County, is intrinsically small. However, many of the species' most important known habitats were lost to urbanization and development, and today the species is found in significant numbers in only a few fragmented locations. The species is now so rare that accurate estimation of its total population size is difficult. This is because it is inherently difficult to find rare species when few individuals are present overall, and surveys that detect even one SFGS are therefore infrequent. This zero-inflated survey frequency (i.e., an excess of zero-observation surveys due to the species' rarity) makes population estimation, even using mark-recapture approaches, unreliable.

21. Given the ongoing, serious threats to the CRLF and SFGS throughout their ranges, conserving these species over the long term depends on affording adequate protections to the species in those remaining habitats where the species are present. It is my professional opinion that both the CRLF and SFGS are present at Sharp Park. The presence of the CRLF at Sharp Park is well documented. Several of the defendants' publications and reports have confirmed

the presence of the species on the property, including the Sharp Park Conceptual Restoration Alternatives Report and several biological reports prepared by the City's biological consultants.

22. On June 26, 2011, I personally observed CRLFs along the channel connecting Laguna Salada to Horse Stable Pond, and in Horse Stable Pond. True and correct copies of photographs of CRLF that were taken during my visit to Sharp Park on June 26, 2011 were attached to my October 6, 2011 Declaration (*see* Docket No. 60-3, Ex. C). It is my unqualified professional judgment that the CRLF is present at Sharp Park.

23. It is similarly my unqualified professional judgment that the SFGS is present at Sharp Park. The recorded literature shows that over 40 specimens were collected there in the mid-1940s, that similar numbers were observed near Horse Stable Pond in the 1970s, and that more recently four SFGS were recorded at Horse Stable Pond in 2005, and two more were found a few feet south of Horse Stable Pond during removal of old tires on September 29, 2008. It is my understanding that three SFGS were observed at Mori Point in 2011, directly adjacent to Sharp Park to the South.

24. In addition to these SFGS sightings, my judgment that SFGS continue to occupy Sharp Park is also based on the fact that the focal prey base upon which the SFGS depends, life stages of stillwater-breeding amphibians, remains available at Horse Stable Pond, though as I discuss later, this prey base is being harmed by RPD's activities. Moreover, other lines of evidence indicate that SFGS continue to occupy Sharp Park. SFGS, like all gartersnakes, feed exclusively in aquatic habitats. Aquatic habitat at Sharp Park includes Horse Stable Pond and Laguna Salada, both of which are stillwater habitats, on which SFGS are cued to search for stillwater-breeding amphibian prey regardless of whether that prey is present, because that type of habitat is the only aquatic habitat in which those amphibians reproduce. For snakes to ignore the aquatic habitats in which their focal prey breeds would put them at risk. Hence, searching behavior by SFGS in stillwater habitat for their stillwater-breeding amphibian prey would be expected. The only suitable alternative stillwater habitats available, several of the ponds that now exist at Mori Point, did not become available until after 2005, when they were created. Yet these ponds subsequently attracted SFGS, indicating that the recovery efforts at Mori Point are

succeeding. Further, Sharp Park's proximity to known SFGS habitats at Mori Point and San Francisco Public Utility Commission watershed lands that can be used for aestivation or overwintering, coupled with the fact that most SFGS sightings over the last 25 years in the area have occurred near the Sharp Park/Mori Point boundary south of Horse Stable Pond, indicate that SFGS move across that area seasonally. These collective data indicate that no valid scientific reason exists why individual San Francisco gartersnakes would *not* be present at Sharp Park.

25. Accordingly, I agree with the City and County of San Francisco's own biologist, Karen Swaim, who concluded in her 2008 report (on p. 3-2, section 3.2, end of first paragraph) that past "observations, the abundance of prey items in these areas, their proximity to observations of the snake at Mori Point and Horse Stable Pond, and historical occurrence suggest that SFGS likely forage in and move through the areas around Lower Sanchez Creek, Laguna Salada, the canal, and Horse Stable Pond."[1] Given the 2011 observations of SFGS at Mori Point mentioned previously, the validity of SFGS currently using adjacent areas of Sharp Park still stands.

II. <u>Activities At Sharp Park Are Taking the CRLF and SFGS</u>

26. In my professional opinion, a host of activities being undertaken by the RPD at Sharp Park are taking the CRLF and SFGS, both directly and indirectly. For purposes of this report, I will address activities that, if left unchanged, are virtually certain to cause ongoing take of the species. For purposes of this report, I am applying the definitions of "take" that I understand to be set forth in the ESA and implementing regulations, i.e., take is defined by the ESA to encompass actions that include "killing," "injuring," "harassing," and "harming" members of a listed species. I also understand that the ESA implementing regulations define "harass" in the definition of take to encompass an action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns such as breeding, feeding or sheltering; and that the regulations define "harm" in the take definition to include actions that entail significant habitat modification or degradation where it actually kills

[1] However, I do not concur with Ms. Swaim's conclusion that an abundance of potential SFGS prey in Laguna Salada—which I will demonstrate, based on Swaim's own data, are in fact largely lacking in the lagoon—drives SFGS foraging. Rather it is the presence of stillwater *habitat* with the *potential* of containing suitable prey that drives SFGS foraging activity.

or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering.

27. Applying these definitions of take to the relevant scientific information, it is my opinion that a number of activities routinely undertaken by RPD employees take, and will unavoidably continue to take, the CRLF and SFGS. These activities include water pumping, which leaves frog egg masses exposed to the air; entrains frog tadpoles, metamorphs or juveniles in the pumps; injures juveniles and possibly adults by plastering them against the intake screens of the pumping gate; and which I understand can alter hydrological gradients in Laguna Salada such that salinity levels may become high enough to kill CRLF embryos, and possibly early life stages. The harmful activities also include mowing, which can kill or injure both species with blades or by crushing them with wheels; and golf cart use, both on and off golf cart paths, which can crush CRLF and SFGS.

A. <u>Water Management Activities</u>

28. When the winter rains come, the golf course at Sharp Park floods. Photographs of flooding events at Sharp Park were attached to my October 6, 2011 Declaration (*see* Docket No. 60-3, Ex. B). To eliminate the flooding, the golf course has installed two pumps that drain Sharp Park's aquatic features and send the water through an earthen berm and onto a relatively saline pool on a sandy beach at low tide and out to sea at high tide. It is my professional opinion that these pumping operations causes take of the CRLF in three distinct ways: (1) through desiccation of egg masses; (2) through entrainment in the pumps; and (3) through modification of habitat in Sharp Park water bodies. By modifying habitat and reducing prey availability by taking CRLF, pumping is also reasonably certain to be taking SFGS.

1. <u>Egg Desiccation and Stranding</u>

29. The CRLF is the largest frog native to the west. Like all true frogs, the species requires aquatic habitats in which to breed and lay eggs, and for tadpoles to develop, metamorphose into juveniles, and become adults. Under normal conditions, the frog will lay its eggs during late winter rains, and attach its egg masses to aquatic vegetation near the high water mark. If the water levels are sufficiently deep for a long enough interval, the eggs will hatch, tadpoles will

emerge and feed, and eventually become adults. However, by pumping water from Sharp Park Golf Course during the rainy season, the golf course exposes CRLF egg-masses to the air, causing these eggs to desiccate or become stranded, and the animals will die.

30. I base this conclusion on my decades of work on the species, my understanding of the RPD's egg mass monitoring data, as well as my review of reports published by the City and County of San Francisco. I concur with the view expressed in the City's Conceptual Alternatives Report, which explains (on page 39) that at Sharp Park, when "the water levels drop, these egg masses can be stranded on dry ground and desiccate," and that "[e]ven if water persists long enough for eggs to hatch in these areas, most tadpoles would have limited mobility in the dense vegetation in the marsh area and may be stranded well before metamorphosis." If pumping were ceased once CRLF eggs are laid, it is my professional opinion that egg masses would not become stranded and desiccate, and there would be sufficient water for CRLF eggs to develop into fully formed-frogs.

31. CRLF attach their eggs to a vegetation brace near the water surface because it ensures higher survivorship at hatching. Because the eggs are attached at a specific point on aquatic vegetation, they have only limited ability to rise and fall with water levels corresponding to the pliability of egg mass jelly. It therefore does not require much lowering of water levels to strand CRLF eggs. Pumping during the breeding season puts CRLF eggs at high risk of being killed. When pumping occurs during the peak-breeding season, an entire annual cohort (generation) of CRLFs can be jeopardized at once. Peak breeding season corresponds with the times that the golf course floods, and therefore, in every year with sufficient rains, golf course pumping operations that take CRLF eggs are a certainty.

32. Indeed, the available data is overwhelming that CRLF egg masses are being desiccated and stranded due to defendants' pumping operations rather than any natural or other factors. Unlike species of western North American *ranid* frogs that typically lay unattached egg masses in water having a shallow total depth (7.5-15 centimeters [3-6 inches]) (for example, Cascade Frog [*Rana cascadae*] and Oregon Spotted Frog [*Rana pretiosa*]) and that are, as a consequence, vulnerable to water fluctuations, CRLFs are less susceptible to stranding because

they typically deposit egg masses attached to a vegetation brace where total water depth is somewhat greater (>15 centimeters [>6 inches]). Moreover, the jelly in which CRLF eggs are imbedded is somewhat pliant and elastic, and the vegetation braces on which the CRLF typically deposits its eggs also have some pliability. In combination, these factors allow CRLF egg masses to generally tolerate some water fluctuation without stranding. Stranding of CRLF egg masses uninfluenced by human activities does occur, but rarely; and typically involves few egg masses. I have personally viewed it but three times (each time involving 1 to 3 egg masses) in many observations of many hundreds of CRLF egg masses over my years of field work on this species.

33. The stranding and desiccation rate at Sharp Park, in contrast, reflects an alarming increase of strandings compared to what would be expected in the absence of human interference. According to data produced in discovery, in 2011 nearly 80% (128) of the 159 CRLF egg masses observed by the City of San Francisco at Sharp Park had to be moved to so the eggs or subsequent tadpoles would not become stranded (Docket No. 54-6, Ex. 10). This is an incredibly high rate of egg-mass stranding, much higher than any rate documented in the scientific literature. It cannot be explained by normal variability in rainfall, topography, or drainage—it can *only* be a product of human agency adversely affecting habitat conditions on the site. In my professional opinion, therefore, the data is overwhelming that defendants' pumping operations are causing and will inevitably continue to cause a large number of CRLF egg mass desiccations and strandings.

2. <u>Entrainment in pumps</u>

34. The second way that the pumping operations inevitably cause take of the CRLF is by entraining tadpoles or other mobile life stages of the species in the pumps as they suck water from Horse Stable Pond out to sea. I have reviewed documents indicating that the City has long known that the massive amounts of water sucked from Horse Stable Pond have a high probability of entraining CRLFs. On June 25, 2011, during a visit to Sharp Park, I personally observed an adult CRLF on flotsam that had accumulated immediately adjacent to the debris grate to the inflow compartment of the Sharp Park pump house in Horse Stable Pond. A copy

of a photograph of that frog in this location was attached to my October 6, 2011 Declaration (*see* Docket No. 60-3, Ex. C). Had the pump been turned on with any frog life stage adjacent to this debris grate, it would be at high risk of entrainment. Entrained animals small enough would go through the grate, and if they survived the sheer stress of moving through the outflow pipe, would be swept into inhospitable (saline) habitat in the pool below the outflow pipe on the upper beach. If they were too large to go through the grate, such as an adult CRLF might be, they would be plastered against the grate until the suction was reduced when the pump was shut off. An animal remaining plastered to the grate for too long an interval (that is, the pump remaining on continuously for more than 30 minutes) would likely either drown if it was beneath the water line or be irreversibly injured because it was unable to do the normal buccal pumping (a movement of its throat muscles) required for it to ventilate its lungs. The latter would deprive the Frog of sufficient oxygen. I have observed several individuals of a closely related species, the Northern Red-legged Frog (*Rana aurora*), die because they were plastered to a grate with similar-sized mesh through which there were only moderate flows, and based on the capacity of the pumps at Sharp Park (over 25 cubic feet per second ("cfs") potential capacity; at least 15.5 cfs actual capacity) the same fate would befall the CRLF.

35. It is also my professional opinion that it is virtually certain that CRLF tadpoles have been taken, and will continue to be taken, by the Sharp Park pumping operations as they are drawn into the pump and spewed out to sea. Crayfish are strong swimmers and have a hard exoskeleton. I have reviewed documents reflecting that crayfish have been sucked through the pumps at Horse Stable Pond. A photograph of a freshwater crayfish observed inside Sharp Park's outfall pipe was attached to my October 6, 2011 Declaration (*see* Docket No. 60-3, Ex. D). The crayfish could only have gotten here by being pumped through the pump house. I have also reviewed a Swaim Biological, Inc. Sharp Park Outfall Repair Biological Monitoring Form from November 23, 2008, which states that "several dead crayfish found at discharge end of pipe at beach," and concluding that "if crayfish can become entrained in pump then frogs might also." California red-legged frog eggs and tadpoles, unlike crayfish, have a highly flexible cartilaginous skeleton surrounded by a jelly-like body, and they are weak swimmers,

particularly during the very early stages of development. Since strong swimming species such as crayfish have been observed dead after being sucked through the pump house, tadpoles would also be sucked into the pump intake under the same or weaker forces.[2]

3. <u>Habitat modification</u>

36. The third way the pumping operations cause take of CRLF is by keeping the aquatic habitats artificially shallow, which degrades habitat quality for CRLF aquatic life stages. Pumping creates shallow aquatic conditions that promote the growth of cattails and tules, aquatic plant species that cannot tolerate deeper water conditions. Over the years, these two tall emergent plant species have encroached on the stillwater aquatic habitats in Sharp Park, namely Laguna Salada, Horse Stable Pond, and the connecting channel between them, greatly reducing the amount of open water, floating, or low emergent vegetation that is suitable habitat for the CRLF and SFGS to breed and feed. This reduces the overall habitat quality for these two species, and reduces the habitat footprint needed for individual frogs and snakes to perform the behaviors they require for survival, behaviors like breeding, feeding, and sheltering. It is my professional opinion that this encroachment, which is really a promotion of succession in a coastal lagoon system that would not otherwise exist at present, is a direct consequence of the Golf Course's ongoing pumping of Horse Stable Pond and Laguna Salada. Lagoons along the coast of California typically have a stream dynamic, largely through winter high flows, that renews their open water habitat footprint. Laguna Salada is a historic lagoon, but its system dynamics are already constrained to varying degrees, mostly by presence of an artificial shoreline berm or seawall. Although these constraints might be expected to alter the lagoon over a long timeline (many decades to a few hundred years), the pumping pattern from Horse Stable Pond has rapidly accelerated the timeline for this encroachment, impairing the species' habitat in a manner that is causing impacts to the species' breeding, feeding, sheltering, and other essential life functions.

[2] Because tadpoles, and in particular recent hatchlings, are extremely delicate, it is highly likely that once the tadpole enters the pump, it will be shredded or torn into unidentifiable pieces before these pieces are spewed to the beach. The bony structures of fish and crayfish, on the other hand are likely to remain at least partially intact through such trauma, making them much easier to observe and, in my professional opinion, good indicators of take of the CRLF in this manner.

37. Pumping also modifies CRLF habitat by changing hydrological gradients affecting Laguna Salada. As pointed out by Dr. Peter R. Baye in his technical review and comment of the Sharp Park Conceptual Restoration Alternatives Report (hereafter Alternatives Report Review), pumping of water from Horse Stable Pond will alter hydrological gradients in Laguna Salada in the long run, especially between the groundwater interface between the Ocean and Laguna Salada. More specifically, as the climate change trajectory promotes continuing sea level rise, Dr. Baye's report suggests that it will become more likely that pumping will modify hydrological gradients around Laguna Salada and increase salinity within CRLF breeding habitats. Coupled with the likelihood that ocean wave overtopping of the seawall will continue to increase sea level rises, habitat degradation due to increased salinity in Laguna Salada is ultimately a certainty unless management practices at Sharp Park are changed.

38. Third, pumping can force young CRLF tadpoles into unsuitable habitat if pumping reduces water levels after the young tadpoles hatch from egg masses. At high water levels, oviposition along Laguna Salada's east margin has been well documented. However, because pumping eliminated water depth in this location, the City was forced to move large numbers of these egg masses to prevent massive egg die-offs. If these egg masses had been allowed to hatch when the water levels were sufficiently high, they would have had a high probability of long-term survival.

39. These same consequences of the City's water management activities at Sharp Park are also reasonably certain to take the SFGS. First, by destroying egg masses, and in turn, reducing the number of CRLFs in the Park, the pumping reduces the available prey base for the Snake in such as a manner as to reduce the prospects for survival of individual Snakes that depend on the site. Second, SFGS may also become plastered against the grate – or juveniles sucked through the grate – just as with the CRLF. Third, as noted, these activities adversely modify SFGS habitat in such a manner as to limit the ability of the SFGS to feed, breed, and engage in other critical life functions.

B. Inability of the Compliance Plan to Prevent Take From Pumping Operations

40. It is my understanding that the City has prepared an "Endangered Species Compliance Plan" ("Compliance Plan") for Sharp Park, which I have reviewed. It is my professional opinion that, even if the Compliance Plan were fully implemented, take of CRLF is nonetheless reasonably certain to continue through pumping-induced desiccation, entrainment, habitat modification, and impingement. Moreover, based on records of pump management and operations I have reviewed, my own observations of Sharp Park, and my professional opinion, I believe that the City is not and cannot actually implement the Compliance Plan.

41. The Compliance Plan is predicated on the City's ability to manage water levels to avoid desiccating or stranding frog egg masses. The inadequacy of this premise was made clear this past winter, when more than one hundred CRLF egg masses were put at risk of desiccation, and eggs in at least one egg mass were killed by the pumping operations at Sharp Park, despite the implementation of the Compliance Plan protocols.

42. It is my understanding, based on City records, that beginning in January, 2011, Recreation and Park Department staff-member Jon Campo was required to move over 100 egg masses which he concluded would be stranded and desiccate if left in place. *See* Docket No. 54-3, Ex. 5). I have also reviewed photographs of an egg mass that was documented at Horse Stable Pond completely exposed to the air, and ultimately found desiccated and partially frozen after extended pumping occurred pursuant to the Compliance Plan protocols. (*see* Docket No. 60-1, Ex. 3 and Docket No. 60-2, Ex. 4).

43. All of these egg mass strandings occurred despite the Compliance Plan because pumping water from Sharp Park during CRLF is inherently in conflict with successful frog breeding efforts. Sharp Park's pumps cannot pump water as fast as the rain flows into the system during normal winter rains. This causes floodwaters to rise above the level at which the Compliance Plan specifies the water must be retained. Indeed, upon reviewing the deposition transcript of John Azcariz, the City's stationary engineer, it is apparent that this fluctuation in water levels is part of the design of the Compliance Plan, despite the plan's purported desire to prevent waters from fluctuating. Rapid cycling of the pumps' on/off mechanism places additional wear and

tear on the pumps, so to improve pump longevity the City purposefully allows water levels to rise for some period of time before the pumps are turned on. Azcariz Dep., p. 25. When the pumps turn on and draw the water back down to the original water level, any egg mass that is laid in the interim will become stranded and die. Because it can take days for the water to be drawn down from a large storm, many CRLF egg masses that were laid under high water conditions will be exposed to the air or stranded in isolated pools, even though the Compliance Plan would be functioning as designed.

44. In addition, because the Compliance Plan allows, indeed commands, that a large amount of water to be pumped out to sea, the water that remains to secure egg and tadpole development is reduced. If a large rain event is followed by an extended drought, the buffer of rainwater provided by the initial storm event is eliminated, and the frog eggs and tadpoles are at risk of stranding or mortality.

45. As discussed above, the City addressed the failure of its Compliance Plan by moving stranded egg masses by hand into deeper waters. But it is my understanding the City will no longer be permitted by the FWS to relocate egg masses in Sharp Park until the City obtains incidental take authorization for its ongoing activities. Dec. 8, 2011 FWS letter. It is also my understanding based on Lisa Wayne's January 9, 2012 deposition (at pp. 222-227) that the City's pumping protocols are going to remain unchanged despite this development, and that Ms. Wayne stated "I don't have any specific plans" when she was asked how she would change protocols in response to this development. Her only suggestion was that she would "let the Fish and Wildlife Service know" if egg masses become stranded again this year. In light of these facts, it is my professional opinion that egg mass strandings will be unavoidable in any winter with precipitation levels are sufficient to raise water levels to the emergent edge of Laguna Salada. Given the FWS's prohibition on moving egg masses, any egg mass so laid will likely desiccate and die.

46. Even if FWS were to reverse course and permit the City to move stranded egg masses this year, the City's approach to locating, monitoring, and moving egg masses is so flawed that so long as the City continues to pump during the breeding season, the City can not possibly

ensure that take of CRLF is reduced to the point that permits from FWS are no longer necessary. The City's approach relies on perfect detection levels by biological monitors as they search for CRLF egg masses in the tules, cattails, and bulrushes around Sharp Park's many acres of waterways, ponds, and canals. However, even with attached, essentially immobile life stages like eggs, it is not possible to detect all of the egg masses, or even estimate their individual detectability rate (a condition necessary to estimate egg mass abundance), using single-pass surveys. It is my understanding, based on Mr. Campo's deposition testimony (at pp. 50, 116), that Mr. Campo believes that he cannot observe all egg masses due to several observation constraints, and that he has explained this to his supervisors previously. I concur with this sentiment. In my extremely broad field experience with amphibians and reptiles, I know that detecting every frog and snake during a single-pass survey is nearly impossible to do, even where habitat complexity is extraordinarily low and the surveyor has the highest possible visibility of the habitat. Yet this nearly impossible task is critical to the success of the Compliance Plan, and that is why the plan is simply not capable of stopping take of CRLF at Sharp Park.

47. Locating and then moving stranded or nearly stranded egg masses due to pumping operations is itself a highly questionable mitigation measure. As a preliminary matter, CRLF typically deposit eggs in habitats where at least some of the offspring have a high probability of survival, otherwise the species would rapidly go extinct. It is therefore likely that moving egg masses from the locations CRLF chose to breed will have some deleterious impact. Moreover, most of the egg masses moved last winter were moved into Horse Stable Pond. Movement of egg masses from Laguna Salada to Horse Stable Pond, where a number of CRLF egg masses had already been laid, risks decreasing the survivorship of tadpoles in Horse Stable Pond because tadpole density is artificially and greatly increased. As density increases, CRLF carrying capacity can be reached or exceeded, and tadpole survival rates can decrease.

48. Additionally, CRLF egg masses are delicate, and individual eggs, and even entire egg masses, can be harmed and may become unviable when they are moved. It is my understanding from the testimony produced in this case that when Mr. Campo moves egg masses he does not

ensure that the egg mass is attached to a brace at the new location. Campo Dep., Docket No. 54-5, p. 57. He has also observed egg masses break apart as a consequence of a move, and he has further observed that the egg masses sometimes disappear from places he has moved them to. *Id.*, 58-62. Since a CRLF egg mass, when laid, is attached to a vegetation brace, to move the egg mass it must be removed from that brace and either re-attached to a new brace if placed in deep water, or laid in shallow water to ensure survival. This is because egg masses through the first two-thirds of the developmental interval will sink (they are denser than water) in deep water if unattached, which will increase the likelihood of mortality. Egg masses placed in shallow water to avoid the sinking problem will risk stranding if pumping occurs, or risk floating into deeper water if unattached and any disturbance occurs.

49. In addition, because the City's practice has been to move all egg masses into Horse Stable Pond—where the suction from the pumps is highest—egg mass movement puts tadpoles at a higher risk of entrainment and impingement. The Compliance Plan lacks adequate protocols to prevent impingement or entrainment of tadpoles or other mobile life stages of the CRLF. In particular, the Compliance Plan does not provide for regular observation or monitoring once pumps are turned on after egg masses hatch; it does not provide for a screening mechanism around known oviposition sites that would prevent tadpoles, particularly hatchlings, from swimming too close to the pump intake port during a pumping event; and it does not provide for some kind of velocity reduction mechanism, such as screening baffles, associated directly with the intake port to reduce the likelihood of CRLF life stages being plastered against the screen.

50. It is my professional opinion that the unauthorized take of CRLF and SFGS through pumping operations will continue so long as RPD operates the pumps at Sharp Park, and that prohibiting pumping when egg masses are found will stop pump-related strandings of frog egg masses and will ensure that tadpoles are not entrained or impinged. Ceasing pumping when egg masses are observed would ensure that egg masses have the greatest possible chance to develop, and tadpoles to metamorphose to adult frogs before water levels decrease when the rains stop. This has been recognized by a wide variety of research, and is the appropriate conclusion based on my many years of research. I concur with the statement contained in Appendix C of the

City's "Sharp Park Conceptual Restoration Alternatives Report," in which the City's consulting biologist, Karen Swaim, concluded that "[d]iscontinuing pumping at Horse Stable Pond would be expected to result in reduced fluctuations in water level and a lower risk of egg mass desiccation. . . . Under ambient conditions, rainfall and inflow from the rest of the watershed during this period would prevent egg masses from becoming stranded above the waterline." I also concur with Ms. Swaim's recommendation in the same report that the City should "[e]liminate unnatural water level reductions during the frog breeding season."[3]

51. Discontinued pumping would also ensure that tadpoles or other mobile life stages of the CRLF are not entrained or damaged by the pump, since no pumping would be occurring.

52. Discontinuing pumping would have the added benefit of improving overall habitat conditions for the CRLF by limiting the growth of tules and cattails, which are currently encroaching on a large number of acres of habitat for the frog. Tules and cattails cannot grow in deep water, and other vegetation types or open water eventually replaces them as water levels rise. This would provide additional habitat availability for frog breeding, egg laying, and tadpole development, significantly improving habitat quality and eliminating the impediments to the CRLFs' essential breeding patterns currently imposed by the golf course water management. Discontinuing pumping would also have the benefit of reducing the likelihood of saltwater intrusion into Laguna Salada, and as a consequence, increase the likelihood that CRLF would make greater use of the Laguna Salada for breeding. Water quality data collected within the last 10-year window in Laguna Salada coupled with my own direct observations of the vegetation on selected areas on the west side of Laguna Salada strongly suggest that a salinity influence on Laguna Salada currently exists that appears to vary seasonally. Pumping is likely to exacerbate salinity to levels that would be lethal to CRLF embryos.[4]

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[3] I have observed atypical water level fluctuations, the consequence of pumping, inhibit breeding in a pond used by Northern red-legged frogs and observed individuals breed in an immediately adjacent pond. Excessive water level fluctuation inhibits breeding in the stream-breeding Foothill yellow-legged frog, so it would not surprise me that atypical fluctuations might not only inhibit breeding at the appropriate time in the CRLF, but it risks egg mortality from stranding after breeding has begun. Any action that minimizes water level fluctuation prior to or during breeding for the CRLF would enhance its successful breeding.

[4] Dredging Laguna Salada to reduce its dense vegetation footprint could result in much more harm and risk to both the CRLF and the SFGS. In particular, the excavation of anoxic organic

C. Take From Mowing and Other Activities

53. Mowing and/or golf cart operations have also been documented to cause take of endangered species at Sharp Park in the past, and it is my professional opinion that these operations also are reasonably certain to result in take of CRLFs and/or SFGS in the future. According to the FWS's 2006 Five-year Status Review of the SFGS, which I have reviewed, a dead SFGS found at Sharp Park in 2005 had been killed by a golf course lawn mower. I have reviewed the declaration of Steve Salisbury, which explains that Mr. Salisbury discovered this dead snake on Sharp Park's Hole 12 near the edge of the green, and I have reviewed the photographs of this snake and have read the correspondence that accompanied the file, all of which is attached to my October 6, 2011 Declaration, *see* Docket No. 60-3, Ex. E. I concur that the snake was killed either by a lawn mower or another mechanized vehicle, such as a golf cart. The dorso-ventral compression indicated in the picture of this animal is characteristic of road-killed snakes that have been run over by a vehicle, of which I have observed many thousands during thousands of hours of road-riding for snakes in my career. However, animals road-killed by car-sized vehicles or larger, especially those the size of a SFGS, typically show extreme dorso-ventral compression: that is they are often paper thin because they have been run over by a number of large vehicles (cars, trunks, or semis) in a relatively short period of time. The animal killed at Sharp Park's Hole 12 shows only a moderate amount of dorso-ventral compression, indicating that the mass of the vehicle or vehicles that ran it over was not as extreme, such as something in the mass range of a mower or a golf cart.

54. Though golf carts have traditionally been viewed as innocuous, recent work clearly demonstrates that they are responsible for substantial mortality among snakes. A 2010 study by Brett DiGregorio and his colleagues on an Outer Banks golf course in South Carolina, *see* Docket No. 79-1, Ex. B, in an area where car-sized vehicle traffic is virtually non-existent, concluded that nearly all of the more than 200 snakes found road-killed in the study were killed by golf carts or lawn mowers, since no other vehicles are used on golf course grounds. Further,

wetland soils can result in the excessive release of toxic sulfides and their acid sulfur oxidation products can subsequently become manifest.

all direct observations by these investigations of a golf cart striking a snake resulted in the death of that snake (B. DiGregorio, *personal communication*).

55. It is reasonably certain that many more SFGS have been killed by mowing and golf cart operations in Sharp Park than have been documented. However, detecting dead SFGS is difficult to do, because snake carcasses are rapidly scavenged. Corvid (various species of crows, ravens and jays) and larid birds (various species of gulls), a number of carnivores (especially foxes, coyotes) and various other species are highly opportunistic scavengers on carrion and will rapidly remove carcasses when these become available.

56. During my two recent (2011) short (partial day) visits to Sharp Park, I observed many crows, gulls, jays, and I heard ravens, and I also directly observed one or two foxes on each visit. The foxes were scavenging from human garbage, suggesting that they were food-limited. In such an environment, I would expect carcasses of either SFGS or CRLF to be available for an observer to detect for only a short time. In fact, Brett DiGregorio and his colleagues clearly demonstrated in a study currently in press (B. DiGregorio, *personal communication*), Docket No. 60-3, Ex. F, that a suite of effective scavengers can result in substantial underestimate of road-kill mortality. My observations of the scavenger set at Sharp Park indicates that numerous effective scavengers are clearly present, so underestimating SFGS mortality at Sharp Park is the anticipated result.

D. Inability of the Compliance Plan to Prevent Take Through Mowing

57. Even if fully implemented, the City's Compliance Plan does not eliminate the reasonable certainty that take from mowing and golf operations will occur, given that the scale of mowing and golf cart use, particularly around the edge of water features, is so massive. As I understand the Compliance Plan, it relies on biological monitors to observe numerous acres of habitat with 100% reliability to ensure that all frogs and snakes will be detected, moved, or mowing delayed until the species are clear from danger. However, the protocol, even if implemented faithfully, cannot attain this level of reliability; rather it is certain to be *unable* to detect all frogs and snakes present. No species of amphibian or reptile has perfect individual detectabilities, and where detectability has been measured it is typically far less than one, with snakes often having

detectabilities less than 0.2 (a detectability of 0.2 simply means that for every individual you see, there are 4 other you did not observe). In imperfect detectability situations, which are the norm for amphibians and reptiles, it is essential to know the levels of detectability of the animals you are trying to observe, or you cannot obtain accurate survey results. But the Compliance Plan protocol, which relies on single-pass, visual surveys before mowing occurs, cannot estimate detectability rates—at least two passes under controlled circumstances would be needed to estimate detectability, and such controlled conditions are unlikely to occur at Sharp Park. Therefore, the City is likely to take SFGS or CRLF simply because it failed to detect the animal under the Compliance Plan protocol.

58. Moreover, it is my understanding that monitoring at Sharp Park is being conducted by the golf course mowing staff, and that this monitoring is infrequent, sometimes conducted in the dark, and not conducted by individuals with the requisite training (Kappelman Deposition, pp. 51-56). Therefore, even these basic, albeit inadequate monitoring safeguards contained in the Compliance Plan are not being implemented. Hence, this inadequate protocol is highly likely to result in take.

59. For these reasons, it is my professional opinion that unauthorized take of SFGS and CRLF through mowing operations is highly likely to occur unless defendants cease mowing and golf cart use within roughly 200 meters of the delineated wetland boundary area at Sharp Park, which will ensure that the species are not taken while they traverse within their normal daily range. Moreover, the size of the buffer area will ensure that edge and upland habitats will extend out beyond the high water mark of flooded areas, and provide secure refuge, estivation and underground habitat for snakes and frogs.

III. The Ongoing Take Threatens The CRLF and SFGS Populations At Sharp Park/Mori Point, and Undermines NPS's Recovery Efforts

60. It is my professional opinion that unless golf course operations that cause ongoing take of the CRLF and SFGS are halted or at least significantly curtailed, populations of both species in the Sharp Park/Mori Point complex will likely be lost in the foreseeable future. With respect to the SFGS, in view of the extremely imperiled status of the species and the critical importance

of conserving all remaining populations, it is my professional opinion that the ongoing take that is occurring at Sharp Park is jeopardizing the entire species.

61. Moreover, because of Sharp Park's proximity to recovery efforts at Mori Point, the golf course is also negatively affecting a functioning recovery process. The Mori Point recovery effort is the driver that maintains and enhances the CRLF and SFGS at the Sharp Park/Mori Point complex. If the harmful activities at Sharp Park are not arrested, the recovery efforts complete disruption and ultimately fail.

62. As a preliminary manner, the available data does not support the proposition that there has been an "overall increase in the number of CRLF in Horse Stable Pond and to a lesser extent, in Laguna Salada." Decl. of Lisa Wayne, Docket No. 72, p. 2. In fact, Fong et al. 2010 showed CRLF egg mass numbers in Horse Stable Pond were, at best, stable from 2003 to 2009, *not* that the egg mass numbers have been increasing. My own analysis of the data set supplemented with 2010 and 2011 egg mass data, supports Fong et al.'s conclusion. I ran a simple linear regression on the GGNRA's available data set for egg masses surveyed at Horse Stable Pond. This data set includes all known observations of egg masses at Horse Stable Pond, but excludes egg masses from Laguna Salada because there has been inconsistent survey effort by the City at Laguna Salada across time, making year-to-year trend analysis of Laguna Salada's egg mass data ambiguous. The results of this analysis show that there has been no discernable change in egg mass numbers at Horse Stable Pond over the past nine years.

63. I agree with Lisa Wayne's subsequent deposition testimony that there are no discernable changes in CRLF egg mass numbers at Sharp Park. For example, when asked, "[d]o you have an understanding of what the trend is of the population of red-legged frogs at Sharp Park?," she responded "no." When she was asked, "What I want to make sure I understand is you can't draw any conclusions on the population trends of Sharp Park based on the egg mass observations of last year; is that right?," she responded "No. In one year, no." Wayne Dep., p. 249-50.

64. It is my professional opinion that pumping-induced habitat degradation at Sharp Park, combined with the high probability of CRLF take events into the future, will cause the CRLF

population to become unstable, decline, and threaten the recovery of the entire Sharp Park/Mori Point population. The defendants' and intervenors' declarants agree that Laguna Salada currently provides poor breeding habitat for CRLF. For example, Dr. Jennings has stated that "Laguna Salada and Horse Stable Pond are now completely choked with a thick and overgrown mat of tules and cattails, displacing optimal frog breeding ground and resulting in less favorable habitat for the Frog," Jennings Decl., p. 19, and Lisa Wayne has suggested that "[d]ense tule and cattail growth, in particular, reduce the value of the habitat for CRLF breeding."[5]

65. What is missing from their statements is an explanation about why tule and cattail growth is increasing. As explained by Dr. Peter Baye, this encroachment is directly attributable to golf course pumping and water management. As water is drawn down by pumping to a shallow depth, and kept within a narrow elevation band, tules and cattails, which cannot survive in deeper waters, are able to grow and spread in the artificially shallow lagoon. This is directly attributable to the artificial water levels imposed by golf course management, and the decline in habitat quality described by the intervenors and the defendants is directly attributable to this pumping-induced vegetation growth. I agree with Ms. Wayne's deposition testimony where she stated that allowing water levels to increase at Sharp Park would prevent tules and cattails from growing rapidly in Laguna Salada and Horse Stable Pond. Wayne Dep., p. 214-215.

66. Breeding habitat in Sharp Park has been declining due to succession caused by artificially shallow and invariant water levels. Furthermore, juvenile recruitment at Sharp Park is also low. How is it then possible that so many egg masses were laid at Sharp Park in 2011? The answer lies neither in the City's failed Compliance Plan, nor in the pumping and mowing threats that the golf course imposes on these species. Rather, the answer is found in the increase in habitat via the creation of new ponds at Mori Point since 2005, and in recognizing the fact

[5] Laguna Salada's decreasing ability to sustain CRLF habitat over time is also indicated by the failure to find CRLF tadpoles in the lagoon, 2008 Swaim report, p. 5.1, and the generally fewer observations of juvenile CRLF in Laguna Salada relative to Horse Stable Pond. These observations clearly indicate inadequate habitat conditions and recruitment problems for CRLF in Laguna Salada.

that the CRLFs that occupy Sharp Park do not represent a population independent from the CRLFs at Mori Point.

67. Directly adjacent to Sharp Park, Mori Point's recently restored habitats are a demonstrable population source that contributes to CRLF and SFGS production at Sharp Park and Mori Point. In November 2004, the Fish and Wildlife Service, the Golden Gate Park Conservancy and the Golden Gate Natural Research Area completed construction of two ponds (Willow and Middle Ponds) at Mori Point to enhance amphibian habitat and provide foraging opportunities for the SFGS (see Fong et al. 2010). In addition, in the fall of 2007 two larger ponds (Wetland Pond [36 m ! 12 m] and Southern Pond [18 m ! 32 m]) were built at Mori Point.

68. During this time period, CRLF egg masses and SFGS were surveyed at both Sharp Park and Mori Point to determine the efficacy of the recovery efforts. The analysis of these surveys showed, as discussed above, that egg mass counts in Horse Stable Pond over this time interval showed no significant change—they were essentially stable. On the other hand, a statistically significant increase in egg mass numbers exists over the 7-year interval 2003-2009 at Mori Point (Fong et al. 2010, p. 6). Using the additional data for the most recent two years (2010 and 2011) obtained from the National Park Service, I ran a linear regression model on the Mori Point egg mass data for the entire suite of years between 2003 and 2011. I was able to show that a general increasing trend in egg mass counts at Mori Point—an indication that the CRLF recovery there is working.

69. In sum, it is my professional opinion that any increase in egg masses observed in the Sharp Park/Mori Point complex reflects continued increases in recruitment from the Mori Point ponds. Yet because defendants' activities at Sharp Park are taking the CRLF in several ways, including by adversely altering habitat conditions at Sharp Park, defendants activities are in fact having negative population-level impacts on the entire Mori Point/Sharp Park CRLF population. Indeed, to the extent that Sharp Park is now operating as a "population sink" due to defendants' activities, the extensive efforts by NPS to recover the CRLF population are being directly undermined and made far less effective than otherwise would be the case. Over the long term, it

is my view that these activities threaten the survival of the resident population and, if the population is lost, the recovery of the entire species will be impeded.

70. Similarly, SFGS in the Mori Point/Sharp Park complex are being negatively impacted by Sharp Park Golf Course's activities, while Mori Point's restoration work is helping the species recover. As explained above, the GGNRA has invested in extensive recovery efforts at Mori Point by constructing feeding habitats for the SFGS. A baseline survey was conducted before these ponds were constructed, and follow-up surveys for SFGS in 2006 and 2008 were implemented to determine the impact of the recovery effort.

71. The surveys were conducted by Swaim Biological, and published in a report entitled San Francisco Garter Snake Habitat Improvement Project at Mori Point, Pacifica, California 2004-2008. I have reviewed this report, and it appears that the SFGS population is in fact growing because of the habitat restoration efforts at Mori Point. The Swaim report generally shows greater numbers of SFGS over the interval 2004-2008, suggesting a recovery since the last systematic surveys were conducted in the mid-1980s and early 1990s. The report itself concludes that the "the long-term response of the SFGS population to the pond creation and enhancement project will be positive." Yet as explained above, Sharp Park's actions act as a "sink" on the overall population, and because the SFGS population is very small, the impact of this sink has extreme import on the population as a whole. If the golf course activities are not abated, it is my professional opinion that the SFGS population at Mori Point/Sharp Park will likely go extinct, and the entire species will be jeopardized with extinction.

1/20/12 s/Marc Hayes
Date Marc Hayes, Ph.D.

I, Brent Plater, hereby attest that Marc Hayes concurrence in the submission of this document has been obtained.

Executed on: January 20, 2012 Brent Plater
Brent Plater

EXHIBIT A

CURRICULUM VITA

Marc Philip Hayes

Birthdate: 12 October 1950
Birthplace: Marysville, California
Nationality: American, first generation (French mother)

Specializations: I am a research herpetological ecologist. The large majority of my career has focused on the ecology of amphibians and reptiles. My work has emphasized aquatic herpetofauna; in particular, the ecology of western North American ranid frogs and Pacific Northwest stream-associated amphibians, fish-amphibian and gartersnake-amphibian interactions, and the ecology of the two Pacific coast turtle species. Most of my work also focuses on native species conservation.

Current Foci: Movement ecology of the northern red-legged frog (*Rana aurora*); the influence of predation on the movement patterns of ranid frogs; Oregon spotted frog (*Rana pretiosa*) ecology, demography and overwintering patterns; ecology of the stream-breeding Coastal tailed frog (*Ascaphus truei*); and influences of altered hydrologies on amphibian habitat use.

Education:

1991 PhD *with distinction*, University of Miami, Miami, Florida
Dissertation: Attendance in the tropical, leaf-breeding frog *Centrolenella fleischmanni* (Anura: Centrolenidae): A study in parental care.
Major Advisor: Jay M. Savage

1975 MA *with highest honors*, California State University, Chico, California
Thesis: Systematics and ecology of the California mountain kingsnake (*Lampropeltis zonata*).
Major Advisor: Frank S. Cliff

1972 BA University of California, Santa Barbara, California

1970 AA *salutatorian*, Yuba College, Marysville, California

1968 Diploma Yuba City High School, Yuba City, California

Teaching Experience:

2010 (April) Society of Wetland Scientists (SWS); Amphibian Management Workshop.

2009 (March) SWS; Amphibian ID & Habitat Assessment Workshop;.

1999 (spring) Portland State University; Vertebrate Zoology (BI 387); lecture and lab.

1999 (June) Bureau of Land Management, Klamath Falls; Workshop on Amphibian and Reptile ID and Habitat Evaluation.

1998 (June) Portland State University; Field Herpetology (BI 505); lecture and lab; techniques course.

1992-8 Portland Community College; Biology [for non-majors] (BI 101,102,103); Principles of Biology [for majors] (BI 211,212,213), and Habitat courses (BI 141[Forest], BI 142[Aquatic], BI 143[Marine]); lecture and lab in all except BI 101 and 103, where lab only.

1996 US Fish and Wildlife Service and Willamette National Forest; Workshop on ecology of the Oregon spotted frog (*Rana pretiosa*).

1996 (spring) Workshop on the western pond turtle (*Clemmys marmorata*); US Fish and Wildlife Service.

1995 (spring) Portland State University; Herpetology (BI 413/513); lecture and lab; team taught with Drs. Richard Forbes and Stanley Hillman.

1993 (spring) Pacific University; Behavioral Statistics (PSY 350); lecture and lab.

1993 (spring) Oregon Zoo; Taught a ZooUniversity course on Amphibian Ecology.

1992 (fall) Oregon Zoo; Taught a ZooUniversity course on Arctic Ecology.

1983-1986 University of Miami; Taught the laboratory sections of courses in Elementary Ecology (BSC 103) and General Biology (BSC 111/112). [both lower division college courses.]

1978-1982 University of Southern California; As a teaching assistant, taught laboratory sections in Ecology and Evolutionary Biology (BIO 215), Fundamentals of Vertebrate Biology (BIO 302), General Biology (BIO 106L), and Genetics (BIO 210) and Humans and their Environment (BIO 102) [all lower division college courses]; and taught lecture and lab in Ornithology (BIO 477L) and Herpetology (BIO 543L). [both upper division and graduate college courses]

1976-1978 Butte College; Taught Environmental Quality Protection (ESC 200) [lecture course]; Field Biology (BIO 205), Field Botany (BIO 204), Human Anatomy (BIO 220), and Human Physiology (BIO 221) [lab and lecture for all courses], and Natural History of Butterfly Botanical Area (INP 100) [field course]. [all were lower division college-level courses].

1975 (spring) Bureau of Land Management, northern California; Taught Amphibian and Reptile Identification/Ecology Workshop.

1974-1975 California State University, Chico; As teaching assistant, taught laboratory sections in General Zoology (BIO 107) and Human Anatomy (BIO 122) [both lower division college-level courses].

Work Experience:

2006-present Senior Research Scientist, Science Team, Habitat Program, Washington Department of Fish and Wildlife; Expanded responsibilities addressing adaptive management research on amphibians in headwater streams; coordinate multi-state co-operation for Recovery of the Oregon spotted frog.

2001-2003 Conducted overwintering study of the Oregon spotted frog at Conboy Lake National Wildlife Refuge; Washington State Department of Transportation (sponsor).

2000-2005 Research Scientist, Science Team, Habitat Program, Washington Department of Fish and Wildlife; Primary responsibility addresses leading adaptive management research on amphibians in headwater streams to ultimately test whether the patch buffers prescribed in the statewide Forest and Fish Agreement are effective in protecting the resources in headwater streams through timber harvest rotations.

2000- Bullfrog selectivity study; on-going work at Conboy Lake National Wildlife Refuge designed to determine whether bullfrogs exhibit any dietary selectivity (positive or negative), especially with respect to the Oregon spotted frog as prey; w/ Christopher A. Pearl and R. Bruce Bury, US Fish and Wildlife Service (sponsor).

2000-2001 Oregon spotted frog demographic study; on-going work at Conboy Lake National Wildlife Refuge designed to determine whether significant larger Oregon spotted frogs found at Conboy exhibit differences in growth or age population from those elsewhere, US Fish and Wildlife Service and The Wildlife Society (sponsors).

1999-2002 Coordinator and Scientific Lead; Rivergate Project; Leading 10-person team in an on-going ecosystem study of South Rivergate Corridor (Lower Columbia River) with focus on western painted turtle (*Chrysemys picta*); Port of Portland (sponsor).

1999-2002 Northern red-legged frog (*Rana aurora aurora*) movement study; work on the Tiller Ranger District of the Umpqua National Forest (southwestern Oregon) designed to determine seasonal spatial patterns of habitat utilization; w/ Christopher A. Pearl and Christopher J. Rombough, Oregon Zoo and the Umpqua National Forest (sponsors).

1999-2001 Northern red-legged frog (*Rana aurora aurora*) overwintering study; work at Burlington Bottoms (Lower Columbia River) designed to determine overwintering patterns; w/ Dr. Peter I. Ritson, US Fish and Wildlife Service (sponsor).

1996-2001 Herpetological Scientific Advisor, North Umpqua Hydroelectric Project; Scientific advisor during FERC relicensing on dynamics of hydrological modifications as influencing the amphibian and reptile fauna of the North Umpqua Hydroelectric Project; Advisor for Stillwater Sciences, Berkeley, California.

1999-2000 Oregon spotted frog/bullfrog habitat partitioning study; on-going work at Conboy Lake National Wildlife Refuge designed to determine how habitat utilization of the Oregon spotted frog and bullfrog differ; w/ Joseph D. Engler, US Fish and Wildlife Service (sponsor).

1998-2000 Co-operator on movement and overwintering study of the Columbia spotted frog (*Rana luteiventris*); w/ Dr. Evelyn Bull, Pacific Northwest Forest Range and Experiment Station, La Grande.

1998-2001 Co-operator on study of headwater stream amphibians that builds an empirically based model of amphibian response in undisturbed versus disturbed (timber harvested) situations; w/ Stillwater Sciences (consultants); NCASI (sponsor), timber industry-funded entity addressing major environmental issues.

1998-9 Oregon spotted frog overwintering study; pilot study design to identify basic overwintering patterns; US Fish and Wildlife Service (sponsor).

1996 Expert panelist; Amphibians and reptiles; Habitat-Species project; Numerous sponsors collectively led by David Johnson and Tom O'Neill, respectively, with the Washington and Oregon Departments of Fish and Wildlife.

1987-1988 Laboratory Coordinator; Organized and coordinated teaching assistants and laboratory technicians in teaching, lab prep, and testing for General Biology (BSC 111/112) at University of Miami.

1972-1997 Researcher, co-operator, participant in over 60 ecological projects for various federal, state, local and private entities.

Other Experience:

2011- Member, Washington State Aquatic Nuisance Species Guidance Committee; committee formulates policy and addresses approaches for dealing with exotic and nuisance aquatic species.

2010- Adjunct Professor, Central Washington University, Ellensburg, Washington. Serving on Committee for Brandon Fessler Masters Degree Candidate working on the movement ecology of the Coastal giant salamander (*Dicamptodon tenebrosus*).

2007- Adjunct Professor, University of Washington, Department of Fisheries, Served on Committee for Amy Yahnke, who complete a Masters Degree on stillwater amphibian ecology in stormwater ponds; and serving on Committee for Amy Yahnke, PhD candidate working on contaminants affecting amphibians in stormwater ponds.

2002- Affiliate Curator, Herpetology, University of Washington Burke Museum. Herpetological collection research and curation.

2001-2006 Adjunct Professor, The Evergreen State College, Olympia, Washington. Served on Committee's for Jennifer Serra Shean and Joanne Schuett-Hames, both graduate students that completed Masters theses on the movement ecology of Northern red-legged frogs (*Rana aurora*).

2001-2009 Herpetological Review, Section Editor, Natural History Notes, Herpetological Review; editor for natural history notes on amphisbaenids, crocodilians, lizards, and tuataras (*Sphenodon*).

2000- Committee Member for two Master's level student projects at The Evergreen State College addressing northern red-legged frog movement and habitat utilization ecology.

2000-2001 Panel Member, Washington State Aquatic Nuisance Species Committee; committee addresses all issues regarding all categories of exotic animal and plant nuisance species ranging from immediate problems to education to research.

1998-2000 Panel Member, Wildlife Integrity Committee of the Oregon Department of Fish and Wildlife; committee developed scientifically based designations for imported and exotic wildlife.

1992- Adjunct Assistant, then Adjunct Associate Professor (1995-), Portland State University; served on Committees for Aaron Borisenko, a graduate student who obtained a Master's degree on the status of the Foothill yellow-legged frog (*Rana boylii*) in Oregon; and Catherine Callison, a graduate study who obtained a Master's degree on the Northern red-legged frog oviposition behavior and ecology.

Posters and Presentations:

2009 "Amphibian production in stormwater detention ponds, King County, Washington." presented at the 2009 Joint Annual Meeting of the Society for Northwestern Vertebrate Biology and Washington Chapter of the Wildlife Society held at Skamania Lodge, Stevenson, Washington, February 18-21, 2009. w/ Amy Yahnke and Christain Grue. (contributed poster)

2009 "Sex-specific identification of *Ascaphus truei* at maturity." presented at the 2009 Joint Annual Meeting of the Society for Northwestern Vertebrate Biology and Washington Chapter of the Wildlife Society held at Skamania Lodge, Stevenson, Washington, February 18-21, 2009. w/ April Barreca and Teal Waterstrat. (contributed poster)

2009 "Torrent Salamander movement ecology: perspective on a 'sedentary' species." Abstracts from the 2009 Joint Annual Meeting of the Society for Northwestern Vertebrate Biology and Washington Chapter of the Wildlife Society held at Skamania Lodge, Stevenson, Washington, February 18-21, 2009. w/ Julie Tyson. (contributed poster)

2007 "Species identification and body size estimation of amphibians in Washington State based on foot morphology. Abstracts from the 2007 Annual Meetings of the Society for Northwestern Vertebrate Biology, Northwest Scientific Association and Northwest Lichenologists held jointly at Harbour Towers & Suites, Victoria, BC, February 21-24, 2007. Northwestern Naturalist 88:101-127. (contributed poster)

2007 "Comparative diet of three species of terrestrial forest-dwelling amphibians (*Rana aurora, Dicamptodon tenebrosus*, and *Rhyacotriton kezeri*) in western Washington." Abstracts from the 2007 Annual Meetings of the Society for Northwestern Vertebrate Biology, Northwest Scientific Association and Northwest Lichenologists held jointly at Harbour Towers & Suites, Victoria, BC, February 21-24, 2007. w/ Casey Richart and Ryan O'Donnell. (contributed talk)

2007 "Differentiating *Ascaphus truei* at sexual maturity." presented at the 2007 Annual Meetings of the Society for Northwestern Vertebrate Biology, Northwest Scientific Association and Northwest Lichenologists held jointly at Harbour Towers & Suites, Victoria, BC, February 21-24, 2007. w/ April Barreca and Teal Waterstrat. (contributed talk)

2006 "Trends in the breeding population of Oregon Spotted Frog (*Rana pretiosa*) at Conboy Lake National Wildlife Refuge. Abstracts from the 2006 Annual Meeting of the Society for Northwestern Vertebrate Biology and the Washington Chapter of the Wildlife Society held jointly at Evergreen State College, Washington, March 27-April 1, 2006. w/ Joseph Engler and Christopher Rombough. (contributed talk)

2006 "Washington terrestrial slugs and snails." presented at the 2006 Annual Meeting of the Society for Northwestern Vertebrate Biology and the Washington Chapter of the Wildlife Society held jointly at Evergreen State College, Washington, March 27-April 1, 2006. w/ Casey Richart and William Leonard. (contributed poster)

2006 "Dispersion of Coastal Tailed Frog (*Ascaphus truei*): A hypothesis relating occurrence of frogs in non-fishbearing headwater basins to their seasonal movements." presented at the 2006 Annual Meeting of the Society for Northwestern Vertebrate Biology and the Washington Chapter of the Wildlife Society held jointly at Evergreen State College, Washington, March 27-April 1, 2006. w/ Timothy Quinn, Daniel Dugger, and Tiffany Hicks. (invited talk)

2006 "Torrent Salamander distribution within headwater streams." presented at the 2006 Annual Meeting of the Society for Northwestern Vertebrate Biology and the Washington Chapter of the Wildlife Society held jointly at Evergreen State College, Washington, March 27-April 1, 2006. w/ Amberlynn Pauley, Stephen West and Marty Raphael. (contributed poster)

2005 "Foothill Yellow-legged Frog abundance in Cow Creek." Abstracts from the 2005 Annual Meeting of the Society for Northwestern Vertebrate Biology and the Oregon Chapter of the Wildlife Society held jointly at Corvallis, Oregon, February 22-25, 2005. w/ Christopher Rombough and Nancy Duncan. (contributed talk)

2005 "Columbia Torrent Salamander (*Rhyacotriton kezeri*) occurrence in headwater streams: the importance of water," presented at the 2005 Annual Meeting of the Society for Northwestern Vertebrate Biology and the Oregon Chapter of the Wildlife Society held jointly at Corvallis, Oregon, February 22-25, 2005. w/ Daniel Dugger and Timothy Quinn. (contributed talk)

2005 "*Plethodon* Salamander occupancy in managed landscapes in southwest Washington." presented at the 2005 Annual Meeting of the Society for Northwestern Vertebrate Biology and the Oregon Chapter of the Wildlife Society held jointly at Corvallis, Oregon, February 22-25, 2005. w/ Aimee McIntyre, Timothy Quinn, Daniel Dugger, and Tiffany Hicks. (contributed talk)

2003 "Population changes in the Oregon spotted frog at Conboy National Wildlife Refuge: The pivotal role of hydrology", presented at the 2003 Annual Meeting of the Washington Chapter of The Wildlife Society in Port Townsend, Washington, April 15-17 w/ Joseph D. Engler. (invited talk).

2003 "Comparing Amphibian Sampling Methods : Which is Best for Headwater Streams?", presented at Amphibian Sampling Symposium at the 2003 Annual Meeting of the Society for Northwestern Vertebrate Biology in

Arcata, California, March 19-22. w/ Daniel J. Dugger, Tiffany L. Hicks, and Timothy Quinn. (invited talk).

2003 "Headwater Habitat Variation: Its Relationship to Stream Amphibian Distribution", presented at the 2003 Annual Meeting of the Society for Northwestern Vertebrate Biology in Arcata, California, March 19-22. w/ Daniel J. Dugger, Tiffany L. Hicks, and Timothy Quinn (invited poster).

2003 "Headwater Habitat Variation: Its Relationship to Stream Amphibian Distribution", presented at the 2003 Annual Meeting of the Society for Northwestern Vertebrate Biology in Arcata, California, March 19-22. w/ Daniel J. Dugger, Tiffany L. Hicks, and Timothy Quinn (invited poster).

2000 "Egg attendance in the frog genus *Hyalinobatrachium*: Function and Phylogenetic Implications", part of the Symposium on Ecology and Evolution in the Tropics: Essays in Tribute to Jay M. Savage, presented at the 80th Annual Meeting of the American Society of Ichthyologists and Herpetologists in La Paz, Mexico, June 14-20. w/ Roy W. McDiarmid (invited talk).

2000 "Oregon spotted frog *Rana pretiosa* oviposition: Conservation Implications", presented at the 80th Annual Meeting of the American Society of Ichthyologists and Herpetologists in La Paz, Mexico, June 14-20. w/ Joseph D. Engler (contributed talk).

2000 "Oviposition patterns in the northern red-legged frog: Factors in site choice", presented at the 80th Annual Meeting of the American Society of Ichthyologists and Herpetologists in La Paz, Mexico, June 14-20. w/ Christopher J. Rombough, presenter (contributed talk).

2000 "Foothill yellow-legged frog *Rana boylii* decline in Oregon: Conservation implications", presented at the 80th Annual Meeting of the American Society of Ichthyologists and Herpetologists in La Paz, Mexico, June 14-20. w/ Aaron N. Borisenko, presenter (contributed talk).

2000 "Oregon spotted frog *Rana pretiosa* oviposition: Conservation Implications", part of the Symposium on Terrestrial and Riparian Amphibians, presented at the year 2000 Joint Annual Meeting of the Society for Northwestern Vertebrate Biology and the Washington Chapter of the Wildlife Society in Ocean Shores, Washington, March 15-17. w/ Joseph D. Engler (invited talk).

1999 "Oregon spotted frog in the Klamath Basin: History and Ecology"; Third Klamath Basin Ecological Conference, sponsored by the Klamath Basin Ecological Restoration Office (invited talk)

1999 "Oregon spotted frog oviposition: Conservation implications"; First Annual Northwest Conservation Research Consortium, sponsored by the Oregon Zoo (invited talk)

1998 "Oregon spotted frog: History and current ecology"; Symposium on the spotted frogs of Oregon, sponsored by US Fish and Wildlife Service (invited talk)

1998 "Vulnerability to predation of the Oregon spotted frog to the bullfrog"; Annual meeting of the Society for Northwestern Vertebrate Biology (contributed talk)

1998 "The status of Oregon spotted frog across its geographic range"; Joint annual meeting of the ASIH, Herpetologists League, and SSAR (invited poster)

1997 "The egg-laying reptile fauna of the Squaw Flat Research Natural Area: Implications for forest management"; The Wildlife Society annual regional meeting, Bend, Oregon (invited talk)

1997 "Vulnerability of the postmetamorphic stages of the Oregon spotted frog"; The Wildlife Society annual regional meeting, Bend, Oregon (contributed talk)

1975-1996 Over 30 invited talks and two invited posters, mostly on various aspects of amphibian ecology and conservation.

Publications

Tidwell, K.S., D.J. Shepherdson, and M.P. Hayes. Inter-populational variability in evasive behavior in the Oregon Spotted Frog (*Rana pretiosa*). *Journal of Herpetology* (in review)

Padgett-Flohr, G., and M.P. Hayes. 2011. Assessment of the vulnerability of the Oregon spotted frog (*Rana pretiosa*) to the Amphibian chytrid fungus (*Batrachochytrium dendrobatidis*). *Herpetological Conservation and Biology* 6(2):99-106.

Conlon, J.M., M. Mechkarska, E. Ahmeda, L. Coquet, T. Jouenne, J. Leprince, H. Vaudry, M.P. Hayes, and G. Padgett-Flohr. 2011. Host defense peptides in skin secretions of the Oregon spotted frog *Rana pretiosa*: Implications for species resistance to chytridiomycosis. *Developmental and Comparative Immunology* 35:644-649.

Palmeri-Miles, A.F., K.A. Douville, J.A. Tyson, K.D. Ramsdell and M.P. Hayes. 2010. Field observations of oviposition and early development of the Coastal Tailed Frog (*Ascaphus truei*). *Northwestern Naturalist* 91(2):206-213.

Hayes, M.P., C.J. Rombough, G.E. Padgett-Flohr, L.A. Hallock, J.E Johnson, R.S. Wagner, and J.D. Engler. 2009. Amphibian chytridiomycosis in the Oregon spotted frog (*Rana pretiosa*) in Washington State, USA. *Northwestern Naturalist* 90(2):148-150.

McIntyre, A.P., M.P. Hayes and T. Quinn. 2009. *Type N Feasibility Study*. A report submitted to the Landscape and Wildlife Advisory Group, Amphibian Research Consortium, and the Cooperative Monitoring, Evaluation, and Research Committee. Washington Department of Fish and Wildlife, Olympia, Washington. 48 pp. + appendices

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Hayes, M.P., R.A. Schlising, and H. Wurlitzer. 1979. *Calycadenia fremontii* – rediscovered? Fremontia 7(1):14-15..

Additionally, over 40 over non-referreed reports and publications have been produced.

Reviewed manuscripts or books for:

Biological Conservation
Biotropica
Copeia
Forest Science
Herpetologica
Herpetological Review
Journal of Herpetology
The Northwestern Naturalist
The Southwestern Naturalist
McGraw Hill: Interactive text in aquatic ecology
Society of NW Vertebrate Biology: Book on sampling amphibians in lentic habitats
Smithsonian Press: Book on environmental enrichment

Professional Societies:

1996-	Life Member of the American Society of Ichthyologists and Herpetologists
1996-	Member of The Wildlife Society
1995-	Member of the National Association of Environmental Professionals
1995-	Member of the Society of Northwestern Vertebrate Biology
1995-	Member of the International Association for Bear Research and Management

1989- Member of the Society for Conservation Biology
1988- Life Member of the American Society of Zoologists
1987- Member of the American Association for the Advancement of Science
1987- Member of the Societas Europea Herpetologica
1986- Life Member of the Society for the Study of Amphibians and Reptiles

Professional Societies: (continued)

1980- Life Member of the Desert Tortoise Council

Also a member of 10 minor, regional, or local professional societies.

Grants, awards, and contracts:

$568,000	2000-2	Department of Natural Resources; funding for Forest and Fish Adaptive Management in headwater streams
$12,800	2000	US Fish and Wildlife Service; funding for deformity study of the Oregon spotted frog at Conboy Lake
$2,025	2000	Oregon Zoo Foundation; funding for PIT tags and skeletochronology on Umpqua northern red-legged frog study
$950	2000	The Wildlife Society; funding for skeletochronology on Conboy Lake Oregon spotted frog study
$124,000	1999-2000	Port of Portland; Rivergate western painted turtle study
$8,500	1999-2000	US Fish and Wildlife Service; Oregon spotted frog habitat partitioning study
$12,000	2000	US Fish and Wildlife Service, SAR funding; bullfrog selectivity study (R. Bruce Bury, principal investigator)
$9,600	1999	US Fish and Wildlife Service; Northern red-legged frog overwintering
$1,200	1999	Umpqua National Forest; funding for temperature data loggers for northern red-legged frog habitat utilization study
$8,700	1999	US Fish and Wildlife Service; Oregon spotted frog oviposition
$4,200	1998-2000	PNW Range and Experiment Station; Columbia spotted frog movements
$35,860	1996-1997	US Fish and Wildlife Service, Oregon Department of Fish and Wildlife; Study of the status of the foothill yellow-legged frog in Oregon
$32,300	1994-1997	Winema National Forest; Aquatic amphibian and reptile studies in the Sky Lake Wilderness
$24,600	1996	Umpqua National Forest; Studies of the amphibian and reptile fauna of the Squaw Flat Research Natural Area

Additionally, I have obtained over 10 additional grants, awards, or contracts totalling over $150,000 during the period 1988-1996.

Languages spoken:

French	fluent
Spanish	near fluent

Marc Hayes Publications since 2000

McIntyre, A.P., Jay E. Jones, F.T. Waterstrat, J.N. Giovanini, S.D. Duke, M.P. Hayes, T. Quinn, A.J. Kroll. Evaluating N-mixture abundance estimators for unmarked individuals of cryptic taxa. *Methods in Ecology and Evolution* (in review)

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EXHIBIT B

MARC HAYES EXPERT REPORT
ATTACHMENT C
MATERIALS RELIED ON IN FORMING EXPERT REPORT OPINIONS[1]

- Exhibits to Sept. 23, 2011 declaration of Dr. Marc Hayes (Plaintiffs' Preliminary Injunction ("Pl. PI Ex.") 6) (DE 60-3)
- Exhibits to Nov. 4, 2011 declaration of Dr. Marc Hayes (Pl. PI Ex. 45 (DE 79-1)
- U.S. Fish and Wildlife Service. 2002. Recovery plan for the California red-legged frog (CRLF). Region 1, Portland, Oregon, USA.
- San Francisco Garter Snake (SFGS) Recovery Plan
- 2008 Swaim report for SFGS/CRLF at Sharp Park and Mori Point (Pl. PI Ex. 22) (DE 56)
- 2005 Swaim report for SFGS/CRLF at Sharp Park and Mori Point
- Swaim, K. SFGS Improvement Project At Mori Point, Pacifica, Cal. (CCSF89390-443)
- Sharp Park Conceptual Alternatives Report and Appendices ("Alt. Report") (Feb. 2006)
- Peter Baye Technical Review and Comments on Alt. Report
- Final Draft Endangered Species Compliance Plan for SFGS (CCSF 4590-4608)
- Declaration of Dr. Mark Jennings dated October 18, 2011 (DE 68)
- Declaration of Ms. Karen Swaim dated October 21, 2011 (DE 66-1)
- Declaration of Lisa Wayne dated October 21, 2011 (DE 72)
- Darren Fong personal communication
- Fong, D. et al. Year 2003-2005 California Red-legged Frog Surveys, Golden Gate National Recreation Area
- Fong, D. et al., Year 2006-09 CRLF Surveys, Golden Gate Nat'l Recreation Area \ and data sets through 2011
- Kuhn personal communications
- DeGregorio, B. A., T. E. Hancock, D. J. Kurz, and S. Yue. 2011. How Quickly are Road-Killed Snakes Scavenged? Implications for Underestimates of Road Mortality. Journal of the North Carolina Academy of Science 172: 184-188 (DE 60-3)
- DeGregario, B.A., et al, 2010. Patterns of Snake Road Mortality On An Isolated Barrier Island. Herpetological Conservation and Biology 5(3):441-448 (DE 79-1)
- Brett DiGregorio personal communications
- CRLF Egg Mass Survey Sheets
- Deposition testimony of Jon Campo (Sept. 13, 2011)
- Deposition testimony of John Ascariz (Dec. 14, 2011)
- Deposition testimony of Wayne Kappelman (Dec. 15, 2011)
- Deposition testimony of Lisa Wayne (Jan. 9, 2012)
- U.S. Fish and Wildlife Service. 2006. San Francisco Garter Snake (Thamnophis sirtalis tetrataenia). 5-Year Review: Summary and Evaluation, Sacramento Field Office, Sacramento, CA.
- Sept. 27, 2011 email from Christina Crooker to Brent Plater and Darren Fong re SFGS sightings at Mori Point

[1] This list encompasses materials the expert relied on in forming expert opinions, and is intended to include all materials listed in the expert report, but to the extent additional references are listed in the report the expert relied on those as well

- Kats, L.B., and R.P. Ferrer. 2003. Alien predators and amphibian declines: review of two decades of science and the transition to conservation. Diversity and Distributions 9(2):99-110
- Gamradt, S.C, and L.B. Kats. 2002. Effect of introduced crayfish and Mosquitofish on California Newts. Conservation Biology 10(4):1155-1162; and references therein.
- Emails between City and FWS (Pl. PI Ex. 5) (DE 54)
- photographs of an egg mass documented in Horse Stable Pond (Pl. PI Ex. 3
  - and 4 (DE 54 and 60)
- photographs of the CRLF taken June 26, 2011 (Pl. PI Ex. 5) (see DE 60)
- photographs of flooding events at Sharp Park (Pl. PI Ex. 5)(see DE 60)
- photograph of freshwater crayfish observed inside Sharp Park's outfall pipe
  - (Pl. PI Ex. 5)(see DE 60)
- Dec. 8, 2011 letter from FWS to CCSF (CCSF 96925-26)
- Phillip Williams & Ass. 1992 Laguna Salada Resource Enhancement Plan
- Jan. 2012 Linear Regression Analysis by Marc Hayes
- Jennings and Hayes, 1994. Amphibian and Reptile Species of Special Concern in California.
- Unpublished Data on entrainment.

EXHIBIT I

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

PGA design
LANDSCAPE ARCHITECTS

CELEBRATING 30 YEARS

October 27, 2011

Bill Wycko
Environmental Review Officer
Planning Department
City of San Francisco
1650 Mission Street, Ste 400
San Francisco, CA 94103-2479

RE: **Sharp Park Golf Course – Historic Resource Evaluation**

Dear Mr. Wycko,

I have reviewed Appendix C of the DEIR for the *Significant Natural Resource Areas Management Plan: Sharp Park Golf Course* and question the determination of eligibility for listing on the National Register of Historic Properties (NRHP). On page 5-4 the author suggests that Sharp Park Golf Course has historic significance under Criterion A and C under the NRHP and Criterion 1 and 3 for the California Register of Historic Resources (CRHR). Criterion C/3 requires that "a property embody the distinctive characteristics of a type, period, or method of construction that represents the work of a master, or that possesses high artistic values". Based on the number and extent of alternations that have taken place since the period of significance (1929 – 1932) I question the validity of finding Sharp Park eligible as a historic resource.

Bulletin 18 "How to Evaluate and Nominate Designed Historic Landscapes,"[1] states "As defined by the National Historic Preservation Act of 1966 and the National Register criteria, to be eligible for the National Register a designed historic landscape must possess significance ..... and integrity of location, design, setting, materials, workmanship feeling and association." Sharp Park Golf Course lacks integrity.

The *Historical Resources Evaluation Report* (HRER) prepared by Tetra Tech, Inc. describes many alterations made to the course since 1932. Comparing the course layouts depicted in the two exhibits included in the Evaluation Report[2] one finds very few similarities between how the course was designed and how it exists today.

[1] National Park Service, "How to Evaluate and Nominate Designed Historic Landscapes," *National Register Bulletin No. 18*, p. 6.
[2] The original Sharp Park Golf Links plan prepared by Mackenzie, Hunter & Egen (Figure 3) and the aerial of the Existing Golf Course (Figure 2).

Chris Pattillo | Cathy Garrett | Christopher Kent
444 - 17th Street Oakland CA 94612
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1. The original hole 1 (now hole 11) was a long, straight shot. The reconfigured hole doglegs to the right.
2. The original hole 2 (now hole 12) was a dogleg that wrapped around the south end of the course. Hole 12 is now a lot shorter with no dogleg.
3. The original holes 3, 4, and 8 were destroyed in a big storm and not replaced.
4. The original hole 5 offered multiple fairway options – a unique design feature of Mackenzie. Hole 17 which replaced 5 is a single straight shot.
5. The original hole 6 that ran east-west at the north boundary no longer exists.
6. The original hole 7 appears to be similar to current hole 16 identified on Figure 2 as having been built after 1941, after the period of significance.
7. The original holes 9 and 10 each offered double fairways. The replacement holes 13 and 14 eliminated these special features.
8. The original hole 11 – a short run - appears to be similar to current hole 15.
9. The original hole 12 was a long straight shot. It has been replaced by hole 18 that is longer with a dogleg.
10. The original holes 13, 14 and 15 were on the east side of the county road and generally paralleled the road running north-south. Today this area has four holes that all run east-west.
11. The original hole 16 was a dogleg left replaced by hole 3 a straight shot.
12. The original hole 17 ran east-west and was a long shot with a dogleg. Hole 8, a short, straight fairway replaced it.
13. The original hole 18 was a dogleg. This hole has been replaced by hole 2, a straight shot.

In summary only hole 11 (now hole 15) is similar to the original design. The layout of the remainder of the course has been substantially altered. The change to the order of how the holes are played is significant as it materially alters the sequence and nature of views the player experiences making it unlike what was intended by the designer. Other major changes implemented since the period of significance include:

A. Elimination or reconfiguration of several sand traps.
B. Construction of a seawall in 1941 to prevent flooding of the golf course. This eliminated views to the beach and Pacific Ocean and the essence of the links design concept.
C. Filling a portion of the lagoon as part of the reconfiguration of hole 10.
D. Installation of concrete golf cart paths along the back nine holes in 1996 where none existed previously.
E. Culverting of water features on five holes and the elimination of water hazards – an important component of the original design.
F. Installation of a 4000-gallon pump to help with annual flooding of Laguna Salada.
G. Alternations made between 1985 and 1994 to accommodate female players such as shortening of the fairways.

Adding together all of these alterations it is apparent that Sharp Park Golf Course lacks sufficient integrity to qualify as a historic resource under criterion C/3. The course no longer reflects the work of Alister Mackenzie. The land use remains a golf course but otherwise there are few similarities between the course that existed during the period of significance and what remains today.

The Evaluation Report notes that Alister Mackenzie attained status as a master golf course architect. Appendix C on page 4-7 notes, "George Shackelford, in his book *Grounds for Golf*, describes Mackenzie as a master designer and offers that Mackenzie's secret to creating unique courses was his talent for routing." Regrettably, today nothing remains of Mackenzie's unique routing. He continues to explain that his work "was known for its original and distinctive bunkers, with irregular shapes and each with its own design." And "Distinctive bunkering, the use of small hillocks around greens, and exciting hole locations were Mackenzie's trademark".

Another of Mackenzie's trademarks was his talent for working with natural landform and subtlety integrating his courses with a site's topography to take full advantage of the unique qualities of each site. Quoting from the HRER, "Mackenzie felt that the success of golf course construction depended entirely on making the best use of natural features and devising artificial ones indistinguishable from nature." The HRER continues with, "....... while many architects try to create a special course, Mackenzie could figure out how best to fit holes into a property and situate a golf course to evoke a comfortable, settled, connection to the ground. His course routings are always functional and original but rarely do they fight the contours of the property."

In summary, defining characteristics of Mackenzie's design style included unique course routing, a talent for adapting a course to fit the land, an ability to offer challenge to players of varying skill levels, distinctively designed bunkers, and inclusion of multiple fairway options – offering advantage to those to took greater risks in their play. The vast majority of these features have been eliminated from the course. According to Wexler, in a recently published article "no appreciable trace of his strategy remains in play."[3]

Unfortunately, Sharp Park Golf Course began to fail even before the course opened in 1932 because Mackenzie failed to fully understand the forces of nature at this site. Page 4-3 of the Evaluation Report notes that the opening was delayed twice due to "drainage problems on the course due to winter rains." Shortly after the course opened a major storm washed out a large portion of the course and necessitated construction of the seawall in 1938 intended to prevent similar damage in the future. This type of damage has continued – as recently as 1982 a major storm wiped out several holes. In 1990 another breach killed many of the cypress trees on the course. Few of the golf courses designed by Alister Mackenzie remain intact today. It would be ironic and misplaced if this course – one that represents a failure in design – became a lasting representative of his life's work by being officially designated as a historic property.

[3] Dr. Alister Mackenzie, "Sharp Park Golf Course", Pacifica, CA page 113

The determination of historic significance is tied to a site's level of integrity. According to *A Guide to Cultural Landscape Reports: Contents, Process, and Techniques*[4] "The historic integrity of a cultural landscape relates to the ability of the landscape to convey its significance." And "Historic integrity is assessed to determine if the landscape characteristics and associated features, and the spatial qualities that shaped the landscape during the historic period of significance, are present in much the same way as they were historically." Emphasis added.

The guide continues, "Historic integrity is determined by the extent to which the general character of the historic period is evident, and the degree to which incompatible elements obscuring the character can be reversed". In the case of Sharp Park Golf Course the changes to the course were not the result of the normal evolution of a living landscape – maturing trees and other plantings, but rather major changes that were forced to solve functional problems that resulted from flaws in the original design – a failure to fully understand the power of nature and it's ability to wreak havoc. The changes made to Sharp Park Golf Course cannot be reversed because doing so would recreate the conditions that necessitated that the alterations be made in the first place.

Page 5-2 of the HRER notes, "Because landscape features change over time, a landscape need not retain all of the original features it had during its period of significance, but it must retain the essential features and characteristics that make its historic character clearly recognizable."

In essence for a site to meet the criteria of historic significance most of the designed features must look as they did during the period of significance. This may be true for the Clubhouse and maintenance building which are not addressed here, but it is not the case at Sharp Park Golf Course and no doubt explains why "None of the state or national registers identified Sharp Park Golf Course as a historical resource" as noted on page 4-1 of the HRER.

By making the finding that the existing golf course represents a historic resource under criterion C/3 it seems that Tetra Tech failed to appreciate not only the subtleties of golf course architecture but its essential features. Just because there was a golf course present in 1932 the fact that there is still a golf course present today, does not qualify the current course as a historic resource.

[4] A Guide To Cultural Landscape Reports: Contents, Process and Techniques by Robert R. Page, Cathy A. Gilbert, and Susan A. Dolan, US Department of the Interior, National Park Service, Cultural Resource Stewardship and Partnerships, 1998.

Sharp Park Golf Course lacks integrity. While a golf course at this site is consistent with the historic land use, that fact is insufficient evidence for a finding of historic significance. Failure to demonstrate significance voids eligibility for historic resource status. I urge you to consider this as you plan for the future use of Sharp Park.

Sincerely,

Chris Pattillo, ASLA
Historic Landscape Architect
President, PGAdesign[inc]

CHRIS PATTILLO

HISTORIC LANDSCAPE ARCHITECT

PROFESSIONAL EXPERIENCE

PGAdesign[inc], 1979 to present

EDUCATION - REGISTRATION

Master of Landscape Architecture, 1975, UC Berkeley
Bachelor of Arts, 1972, UC Berkeley
California Landscape Architect, #1925

ASSOCIATIONS

Historic American Landscapes Survey (HALS), No. California Chapter, Co-Founder 2004, Chair 2004-2009 & Vice Chair 2010
American Society of Landscape Architects (ASLA), Member
ASLA Historic Preservation Professional Practice Committee, National Chair & Vice Chair 2006-2009
California Geneology Society, Vice President & Board member 2010
Garden Conservancy, Member
California Preservation Foundation, Member
National Trust, Member
Oakland Heritage Alliance, Member
Oakland Chamber of Commerce, Member
Oakland Chamber of Commerce Economic Develop Committee
Open Space, Conservation & Recreation Elements (OSCAR), Advisory Committee

AWARDS

Oakland Chamber of Commerce: "Small Business of the Year" 1995
Oakland Chamber of Commerce: "Woman Owned Business of the Year" 2000

RELEVANT PROJECT EXPERIENCE

Badger Pass Ski Area CLR, Yosemite Natl. Park, CA
Doyle Drive in San Francisco Presidio HALS, San Francisco, CA
Atchison Village HSR, Richmond, CA
Meyers Estate Garden Master Plan & Maintenance Guidelines, Union City, CA
Roeding Park HALS, Fresno, CA
Sakai-Oishi Nurseries HALS, Richmond CA
William Land Park Cultural Landscape Survey & Evaluation, Sacramento
Berkeley City Club Gardens HALS, Berkeley, CA

PUBLICATIONS

"Preparing a Historic American Landscapes Survey (HALS) History: Brief Guide to Identifying and Documenting HALS Sites," co-author, *National Park Service, US Dept of the Interior,* Washington DC, August 2010

"Doyle Drive: Using Innovation HALS Methodology," SF Heritage News, Vol. XXXVII, No. 2, Summer 2010

"Innovation HALS Methodology Developed for SF Presidio Project," CPF News, Summer 2009

PRESENTATIONS

Documenting our Heritage, Annual ASLA conference, San Diego, California, October 2011

Historic American Landscapes Survey – An Introduction, for ASLA Chapter Presidents, October 2011

Exploring Cultural Landscapes through Case Studies, California Preservation Foundation (CPF), August 2010

Historic American Landscapes Survey – An Overview, American Society of Landscape Architects (ASLA), July 2010

Doyle Drive HALS at the Presidio of San Francisco, CPF, May 2010

Landscape Within The Historic Context, American Institute of Architects (AIA) Historic Resources Committee, San Francisco, CA, June 2009

Historic American Landscapes Survey – Tools of Preservation, UC Berkeley Extension, Landscape Architecture Program, May 2009

Alviso Adobe Park: History & Design Process – Opening Remarks, Pleasanton, CA, October 2008

Historic American Landscape Survey – A Panel Discussion, ASLA Annual Conference, San Francisco, CA, October 2007

Olmsted in the East Bay – tour leader & speaker, ASLA Annual Conference, San Francisco, CA, October 2007

Oakland Waterfront Parks – tour speaker, ASLA Annual Conference, San Francisco, CA, October 2007

Historic American Landscapes Survey – An Overview, Oakland Heritage Alliance (OHA), Oakland, CA, Summer 2007

Historic American Landscapes Survey – An Overview, Town & Gown Club, Berkeley, CA Spring 2007

Cleveland Cascade – Rehabilitation of a Howard Gilkey Landscape, OHA, Oakland, CA, March 2007

Making a Splash: Preservation of Pools and Fountains, CPF Conference, Sacramento, CA, April 2006

Peralta Hacienda Historical Park – Planning and Design, Friends of Peralta Hacienda, Oakland, CA, December 2005

Kaiser Roof Garden and the Gardens of the Museum of California: Comparing Two Mid-Century Modern Roof Gardens, OHA, Oakland, CA, July 2005

Planning and Public Policy: The Urban Planning Process, Department of City & Regional Planning, UC Berkeley, April 1983

HISTORIC AMERICAN LANDSCAPES SURVEY (HALS) NOMINATION FORMS

Anderson Marsh State Historic Park, Lake County, 2011

Berkeley Women's City Club, Berkeley, 2011

Bidwell Mansion, Chico, 2011

Bidwell Park, Chico, 2011

Boyd Memorial Park, San Rafael, 2010

California Nursery Company Historic Park, Niles, 2008

Call Ranch at Fort Ross State Park, Jenner, 2009

Captain Fletcher's Inn & Manager's House, Navarro, 2009

Centerville Pioneer Cemetery, Fremont, 2008

Children's Fairyland, Oakland, 2009

China Camp State Park, San Rafael, 2009

Fern Dale (Shaw House), Ferndale, 2009

Forest Theater, Carmel, 2010

Henry H. Meyers Garden, Union City, 2010

La Mirada Adobe, Monterey, 2010

Marin Art and Garden Center, Ross, 2009

McConaghy Estate, Hayward, 2009

Meek Mansion & Carriage House, Hayward, 2009

Mendocino Woodlands Demonstration Recreation Area, Mendocino, 2009

Micke Grove Park, Lodi, 2009

Mountain View Cemetery, Oakland, 2010

Point Arena Cove, Point Arena, 2010

Point Arena Lighthouse, Point Arena, 2010

Point Cabrillo Lighthouse, Casper, 2009

Rancho Higuera Adobe Historical Park, 2008

Ravenswood Estate, Livermore, 2009

Robson-Harrington Park, San Anselmo, 2009

Shibata Japanese Garden (Mount Eden Nursery), Hayward, 2010

Shinn Historical House & Arboretum, Fremont, 2008

Sun House, Ukiah, 2009

Tor House, Carmel, 2010

Wassama Village, 2010

WILD Equity INSTITUTE

Building a healthy and sustainable global community for people and the plants and animals that accompany us on Earth

The Wild Equity Institute is working to build a new public park at Sharp Park in Pacifica, CA. With our partners at the NPCA, the Neighborhood Parks Council, the National Japanese American Historical Society, and many other organizations, we have proposed to close the course and partner with the National Park Service to restore the land and interpret its hidden history, including the former WWII internment camp and prehistoric artifacts that have been found on the site.

Perhaps in response to this idea and litigation, **for the first time San Francisco is proposing to landmark Sharp Park Golf Course. This proposal is not well informed.** Below you will find background information about this proposal.

Although Alister MacKenzie, the original architect of Sharp Park Golf Course, has made some important golf courses, there is significant disagreement about (a) the quality of the original architectural design at Sharp Park and whether it is a reflection of Mackenzie's signature design, and (b) its current integrity. **Every history written about this course before the restoration proposal we are advancing was announced concluded that the original MacKenzie design no longer exists at Sharp Park today.**

Some contemporary golf advocates have suggested that these previous assessments were based on misinformation or bad data. They have gone as far as suggesting that several of the links at Sharp Park remain consistent with Sharp Park's original design. As a preliminary matter, **golf courses are not simply a collection of links: they are a course, and to suggest that because a few golf links remain in the places Alister MacKenzie placed them does not answer the question about the historic integrity of the course as a whole.**

But more importantly, these assessments are directly contradicted by assessments made away from the heat of this dispute, and not conducted by individuals with a stake in the outcome. **Indeed, the only individuals who have asserted that Sharp Park is historic are associated with the San Francisco Public Golf Alliance—a golf activist organization that is not qualified to provide these assessments, and has an inherent conflict in doing so regardless.** Therefore, the previous assessments are more likely to be unbiased and accurate: even if the historians who wrote them would prefer the original course be restored, instead of than the natural areas upon which the course was built.

Some of MacKenzie's courses should be considered for recognition. But Sharp Park is simply not the place to start. There is not a single Alister MacKenzie golf course presently listed on the California or federal registers of historic places, and most everyone would agree that Sharp Park is not one of the greatest examples of his work. Indeed, **the litany of problems the golf course faces—from chronic annual flooding, to the killing of endangered species, to the low grades given the course by its own golfers, to the chronic financial instability of the course, to the inevitable loss of the site to sea level rise as our climate changes—all indicate that this particular course does not exemplify the work of a master implementing his art.**

Moreover, the San Francisco Public Golf Alliance has distributed false information to the Planning Department and to the Historic Preservation Commission arguing that Sharp Park Golf Course itself has been designated an historic landmark by the City of Pacifica. **This is not true: indeed, to the extent any historic preservation has been provided to Sharp Park, it has been equally provided to the trees, lagoon, and marsh on the property,** as will be shown below. Indeed, a proposal to try and landmark the golf course was tabled indefinitely by Pacifica's Planning Commission in 2009.

The Pacifica General Plan (as updated August 2005) Historic Preservation Element. This section includes a "list and map of all of the sites and structures felt to be of historic significance in Pacifica."

With regards to Sharp Park, the Pacifica Historic Sites list includes:

Number 18. Laguna Salada & Marsh
Number 19. Sharp Park Golf Course & Clubhouse
Number 20. Trees in Sharp Park

However, this section also states that "the element would be implemented by an Historic Ordinance which would establish a Pacifica Historic Sites Advisory Committee to review proposed changes to sites and structures designated on the Historic Sites Map and advise the Planning Commission and City Council of the appropriateness of the proposal." **No such Historic Ordinance or Advisory Committee was ever created: instead Pacifica implemented this through its zoning code.**

Title 9 of Pacifica's Zoning Code, Chapter 7 covers Historic Preservation. Section 9-7.208 of the Code lists Pacifica's designated Historic Sites:

Sec. 9-7.208. - Final designations.
The following structures, having been approved by the Planning Commission and Council for designation as historic landmarks pursuant to the procedures of this article, are hereby given final landmark designation:

(a)Sanchez Adobe;
(b)Sharp Park Golf Course Clubhouse;
(c)Little Brown Church;
(d)San Pedro Schoolhouse;
(e)185 Carmel Avenue;
(f)Vallemar Station, 2125 Cabrillo Highway;
(g)Anderson's Store, 220 Paloma Avenue;
(h)165 Winona Avenue; and
(i)Dollaradio Station.

(§ 1, Ord. 482-C.S., eff. May 27, 1987, as amended by § 1, Ord. 533-C.S., eff. September 27, 1989, § 1, Ord. 534-C.S., eff. September 27, 1989, and § 2, Ord. 569-C.S., eff. July 10, 1991, § II, Ord. No. 770-C.S., eff. May 26, 2010)

As you can see, only the golf course clubhouse has been designated historic by Pacifica. **Laguna Salada itself, along with the golf course, are 'potential' historic resources according to the general plan, but because these potential resources were never finalized into actual landmarks, they are not so protected.**

Only Sharp Park Golf Course's clubhouse is listed as an historic landmark in Pacifica, an uncontroversial finding that is not impacted in any way by the restoration proposals we have all pursued. However, **to rely on Pacifica's general plan as reason to landmark the golf course takes one only so far, because the marsh, lagoon and trees—all directly threatened by the course, are provided the same level of so-called protection as the course itself.**

San Francisco's own Historic Preservation Commission, the City's agency responsible for identifying and designating landmarks, disagreed with this assessment. **On September 21, 2011, the Commission ordered staff to prepare comments stating that they do not concur in the Recreation and Parks Department's position that Sharp Park retains historic integrity.**

There is good reason for this determination:

- The Recreation and Parks Department's Historic Resources Evaluation provides **insufficient information and evidence to support its conclusion that Sharp Park retains historic integrity.**
- The evaluation also **lacks a proper analysis of the historic landscape**, and thus there isn't an appropriate baseline to judge integrity.
- The Evaluation also **fails to consider a range of mitigation measures**, and thus precludes restoration of endangered species habitat. Historic preservation and natural resources protection are not exclusive – Crissy Field and Muir Woods restoration are examples of natural resource restoration projects where historic resources existed.
- The National Park Service has asked to play a role in any historic resource evaluation of the golf course – per their 2009 statement – because the course is within their historic boundary and they are undertaking a multi-million dollar wildlife habitat restoration project adjacent to Sharp Park, yet the City has not engaged the Park Service. The **Park Service is considered the most respected expert in historic resource preservation.**

Attached to this memo are previous statements by the National Park Service and the City of San Francisco opposing landmarking the golf course in Pacifica; written histories about how the course no longer retains integrity; and a link-by-link assessment of what has been lost at the golf course.

WILD Equity
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Building a healthy and sustainable global community for people and the plants and animals that accompany us on Earth

Sharp Park today bears no resemblance to Alister MacKenzie's original design. **Every link has been changed at Sharp Park—in many cases radically, and many holes have been lost completely.** It is misleading to claim that any historical integrity exists at the course.

- The water features on five MacKenzie holes east of Laguna Salada, original holes 1, 9, 15, 16, & 17, have been culverted, eliminating crucial water hazards essential to his design.

- Five holes west of Laguna Salada, including original holes 3, 4, 6, 7, & 8 were destroyed completely by massive coastal storm surges and the subsequent construction of the berm.

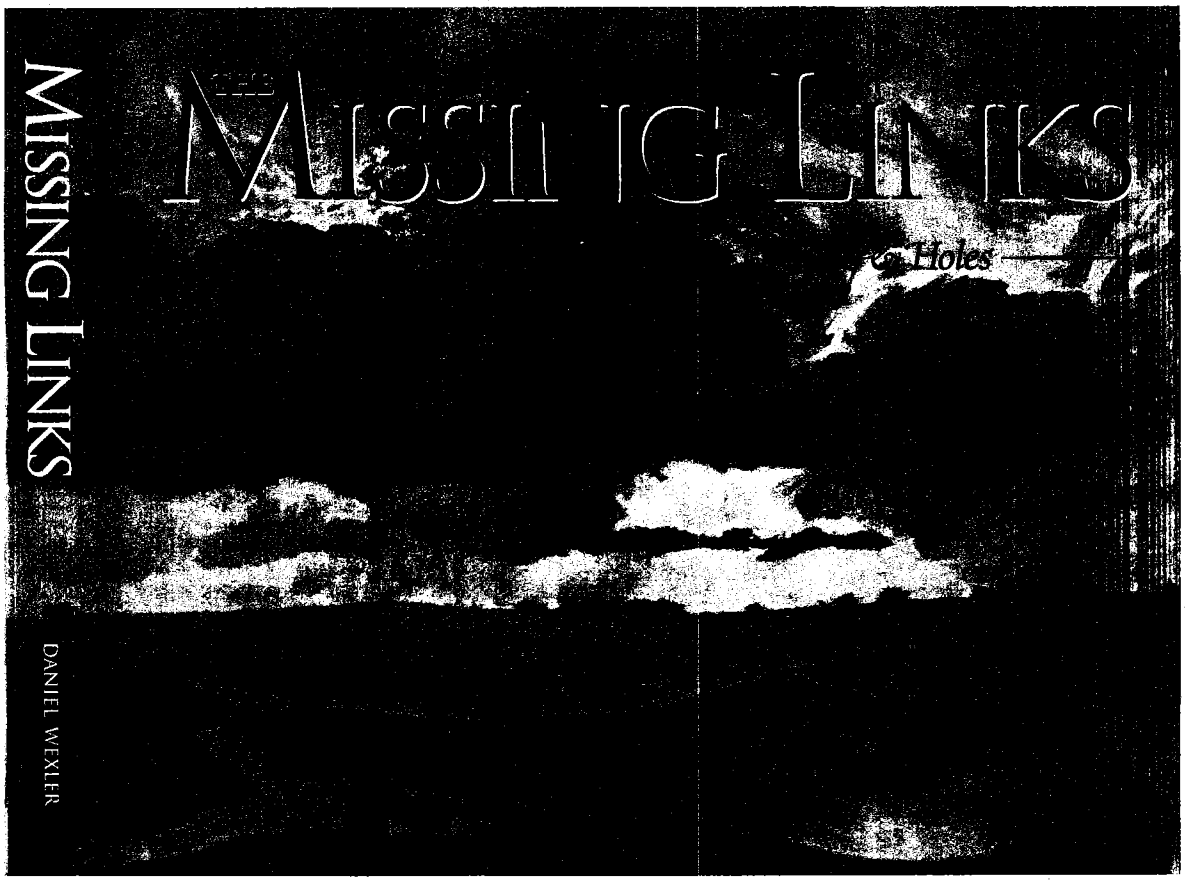
- Two others, original holes 2 & 5, were severely damaged and modified to eliminate additional water features and other elements of their design. Now the site of hole 12, the original hole 2 was shortened by 60 yards and a stroke while the strategic features—including its proximity to a much larger Horse Stable Pond than exists currently—are almost completely irrelevant to the hole's play today. Hole number 5, which was considered by Jack Fleming to be "one of the most interesting holes on the course, similar to Dr. MacKenzie's 'ideal golf hole,'" is now the current site of hole 17, but other than occupying the same space the hole bears absolutely no resemblance to the original hole 5: a tee shot over Laguna Salada has been removed, and dual fairways have been combined into one, eliminating strategy alternatives integral to MacKenzie's design.

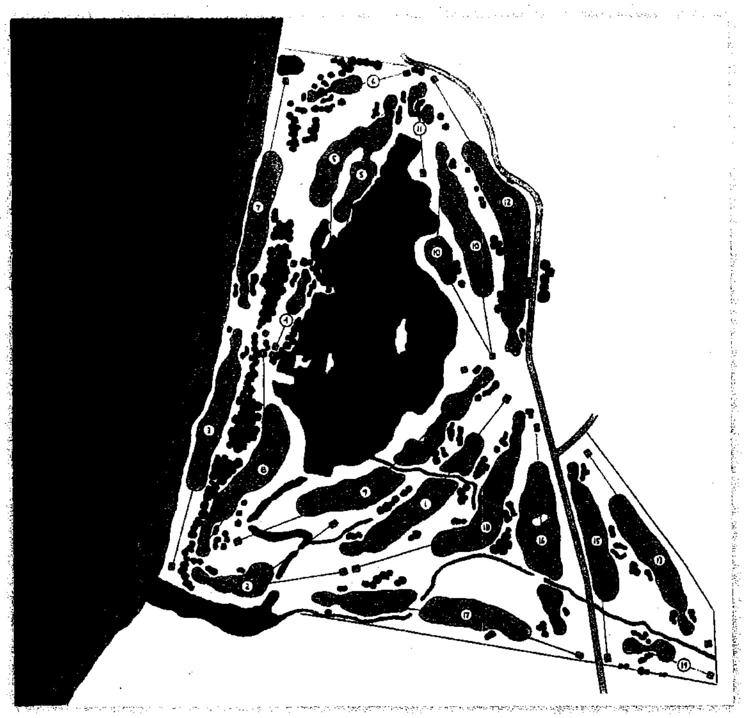
- Original holes 10 and 11, now the location of holes 14 and 15, have likewise been modified with changed greens and fairways that bear no resemblance to MacKenzie's layout. Indeed, Daniel Wexler argued that the original hole 10 was perhaps the course's best link, but its essential feature—a double fairway—no longer exists.

- Original hole 12, now the location of hole 18, has had sand traps removed from the design. In addition, original hole 13 (now 3), and original holes 14 and 15 (now the location of holes 8 and 2) described by Wexler as "not among the layout's finest" to begin with, have likewise had hazards reconfigured, as has the final original hole, 18 (now the location of hole 10).

- In addition, the theory of the course—the creation of a links-type, seaside course—was entirely upended when the berm was built separating the course from the ocean.

P.O. Box 191695 ❧ San Francisco, CA ❧ 94119 ❧ P: 415-349-5787 ❧ info@wildequity.org ❧ http://wildequity.org





SHARP PARK																				
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4	4	4	3	4	3	4	4	5		4	3	5	4	3	4	4	5	4		

1943 aerial survey reveals a number of MacKenzie's original holes still intact, plus four newer ones built to the east. (National Archives)

SHARP PARK GOLF COURSE

PACIFICA, CA

Opened in 1931 / 6,154 yards Par-71

As today, some 65 years after his death, Dr. Alister MacKenzie remains perhaps the most celebrated golf architect in history, it is truly remarkable that two public courses he laid out in major American metropolises could have been so short-lived and poorly documented. Yet Bayside, as we have seen, labored in (and vanished into) almost complete obscurity—and it cannot even begin to compare with the briefly-lived legacy of San Francisco's Sharp Park.

MacKenzie's Sharp Park layout is surely one of golf architecture's most enduring mysteries. Owing to the fact that it was built in 1931, then washed into oblivion by a coastal storm shortly thereafter, its original design was seen firsthand by very few. Nor was this initial version in any way adequately recorded, with few photographs of any kind known to remain in existence. Further, a visit to today's 6,299-yard facility offers little; this vastly-altered layout serving mostly to make one wonder if a vintage MacKenzie design ever *could* have existed upon this site.

But the Doctor's original, located very much upon this same land, was all that its tantalizing prospects have suggested, a marvelous golf course featuring seaside holes, two double fairways, a large lake, and a cypress-dotted setting fairly reminiscent of Monterey. It was, in short, a municipal masterpiece.

Located just 10 miles south of downtown San Francisco, the site given to MacKenzie was uncommonly fine for a public facility, including a nearly 1,000-yard oceanfront stretch along Salada Beach. For a county whose public course facilities at Harding and Lincoln Parks were among the busiest in the nation, the development of Sharp Park was a godsend, but this wonderful property was not without its drawbacks.

For one thing, a fair amount of the land required shoring up with massive quantities of dredged sand in an expensive, Lido-like operation. Second, the site was partially divided by a small county road, a circumstance dictating that three of MacKenzie's back-nine holes be separated from their 15 brethen. Years later this road would be rerouted, though by that time the storm-driven reconfiguration of the golf course would still leave four newer holes separated, about the only commonality between MacKenzie's work and the course in play today.

The 1931 layout began with a dogleg-right par-4 of 400 yards, a strong but not especially memorable opener. But things changed quickly at the second, a 274-yard par-4 with alternate tees situated on either side of the first green. In what today might be referred to as "risk/reward" style, this nearly-driveable hole featured a large bunker front-right of the putting surface and a lake to the left of the fairway, creating the wonderful question of just how near the water one dared to venture in pursuit of an easier angle for his second.

The third was a long two-shotter of 423 yards, playing directly north along the beachfront. Again the risk/reward question was laid before us: play safely down the middle and deal with a front-right greenside bunker or aggressively skirt the beach in pursuit of an open second? Seaside winds generally affected play at Sharp Park greatly, bringing those most unlinkish of obstacles—trees—into play along the right side as well.

Following the short fourth, a precise pitch played along the lake's westward shoreline, one reached the first of the dual-fairway holes, the 338-yard fifth. Here the player's options were numerous with a "safe" left-side route leaving the most difficult second-shot, a dangerous lakefront fairway opening up a more direct line, or the all-out blast over everything leaving a mere pitch from a wide-open angle. As at the second hole, a second tee positioned left of the previous green served to create additional angles and variety.

The 385-yard seventh was the course's second and last seaside hole, playing directly south to a long, narrow green flanked on either side by sand. The slight angling of the putting surface again tempted one to drive close to the beach (particularly if the pin was cut back-left), but the lesser presence of trees at least made this tee shot a bit more forgiving.

The 398-yard eighth, though built with only one fairway, offered two very distinct lines of play. A drive aimed safely left was simple enough but set up a nearly all-carry approach across two front-left greenside bunkers. For the man capable of controlling a long fade, however, there was the option of skirting the treeline, a shot which, if brought off successfully, again yielded a more favorable approach.

Though one hesitates to name a best hole among so many good ones, the 392-yard 10th did a fine job of nominating itself. Here was the double fairway concept played out to the fullest, the right side providing ample safety but a bunker-obscured second, the left requiring a gutsy tee shot to a water-guarded fairway but yielding a straight-on approach. Yet again, dual tee boxes varied the challenge from day to day, making the 10th a truly great hole—but an intimidating prospect for anyone hoping to slip past the starter and begin play on the back nine.

Following the 142-yard 11th came the long 12th, a 493-yarder distinctly reachable in two, provided one avoided several prominent trees and the out-of-bounds which ran down the entire left side.

Perhaps not surprisingly, the three holes exiled across the county road were not among the layout's finest, the 345-yard 13th being the best of the bunch with out-of-bounds also threatening its more-favored left side.

With the routing having returned to the clubhouse for a third time, one set out again at the 363-yard 16th, a par-4 following much the same path as today's first hole. Here a large mound punctuated the fairway some 175 yards off the tee, offering several different angles of play. The more difficult drive was the one aimed down the right side, close to a clump of trees. Naturally this choice also provided the better approach angle to a deep, narrow putting surface.

MacKenzie closed out Sharp Park with a pair of long finishers beginning with the 471-yard 17th. Though not a particularly difficult hole, this short par-5 often faced a strong sea breeze and featured out-of-bounds left, two bunkers, a meandering brook and a green laid precariously close to a rough, marshy depression. The 18th, by contrast, was a bit of a monster, its 443 yards requiring more brute strength than finesse, though the ability to draw one's tee shot would obviously have come in handy.

It was indeed unfortunate for Sharp Park that so many of its best holes fell along the property's ocean side, for it was this flank which took the brunt of any incoming storms. Following the early 1930s deluge that washed several of these gems out to sea, a massive berm was constructed (largely upon land once occupied by holes three and seven) to prevent history from repeating itself. The subsequent rerouting of the county road and reconfiguring of the lakeside holes has further muddled things so that today only a handful of holes run consistent with MacKenzie's originals, and no appreciable trace of his strategy remains in play.

How Sharp Park Would Measure Up Today

Oceanfront holes, double fairways, MacKenzie bunkering, marvelous scenery...

Any way you look at it, even at only 6,154 yards, Sharp Park would have to stand well out in front as America's finest municipal golf course.

Restoration anyone?

SHARP PARK

Being that the City had come by the lots at Sharp Park so cheaply (free in fact) they decided to bring in one of the world's foremost golf architects, Dr. Alister Mackenzie. The fact that Mackenzie and his assistant at that time, Jack Fleming, were able to design a golf course along the San Mateo County coast line was quite an accomplishment in itself. They managed to accomplish this difficult feat by dredging for fourteen months in order to build up the fairways.

On May 15, 1930 Robert Hunter, Jr. was appointed the superintendent of construction for Sharp Golf Course at a fee of $750 for ten month's work. Four and a half months later on October 2, 1930 Willis Polk and Company was authorized to prepare plans and specifications for the starter's house at the golf course. The original cost of playing golf was $2.00 per month and a card good for all three courses became available in May 1932 for $5.00.

The courses's opening in 1932 was twice delayed due to wet conditions. The golf course officially opened April 1, 1932. Perhaps the fact that even the opening of the course had to be delayed twice due to winter rains should have warned of the drainage problems this site would always face. Normally a golf course will welcome the rest and revitalization the winter rains bring. In Sharp Park's case the winter rains brought about the annual flooding of Laguna Salada out on to playable portions of the golf course. This problem still persists 47 years later even though a 4,000 gallon water pump has been installed. Two factors contribute to the poor drainage problem at the Sharp Park site. First and foremost

is the fact that the course is built at sea level and thus was susceptable to changing tides. The second factor was the annual flooding of Laguna Salada itself.

The golf course that opened on April 1, 1932 was becoming increasingly popular until it was severely damaged by high tides in a storm during the winter of 1938. The holes constructed on or near the beach were unindated by the unchecked tides of the storm. This resulted in severe damage to the beach holes - Numbers 2 through 8. The course, generally considered one of the best tests of golf in Northern California would never be the same. The beach holes had to be abandoned and reconstruction was forced across the Coast Highway up into what is now referred to as "The Canyon Holes". The effect was much the same as taking a house with a beach view and turning it 180 degrees to face a mountain slope. This was the most drastic architectural change the Sharp Park layout would ever face. Even the State Highway construction in the early 1960's that wiped out one par three hole would not have as damaging effect as nature.

Sharp Park remains very busy to this day drawing players both from the City and from down the peninsula. During the winter, however, as the water table rises, the course becomes less playable and suffers a significant drop in play - more so than other municipal courses during the winter. One winter in the early 1970's flooding was so thorough that the unchecked water nearly reached the clubhouse.

City and County of San Francisco
Recreation and Park Department

McLaren Lodge in Golden Gate Park
501 Stanyan Street, San Francisco, CA 94117
TEL: 415.831.2700 FAX: 415.831.2096 WEB: www.parks.sfgov.org

September 1, 2009

Honorable Julie Lancelle
Mayor, City of Pacifica
City of Pacifica City Hall
170 Santa Maria Avenue
Pacifica, CA 94044

Michael Crabtree, Planning Director
City of Pacifica
Planning Department
1800 Francisco Blvd.
Pacifica, CA 94044

Re: Proposed Designation of Sharp Park Golf Course as a Pacifica City Landmark

Dear Mayor Lancelle and Director Crabtree,

I am writing in regard to the City of Pacifica's application to designate the Sharp Park Golf Course a Historic Landmark under Pacifica Municipal Code, Chapter 7. We think this action is both inappropriate and unnecessary. Under California law, the City of Pacifica cannot regulate land use at Sharp Park which is owned by the City and County of San Francisco. (*See*, Cal. Govt. Code §§ 53090, et seq., *Akins v. County of Sonoma*, 67 Cal. 2d 185 (1967).) Therefore, any designation of the Sharp Park Golf Course as a historic landmark by the City of Pacifica will have no legal effect and, frankly is not helpful in furthering a legitimate public policy debate here in San Francisco.

We certainly recognize that Sharp Park Golf Course is used and enjoyed not just by many San Franciscans, but also by the residents of Pacifica, and that your City is concerned about any potential changes to it, and particularly to the golf course. As you may know Sharp Park is approximately 400 acres -- 237 of those acres are included in the San Francisco Recreation and Park Department's Significant Natural Resource Areas Management Plan (SNRAMP). This Plan is currently undergoing environmental review under the California Environmental Quality Act. We appreciate the historic and cultural value of the golf course, and an evaluation of the effects of the SNRAMP on the golf course as a potential historical resource will be included in the SNRAMP EIR.

As you also likely know, the area around the Sharp Park Golf Course contains habitat that support two special status species: San Francisco garter snake (*Thamnophis sirtalis tetrataenia*), listed as endangered under the federal Endangered Species Act, and classified as a fully protected species under California Fish and Game Code § 5050; and the California red-legged frog (*Rana draytonii*), listed as threatened under the federal Endangered Species Act and a state species of special concern. Under federal and state law, the City and County of San Francisco must ensure that the golf course operation does not endanger or harm either of these species. Recently, the San Francisco Board of Supervisors enacted legislation directing the Recreation and Park Department to develop a plan for

restoring the habitat for the garter snake and red-legged frog in conformance with federal and state law. Currently, we are preparing option plans, including schedules and costs for presentation to the public and to the Board which we hope to have preliminarily completed in October 2009.

We take our stewardship responsibilities at Sharp Park very seriously. In a very difficult financial climate, we must manage the recreational, cultural and biological uses of the park in a manner that best balances legitimate recreational needs with our fiduciary and legal responsibility to protect the habitat. We will continue to include the City of Pacifica in our discussions as we evaluate plans Sharp Park's future.

Very truly yours,

Philip A. Ginsburg
General Manager

cc: Mayor Gavin Newsom
Members of the Board of Supervisors
City Attorney Dennis Herrera
Members of the Recreation and Park Commission

United States Department of the Interior
NATIONAL PARK SERVICE
Golden Gate National Recreation Area
Fort Mason, San Francisco, California 94123

IN REPLY REFER TO:

L1415 (GOGA-PLAN)

July 20, 2009

Mr. Michael Crabtree
Planning Director
170 Santa Maria Avenue
Pacifica, CA 94044

Re: Proposed Historic Landmark Designation for Sharp Park Golf Course. HLD-6-09

Dear Mr. Crabtree:

Enclosed is our statement regarding the proposed action above. Please make this part of the July 20, 2009 City of Pacifica Planning Commission hearing. If you have any questions, contact Nancy Hornor at (415) 561-4937.

Sincerely,

Frank Dean
Acting General Superintendent

Enclosure:

United States Department of the Interior
NATIONAL PARK SERVICE
Golden Gate National Recreation Area
Fort Mason, San Francisco, California 94123

IN REPLY REFER TO:

NPS Statement on Pacifica Landmark Designation for Sharp Park

July 20, 2009

We learned of the City of Pacifica's proposal to designate Sharp Park Golf Course as a Pacifica Historic Landmark when we received the public hearing notice. We were not notified of this proposal through the Pacifica GGNRA Advisory Committee, which was set up by the Pacifica City Council to discuss items pertinent to both bodies.

As you know, Sharp Park is within the boundary of the Golden Gate National Recreation Area and adjacent to lands that we manage at Sweeney Ridge and Mori Point. We are currently completing a multi-year restoration project at Mori Point, to protect the Endangered San Francisco Garter snake and the threatened Red-legged frog and provide for compatible recreation and community stewardship and educational activities. Therefore, we have an interest in the future of Sharp Park.

Although we concur that the golf course and club house, as well as the remains of the WWII internment camp, should be evaluated, we request that you not make a landmark designation without a professional assessment of the significance and integrity of the property. We can assist with such an evaluation and would like to work with City of Pacifica and the City of San Francisco to define an appropriate process that includes all stakeholders.

SAN FRANCISCO
PLANNING DEPARTMENT

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CA 94103-2479

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415.558.6409

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Information:
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September 26, 2011

Mr. Bill Wycko
Environmental Review Officer
San Francisco Planning Department
1650 Mission Street, 4th Floor
San Francisco, CA 94103

Dear Mr. Wycko,

On September 21, 2011, the Historic Preservation Commission (HPC) held a public hearing and took public comment on the Draft Environmental Impact Report (DEIR) for the proposed Significant Natural Resources Area Management Plan. After discussion, the HPC arrived at the comments below:

- The HPC did not have consensus on the historical integrity of the Sharp Park Golf Course. Some commissioners thought that the property does not retain sufficient integrity to convey the property's historical significance per the National Register of Historic Places and/or California Register of Historical Resources, while others thought that the property does retain sufficient integrity.
- The HPC suggest that the mitigation measure described in M-CP-1 (Page 11) should be modified to specify that the future historic resource evaluations should be completed by a qualified professional landscape architectural historian.
- The HPC suggests that the mitigation measure described in M-CP-7 (Page 13) should be modified to specify that a qualified professional landscape architectural historian should be retained to document the cultural landscape.
- The HPC suggests that implementation of the Sharp Park restoration activity to construct a post and rail fence along the seawall of the golf course described in I-CP-8 (Page 14) *would* cause a substantial adverse change in the significance of the Sharp Park Golf Course.
- The HPC also commented that it is likely that future projects involving federal permitting or funding will be reviewed and commented on by the Commission as part of the National Environmental Policy Act (NEPA) process.

The HPC appreciates the opportunity to participate in review of this environmental document.

Sincerely,

Charles Chase, President
Historic Preservation Commission

MEMORANDUM FOR RECORD

FILE NUMBER: 2010-00327
PROJECT: Sharp Park Pump Maintenance
DATE: 9/29/10
SUBJECT: NPR

Proposed Site: The project site is located in a portion of a wetland located within the Laguna Salada Restoration Project located within Sharp Park, in the city of Pacifica, San Mateo County, California.

Proposed Project: The San Francisco Recreation and Parks Department proposes to dredge a small area (68 sq. feet) within Laguna Salada wetland to maintain the pumps that convey storm flows from the lagoon to the ocean.

A trash Debris pump would be used to suck the sediment in a 4 foot by 8 foot by 2 foot area in front of the intake structures. Sediment would also be removed from the intake box. On September 23, the project was discussed further with the applicant's agent. He confirmed that no fill in the wetland would occur. The site would be access from upland roads or the seawall associated with the wetland. The sediment would be deposited on uplands occupied ice plant as indicated on the delineation map verified by the Corps. Additionally, no coffer dam would be required to complete the work.

Project Background: A wetland delineation was verified by Project Manager, Ian Liffmann (file 209-00044). On August 17, 2010 a letter requesting approval to complete the dredging was submitted. On September 8, 2010 the DMMO office confirmed that the project is not navigational dredging and therefore should be handled by the Regulatory Office.

Site Visit: None completed.

Jurisdictional Determination: None Completed.

Endangered Species: There are known occurrences of California red-legged frog and San Francisco Garter Snake within Sharp Park Golf Course. The letter should clearly indicate that although no permit is required, that compliance with federal ESA is still required. This topic was further reviewed by the Project Manager, Paula Gill and the applicant's agent David Munro on September 23, 2010.

Historic Properties: None are expected to occur.

Corps Recommendations: The proposed project does not trigger the need for a USACE permit.

Paula Gill, Project Manager

9/29/10
Date

CESPN-OR-R

Memo For The Record

Project Manager: Ian Liffmann

Attendees: Kelly Bayer, Daniel LaForte, David Munro, Katerina Galacatos, Ian Liffmann

File No.: 2009-00044S

Date: March 2, 2009

Subject: Site visit (February 18, 2009) and decision to issue JD verification letter.

Site Location: The Laguna Salada Wetland Restoration and Habitat Recovery Project is located in the Sharp Park Golf Course, in the City of Pacifica, San Mateo County, California.

Proposed Project: The project will involve re-working the wetlands and open waters within the golf course in order to create potentially better habitat for the San Francisco garter snake and the California red-legged frog, and to stabilize the fluctuations in the water level of the wetlands by creating better flow to the pump station that regulates the water level. A formal application for the project has not been received yet- at this point it is only a JD verification.

Notes/Site Inspection: The site was heavily flooded when we visited it- the main pump to the ocean was broken, and thus water was backing up and flooding the wetlands and the golf course. The wetlands and golf course are situated behind a levee that separates them from the Pacific Ocean. Before the levee was constructed this area was a tidal lagoon.

JD: The Corps has jurisdiction of the pond and the wetlands up to the ordinary high water mark.

Federally Listed Species Issues: The site is home to the San Francisco garter snake and the California red-legged frog.

Impacts to Corps Jurisdiction: A formal project application has not been received yet, but initial conversation indicate that the project may propose the filling of up to 5 acres of wetlands. I had a conversation with the consultants about the fact that all of these impacts would have to be mitigated for (even if they were beneficial for wildlife), and that it was possible that a combination of on and off site mitigation could compensate appropriately, but that minimizing as much of this fill as possible should be the number one priority.

Mitigation Proposal: A formal mitigation proposal has not been received.

Historic Properties: There are no historic properties at this site.

Corps Staff Recommendations: Since the site's water is regulated artificially, coming to a decision on an exact boundary of the wetlands and waters would be difficult. The map that the consultants provided is a good representation of what the site would normally look like if the pump was working, which would be different than it was when the site was visited. Because the water could be kept at any number of levels artificially, I believe that the map that was provided would be a good representation of the normal level that the wetlands and waters extend to, and therefore a JD letter verifying this map as accurate should be sent.

EXHIBIT J

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

San Francisco Department of Public Works

Sharp Park

Sharp Park Sea Wall Evaluation

December 2009

Arup North America Ltd
560 Mission Street, Suite 700, San Francisco, CA 94105
Tel +1 415 957 9445 Fax +1 415 957 9096
www.arup.com

Job number 211219

2.3 Task 3 – Saltwater Intrusion Evaluation

Arup reviewed existing salinity data of Laguna Salada collected by the SFRPD. The purpose of the review was to identify if water is penetrating the Sea Wall and entering the wetlands. We also visually inspected the Sea Wall to determine if noticeable areas of salt water intrusion are present.

3 Site History

3.1 Acquisition and Building of the Golf Course

The City and County of San Francisco acquired the property of Sharp Park in 1916-1917 through an indirect bequest by Mrs. Honora Sharp. The property came with the stipulation that the property be used only for a public park or playground. The decision to build a Golf Course took place in 1929 and it was completed in 1932. It was designed by Dr. Allister McKenzie along with Robert Hunter (Geomatrix 1987).

3.2 Building of the Sea Wall

The first unarmored earthen Sea Wall embankment at the site was built between 1941 and 1952 to protect the golf course from waves and flooding (Philip Williams & Associates [PWA] 1992). From that time until a major storm in 1983, maintenance was periodically performed on the Sea Wall embankment.

3.3 Major Storms and Erosion of Coastline

Since 1931, between 200 to 300 ft of beach has been lost due to shoreline erosion, including 16 acres of the golf course. A majority of this erosion has occurred during major storms. The most noteworthy have been in 1958 ,when most of the golf course was submerged due to wave overflow and storm inflows, and January 1983, when a large portion of the Sea Wall was breached and large amounts of sand were carried onto the golf course (PWA 1992).

3.4 Reconstruction of Sea Wall in 1989

After the 1983 breach, the City and County of San Francisco took measures to prevent erosion of the Sea Wall on a large scale. In 1984, a geotechnical study titled Restoration of Coastal Embankment; Sharp Park Golf Course was performed by Woodward-Clyde Consultants, which looked at the soils underlying the Sea Wall and the area in the immediate vicinity. In 1987, a feasibility study was conducted by Geomatrix Consultants titled Restoration of the Coastal Embankment; Sharp Park Golf Course, which looked at various design alternatives for the Sea Wall. In 1989, a reconstructed Sea Wall was completed which spanned the entire 3,200 ft of coastline at Sharp Park. Several years later, the northern 1,140 ft of the Sea Wall was lightly armored to protect against wave action. Then, between 1997 and 2000, the southern 285 ft of the Sea Wall was also armored.

4 Review of Available Data

4.1 Available Geotechnical Data

The majority of the available geotechnical data for the site is in the 1984 geotechnical study by Woodward-Clyde Consultants. For this report, eight borings were drilled along the Sea Wall and engineering laboratory tests were conducted on the collected soil samples. The report presents several potential designs for the Sea Wall.

In this report, six of the eight borings show loose to dense Beach sand over their entire depth, which is 14.5 to 20.5 ft below the bottom of the Sea Wall. Two boreholes in the area west of the southern portion of the Sea Wall show silty clay below the Beach sand. In one borehole the silty sand goes from 20 ft to the bottom of the borehole at 24.5 ft. In the other borehole, the silty sand is present from 22 to 26 ft and is underlain by sandy gravel that extends to the bottom of the borehole at 29.5 ft. The surface elevations of the boreholes are not given in the report (Woodward-Clyde 1984b).

Another 1984 study by Woodward-Clyde Consultants titled Design Memorandum, Beach Boulevard Seawall provides subsurface information at the northern-most edge of the Sea Wall alignment. In this report, 5 boreholes are within 400 ft of the Sea Wall alignment and were considered relevant to this project. They show loose to medium dense, fine-grained sand at the ground surface to elevation 3.6 to -4.5 ft (NGVD29). Below the sand is medium stiff to very stiff, silty or sandy clay, which extends to the bottom of the boreholes at elevation 0.6 to -10.3 ft (NGVD29) (Woodward-Clyde 1984a).

4.2 Aerial Photographs

Fourteen aerial photographs were obtained from Pacific Aerial of Oakland, CA for the area of the Sharp Park Sea Wall. The earliest photograph obtained is from 1946 while the latest is from 2000.. In the 1946 to 1969 photographs, the crest of the Sea Wall appears to be low and non-uniform, as shown in the 1946 photograph (Figure 3). In 1972, a well-defined Sea Wall appears over the northern half of the alignment (Figure 4) but appears to deteriorate through 1981. In 1983, the Sea Wall is no longer visible as it was breached and eroded in the January 1983 storm (Figure 5). In 1985, it seems that minor repairs have been done along the alignment, and in 1989 the Sea Wall appears in its current form (Figure 6). In 1991, the rip rap on the northern section is present. The rip rap on the southern section is visible in the 2000 photo (Figure 7).

4.3 Current Tidal Data and 100-year Flood Estimate

The three nearest tidal stations to the Sharp Park Golf Course are Ocean Beach, San Francisco Bar, and Half Moon Bay. Daily tidal predictions are available for these stations from the National Oceanic and Atmospheric Administration (NOAA). However, these stations do not present data in terms of absolute datums and therefore were not used. The nearest station that has datums available is San Francisco (Golden Gate). At this location, the Mean Highest High Water (MHHW) level is 5.84 ft above the Mean Lowest Low Water (MLLW) level. This corresponds to a MHHW level of elevation 5.92 ft in the NAVD88 datum. The highest water level recorded at this station during the period of 1983 to 2001 was 8.74 ft (NAVD88) on January 27, 1983 (NOAA 2009).

The Base Flood Elevation (BFE) at the Pacific Ocean, at Sharp Park State Beach, located approximately 2,000 ft north of the site, is 29.7 ft (NAVD88). The BFE is the elevation to which floodwaters are expected to rise to during a 100-year flood (Federal Emergency Management Agency [FEMA] 2009). A 100-year flood is the flood that has a 1% chance of occurring every year. The definition is the same for a 100-year storm.

4.4 Previous Coastal Design Criteria

In the previous design and feasibility studies performed by Woodward-Clyde Consultants (1984) and Geomatrix Consultants (1987), coastal design criteria were presented for the design of the Sea Wall. In the Woodward-Clyde report, a design still water level of 9 ft (MLLW) was assumed. A design wave height of 12.7 ft (MLLW) was assumed.

Photograph: AV9-13-1
Date: 7-29-1946

HISTORICAL AERIAL PHOTOGRAPH: 1946

Sharp Park
Sharp Park Sea Wall Evaluation - Draft
Department of Public Works
San Francisco, California

December 2009

ARUP

FIGURE 3

Photograph: AV-1045-02-23
Date: 5-11-1972

HISTORICAL AERIAL PHOTOGRAPH: 1972

Sharp Park
Sharp Park Sea Wall Evaluation - Draft
Department of Public Works
December 2009 San Francisco, California

ARUP

FIGURE 4

D:\21121964 Internal Project Data\4-05 Reports & Narratives\01 Sharp Park Draft Report\Individual Figures\Historical Photo 1972.grf

Photograph: AV-2265-01-18
Date: 6-6-1983

HISTORICAL AERIAL PHOTOGRAPH: 1983

Sharp Park
Sharp Park Sea Wall Evaluation - Draft
Department of Public Works
December 2009 San Francisco, California

ARUP

FIGURE 5

D:\21121964 Internal Project Data\4-05 Reports & Narratives\01 Sharp Park Draft Report\Individual Figures\Historical Photo 1983.grf

Photograph: AV3556 1 16
Date: 6-19-1989

HISTORICAL AERIAL PHOTOGRAPH: 1989

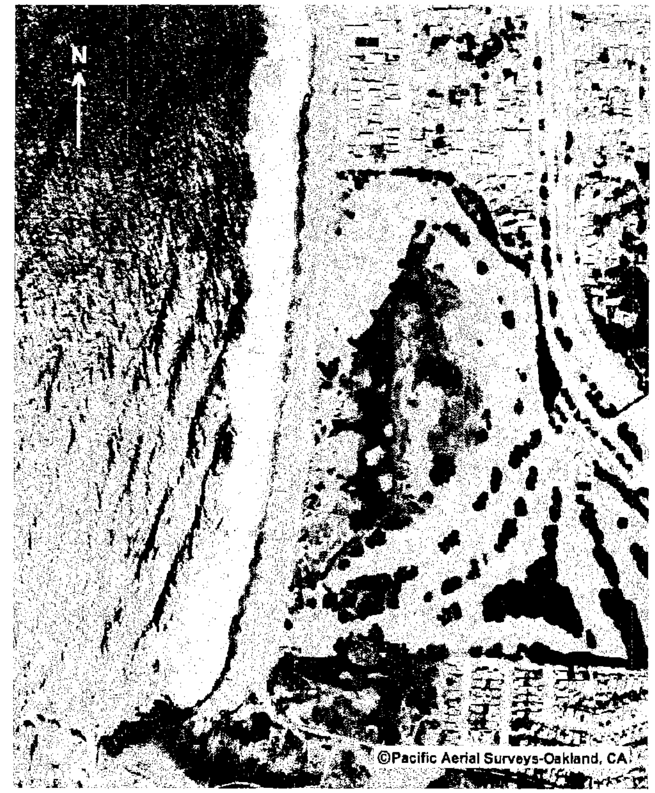
Sharp Park
Sharp Park Sea Wall Evaluation - Draft
Department of Public Works
San Francisco, California

December 2009

ARUP

FIGURE 6

Q:\2112194 Internal Project Data\4-05 Reports & Narratives\01 Sharp Park Draft Report\Individual Figures\Historical Photo 1989.grf



Photograph: SMT AV 6600 2 15
Date: 8-15-2000

HISTORICAL AERIAL PHOTOGRAPH: 2000

Sharp Park
Sharp Park Sea Wall Evaluation - Draft
Department of Public Works
San Francisco, California

December 2009

ARUP

FIGURE 7

Q:\2112194 Internal Project Data\4-05 Reports & Narratives\01 Sharp Park Draft Report\Individual Figures\Historical Photo 2000.grf

EXHIBIT K

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project Final Mitigated Negative Declaration and Project Approval

UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
NORTHERN DIVISION

WILD EQUITY INSTITUTE, a non-profit corporation, *et al.* Plaintiffs, **v.** **CITY AND COUNTY OF SAN FRANCISCO,** *et al.*, Defendants.	Case No.: **3:11-CV-00958 SI** **WENDY DEXTER EXPERT REPORT**

1. I am submitting this expert report on behalf of plaintiffs in this case.

BACKGROUND AND QUALIFICATIONS

2. I am the President and Principal Biologist at Condor Country Consulting, Inc., a biological consulting firm I founded ten years ago. For the past twenty years I have worked professionally as a wildlife biologist, with an emphasis on herpetology, i.e., the study of amphibians and reptiles. Through my work I have conducted special-status species surveys and prepared biological reports for projects requiring permits from federal and state agencies, including Endangered Species Act permits from the United States Fish and Wildlife Service. In this capacity, I have provided my expertise to many public entities, including the San Francisco Public Utilities Commission, Caltrans, San Mateo County Public Works, and many other public agencies. I am a member of several professional organizations, including the Wildlife Society, the Society for Conservation Biology, and the Society for the Study of Amphibians and Reptiles.

3. I received a B.S. in Environmental Planning and Management from U.C. Davis in 1990, and completed my graduate coursework in Biology at California State University at Hayward in 1998. Sam McGinnis, PhD. was my major professor and under his tutelage I worked on several research projects collecting data on the San Francisco gartersnake (*Thamnophis sirtalis tetrataenia*, SFGS) and the California red-legged frog (*Rana draytonii*, CRLF).

4. I am one of a small number of professional biologists permitted by both the United States Fish and Wildlife Service and the California Department of Fish and Game to carry out recovery actions on the SFGS. I am therefore one of a few individuals authorized to study and implement recovery actions for this subspecies. I am also permitted to work with the CRLF and other federal and state-listed threatened and endangered herpetofauna (reptiles and amphibians) by these agencies.

5. I have studied almost a significant number of the peer-reviewed journal articles and books that address life history aspects of SFGS and CRLF, in addition to various master's theses, Environmental Impact Reports, habitat assessments, Biological Opinions, and Biological Assessments that contained information or opinions on these species. I have also reviewed historic accounts of SFGS in Wade Fox's papers, and of CRLF in Storer's 1925 A Synopsis of the Amphibia of California.[1]

6. I have conducted several studies on lands where the SFGS and the CRLF occur, logging hundreds of hours searching for, identifying, and monitoring these species during all life stages. For example, I have performed population studies of SFGS at the Pescadero Marsh State Park, Crystal Springs Reservoir, and West of Bayshore properties. I have participated in habitat enhancement efforts including pond construction, dredging of aquatic habitat, and vegetation management and enhancement at several other sites throughout San Mateo County. In addition, I have trapped or performed visual surveys for SFGS at seven other locations. All but two of these projects also included either studying, protecting, or enhancing habitat for the CRLF. I have spent hundreds of hours observing, trapping, netting, capturing, relocating, and surveying for this frog in counties throughout its range.

7. In the process of performing these studies I have discovered new populations of CRLF. I have also assisted in the discovery that CRLF tadpoles can overwinter, and that female CRLF

[1] At one time the California red-legged frog and the Northern red-legged frog were considered two subspecies of *Rana aurora*. Today the California red-legged frog is considered its own species, *Rana draytonii*. Nonetheless, observations that pre-date this taxonomic change can still provide useful information about *Rana draytonii* if the observations are from areas where only one of the two species was known to occur. The two subspecies did not overlap in range at Sharp Park, so these older observations are relevant to our current knowledge of the frogs at Sharp Park.

can vocalize when frightened or when desiring release during amplexus (an egg-laying position where the male frog holds the female from behind in order to fertilize eggs as they are laid). Both of these life history characteristics were undocumented prior to work on a project in Contra Costa County where I and my colleague Jeff Alvarez first observed these phenomena.

8. Part of my profession is to determine project impacts on threatened and endangered species. In the course of my career this work has prompted literature review and synthesis on a variety of threats that could affect the CRLF and the SFGS. This research has focused on topics such as wildlife mortality associated with vehicle collisions on roads (specifically focusing on frogs, salamanders and snakes), noise and nighttime lighting impacts on sensitive bird and bat species, vegetation management impacts to herpetofauna and avian species, ground disturbance impacts to a host of species that live underground for some portion of the year (including CRLF and SFGS), impacts associated with the introduction of invasive non-native fauna, as well as large scale impacts associated with converting habitat to development. I have studied and observed threats to individual animals, such as activities that directly "take" or injure and kill these animals, and activities that impair important aspects of their life history through habitat conversion and modification associated with flood control, water management, land clearing, construction, and vegetation management.

9. For example, approximately ten years ago I was studying SFGS at the West of Bayshore property. On a cold but sunny day in mid-October, I observed an SFGS basking early in the morning on the levy road along cupid's row canal, an activity that put the animal at great risk of being run over. I have also reported and examined an SFGS that was killed by a vehicle traveling on a construction site at slow speeds in the same area and time period. The driver had received species awareness training and direction on procedures necessary to keep from hitting snakes. These experiences inform my recommendations about operating vehicles in SFGS habitats, and the ability of operators to avoid harming these animals.

10. I have also spent dozens of hours monitoring vegetation removal in and around SFGS aquatic habitat in several locations, including West of Bayshore and Woodside, and I have a keen awareness of how difficult the snake is to detect, how quickly they can move in or out of

an area, and how difficult it is to remain alert and vigilant to the task at hand when an animal has not been seen for hours or days. These experiences have informed my opinions about protocols that purport to prevent take of these species by relying on visual detection of these elusive animals.

11. Another part of my profession is to ensure that endangered species permits under state and federal law are properly applied for, obtained, and complied with. I have worked on many projects that have required incidental take approval from the U.S. Fish and Wildlife Service under the Endangered Species Act, and I am very familiar with these permitting processes. I have worked on projects that have had a federal nexus and therefore may be permitted through the Section 7 Consultation process under the ESA, and on projects that do not have an obvious federal nexus and require a Section 10 habitat conservation plan in order to obtain incidental take authorization. For example, I worked on a small project that had both frog and snake impacts, but had no federal nexus because the applicant was claiming no impact to Army Corps of Engineers jurisdictional waters. A majority of my work consists of assisting clients with permitting projects under existing HCPs, through Section 7 Consultation, or in the odd case where both Section 10 and Section 7 Consultation are required. This experience includes permitting dozens of projects that had the potential to impact CRLF or SFGS.

12. For example, in the past five years a client in Woodside was considering installing a golf course on their property, which was habitat for SFGS. I spend a considerable amount of time researching and considering how this might be accomplished for a subspecies listed as "fully protected" under the California Fish and Game Code, but could not conceive of a golf course where no take would occur.

13. I have also worked on many projects where CRLF were present, often in more than one life stage (e.g. adults and tadpoles), where pumping was required. My experience with these projects included assisting with the pump cage design and monitoring the cage to be sure that no animals were trapped on the mesh. Through these experiences I have found that unless there is a vigilant monitor clearing the fine mesh screen and very low water velocities, tadpoles become entrained and either are sucked through the pump and killed or they are sucked against the mesh

and die because they cannot free themselves. All of these projects had take permits, but none of them attempted to draw down the water in the pond during the timeframe when eggs or very small tadpoles would be in the water.

14. Based on my professional experience and expertise with CRLF and SFGS, in 2009, I was invited by the City and County of San Francisco to participate in a "peer-review panel" to discuss the City's Conceptual Restoration Alternative Plan for Sharp Park. I am very familiar with Sharp Park. I visited Sharp Park for several hours in August 2011, and based on that visit and my review of all available reports (as outlined in Attachment B), it is my professional opinion that Mori Point and Sharp Park constitute *one* population of the SFGS and *one* population of the CRLF that function within a complex habitat mosaic. A SBI (2006) document supports my opinion that the two properties constitute one population when it states "[b]ased on size class data, a few individuals captured in 2004 and 2006 may represent young of year from Fall 2003 and Fall 2005. This implies that SFGS at Mori Point are part of a breeding population that occupies the Mori Point and Laguna Salada area. This population may also extend to the south into the Calera Creek watershed where no physical boundaries exist between the parcels and occurrence has been documented in the past (McGinnis 1990)."

15. My experiences there have also helped me understand the proximity of the mowed areas to the aquatic habitat, and to understand how predators and scavengers, as well as prey availability, may impact SFGS and CRLF populations, as well as our ability to detect these species, at the site.

16. I have also reviewed documents regarding CRLF and SFGS at Sharp Park and the surrounding lands (*see* Attachment B). I have reviewed these documents with a particular interest in the differences between management approaches at Sharp Park—which conducts several activities that create a population "sink"—an area where death rates exceed birth rates due to poor quality habitat or impacts associated with disturbance—and management approaches at the adjacent Mori Point National Park—where a robust recovery action is ongoing, creating a population "source" for both species, continually introducing new snakes and frogs into Sharp Park, despite the operations that make Sharp Park a sink.

17. More information about my work with CRLF and SFGS can be found in my resume, which is attached as Exhibit A. My expert testimony in this report is based on the resources described above, along with the documents listed on the attached Exhibit B as well as any other materials discussed below. I am charging plaintiffs $75 per hour for the time I spend reviewing materials and providing deposition and trial testimony in this matter. I have not authored any publications in the previous 10 years, and I have not testified as an expert at trial or by deposition during the previous four years.

REQUESTED TESTIMONY AND FACTS CONSIDERED

18. Plaintiffs have requested that I provide my expert opinion and testimony regarding the presence of San Francisco garter snakes at Sharp Park Golf Course; the effects of mowing operations at Sharp Park Golf Course on the San Francisco garter snake population found there; and the overall impacts the Golf Course's activities have on the population and the species.

SAN FRANCISCO GARTER SNAKES ARE PRESENT AT SHARP PARK

19. It is my professional judgment that the San Francisco gartersnake is present at Sharp Park based on the continued observations of SFGS on the property and at the adjacent Mori Point; on the fact that biologically speaking the Mori Point and Sharp Park populations are one biological unit; and because suitable habitat exists at Sharp Park wherever the golf course operations and management have not removed or degraded required elements of suitable habitat.

20. Many studies from diverse sources indicate that SFGS has persisted at Sharp Park for many decades, and continues to do so. Wade Fox, the first biologist to systematically survey and record amphibian and reptile species at Sharp Park, found relatively large numbers of San Francisco gartersnakes at Sharp Park in the 1940s, collecting 34 specimens there during ten visits to the site in 1946. In 1978, Sean Barry observed 37 San Francisco gartersnakes near Horse Stable Pond, and an additional 46 at Mori Point in ten visits: indicating a persistent population at least on the southern edge of the golf course at that time. Extensive trapping in the mid- to late-80s by Dr. Sam McGinnis captured only two San Francisco gartersnakes at Sharp Park (SBI 2009), and while subsequent surveys conducted from 1990 to 1992 found 3

SFGS at Mori Point, but none at Sharp Park (PWA 1992 *in* SFRPD 2006). In 1997 McGinnis trapped one SFGS in the "marsh pond and stable area" (SBI 2009). Swaim Biological Consulting (2005) reported capturing four SFGS at Horse Stable Pond and one at Laguna Salada in 2004. SFGS were observed at Horse Stable Pond in 2005 (Campo 2005 *in* SFRPD 2006). SBI (2006) also reported four snakes trapped in 2004 at Sharp Park in the vicinity of Horse Stable Pond and 6 or 7 trapped in the same vicinity in 2006. The discrepancy in the 2006 numbers is derived from a difference between the data in Figure 9 and Table 1 of the document. In 2008, two San Francisco gartersnakes were observed at Sharp Park (SBI 2009); and between 2006 and 2011, 17 SFGS have been incidentally observed at Mori Point (Crooker email 2011). Throughout this time period, several other San Francisco gartersnakes were also observed in adjacent San Francisco Public Utility Commission watershed lands.

21. The absence of the snake from certain survey efforts demonstrate that negative findings do not equate to extirpation of the species from a site. McGinnis performed two extensive survey efforts in 1986 and 1988, capturing no SFGS at Sharp Park or Mori Point (SBI 2009). Yet SFGS were detected in years after 1988. Those snakes did not likely come from afar to recolonize this location. There was likely a small population that was just not detected during the surveys. The idea that negative survey results are not the same as the species being absent from the site is an idea supported by both CDFG and USFWS. Karen Swaim describes it this way in an email to a client:

> "The primary reasons a negative finding could not be accomplished in this study include the documented presence of the SFGS population at Mori with no barriers or even deterrents to movement between the sites and habitats, the historical presence in Calera Creek --[sic] former quarry) and the continued presence of suitable habitat and abundant prey species (including a federally listed species) there. It is also relevant to point out population fluctuations in biological systems prevent establishment of an "absence finding" for SFGS in this situation. I can site two very specific examples of locations where SFGS surveys have been conducted with none found in one survey and subsequently conducted in the same location in following (consecutive or with many years in between), one of those being Mori Point and the other a site on SF PUC property where Dr. McGinnis did a 90 day study below Crystal Springs Dam and got no SFGS (I'm not sure what year) and we trapped in 2007 and got an SFGS within one month."

22. The variable survey effort and reported captures within Sharp Park provide an unreliable picture of the SFGS population through time because different techniques (trapping, hand

capture, and incidental observations) with varying success rates were used and because levels of effort and survey timing (time of year) varied widely. The best population comparisons available are those of Fox and Barry because they both constitute ten days of survey effort and they both used a hand capture technique. Given that the population appeared to remain fairly stable between those two survey efforts, it is interesting to note that major flood events occurred in 1938 (Faulkner 1979), eight years prior to Wade Fox's survey, and in 1958 (Geomatrix 1987) and January of 1978 (FEMA 1987), 20 years and immediately prior to Barry's survey. Other major flooding occurred in the winters of 1978 and 1983. It is obvious that both the snake and its prey, CRLF and Sierran treefrog, have survived many large storm events that may have temporarily increased the salinity of a portion of the aquatic habitat available to them in Sharp Park. The mosaic of habitat provided by the creek, ponds and marshes allow these species to move away from saline habitats into fresh water habitats until they recover.

23. Although the most recent sightings of SFGS have occurred at Mori Point, this does not mean SFGS are no longer present at Sharp Park. Sharp Park and Mori Point share a contiguous boundary of suitable habitat, from Horse Stable Pond east to Fairway Drive. These areas are connected with suitable habitat through the slough/connector channel to Laguna Salada. SFGS found at Mori Point therefore have suitable habitat to reach Sharp Park, and vice versa.

24. Moreover, telemetry studies of the snake determined that the species conducts its daily routines within one to two hundred meters of aquatic foraging habitat (Larsen 1994; SFGS 5-Year Review). In some instances, forays of up to 671 meters were recorded (Larsen 1994). Several areas where SFGS have been recently observed at Mori Point are within one to two hundred meters of Sharp Park, including Mori Point ponds that were restored as part of an SFGS and CRLF recovery action implemented by the National Park Service.

25. There is even evidence from snakes at Sharp Park that indicate individuals found there use both Mori Point and Sharp Park habitats. In 1978 Sean Barry recaptured a snake at Mori Point that he had originally captured and marked at Sharp Park two years prior, about a half mile away. This information supports the assertion that SFGS will continuously move through the Mori Point/Sharp Park population, from Laguna Salada and Horse Stable Pond at Sharp

Park to Mori Point ponds, because the areas contain contiguous suitable foraging and upland habitat.

26. While SFGS have not been observed at Laguna Salada in recent years, they have been observed within Sharp Park at Horse Stable Pond during every trapline survey conducted in recent times. Since the last trapline survey was conducted in 2008, only visual, opportunistic surveys for SFGS have occurred at Sharp Park. However, while a visual survey can confirm presence of SFGS when one is found, as explained above, a failure to detect the species does not mean the species is not present. San Francisco gartersnakes are difficult to find, even under favorable conditions. The subspecies is relatively small, secretive, and cryptic. In addition, its preferred habitats make visual observation difficult. Because of this, one cannot conclude that the subspecies is no longer present simply because you have not visually observed it.

27. My opinion that SFGS continue to be present at Sharp Park is consistent with every written document prepared by the City's Natural Resource Program Manager Lisa Wayne, who has repeatedly written that SFGS are found at Sharp Park. My opinion is also consistent with the conclusions of Karen Swaim, a consultant working for the City, who has repeatedly determined that SFGS are present at Sharp Park. To my knowledge, not a single biologist, herpetologist, or regulatory agency has ever determined that SFGS no longer inhabit Sharp Park.

GOLF COURSE OPERATIONS ARE TAKING THE SAN FRANCISCO GARTER SNAKE

28. Many different golf course activities are harming the San Francisco gartersnake, both directly and indirectly. These activities include golf cart use both on and off golf cart paths, which is reasonably certain to crush San Francisco gartersnakes, and mowing, which is reasonably certain to kill both snakes and frogs with mower blades or crush them with the mower's wheels.

29. It is my professional opinion that the San Francisco gartersnake's habitat at Sharp Park is not secure, and that the subspecies has been taken, and will continue to be taken in the foreseeable future, by the continued operations and management of Sharp Park Golf Course.

30. As will be explained below, it is my professional opinion that these take events have occurred more frequently than observed in the past, and will continue to occur in the future unless the relief requested in this case is provided.

31. SFGS, like most gartersnakes, feed in aquatic features like ponds and lagoons. The snake is also an obligate basker, meaning that it needs to bask in the sun in order to function well, so it seeks open uplands adjacent to suitable foraging habitat to warm itself.

32. Nearly all of the areas surrounding Laguna Salada and Horse Stable Pond are mowed regularly by the golf course, very near or immediately adjacent to the wetland edge. This leaves a very narrow band of emergent wetland habitat between the open water areas of the lagoon and the golf course links, and no protected upland in which SFGS can bask, breed, or seek refuge in a burrow. Beyond the narrow band of emergent vegetation, SFGS would face a very high likelihood of being taken directly by mowing operations.

33. Upon inspecting the golf course on August 28, 2011, it is clear to me that the City is mowing aquatic vegetation, *i.e.*, it is directly mowing wetland habitats that are important for the San Francisco gartersnake. This alone creates a high degree of certainty that a San Francisco gartersnake will be taken by golf course mowing operations. These areas are important habitats for San Francisco gartersnakes, and there is a high probability that lawn mowing activities there will result in take of the snake. This is in part due to the fact that, from a snake's perspective, cover equals safety, so any snake basking near or foraging in or near this habitat edge will seek cover in the edge habitat if disturbed. If that disturbance is an approaching lawn mower, the snake will feel protected by the cover even though that cover is exactly what the mower is removing.

34. Moreover, mowing activities eliminate cover and shelter for the gartersnake, making them more susceptible to predation events. This habitat modification is therefore leading directly to injury and death of individual animals, taking the gartersnake.

35. It is reasonable to expect that snakes are almost constantly moving between and among all aquatic habitat at Sharp Park and Mori Point and that some portion of the population will forage and disperse into the Laguna Salada area, a straight line distance of less than 350 meters

from one Mori Point pond. As SFGS move from Mori Point to Laguna Salada, they will be exposed to activities like lawn mowing that can harm or kill individual snakes. It is likely that these SFGS will be killed by mowing so long as mowing occurs within the normal activity range of the SFGS.

36. The United States Fish and Wildlife Service stated in its 2006 Five-year Status Review of the San Francisco Gartersnake that a dead SFGS found at Sharp Park in 2005 had been killed by a golf course lawn mower. I have reviewed the photographs of this snake, read the correspondence that accompanied the file, and reviewed photos of other snakes injured or killed by lawnmowers that I found and I concur that the snake was likely killed either by the wheels and blades of a lawn mower or by another mechanized vehicle, such as a golf cart. I identified two compression wounds on the snake that could have been made by either mower or golf cart wheels, one above the tail end of the snake and one anterior to the middle of the snake that would have crushed vital organs. In addition, there are a number of lacerations along the entire length of the snake's body that are characteristic of blade cuts. These include cuts where the flaps of skin remain and locations where large chunks of flesh were removed (mid-body) and removal of a portion of the tail.

37. It is my professional opinion that many more San Francisco gartersnakes likely have been killed by mowing and golf cart operations in the past, and that more will likely be killed in the foreseeable future. Detecting dead San Francisco gartersnakes is very difficult to do, because snake carcasses are rapidly scavenged. Several studies documenting wildlife mortality on roads have also quantified the percentage of mortalities not detected due to scavenging. In a study by Antworth et al. (2005), researchers planted dead snakes in the median and on the side of a busy road and then monitored the carcasses at two-hour intervals do determine the percentage of carcasses that are missed in roadkill surveys. They used dead snakes and chicks as carcasses and found that there was about an 85% chance of encountering a dead snake on the road within 2 hours of the carcass being placed there. At 4 hours the chance of encounter decreased to less than 50%, and after 24 hours the chance of encounter was less than 10%.

38. . While visiting Sharp Park in August, 2011, I observed many potential scavengers of snake carcasses. I observed a red fox hunting on the golf course for more than an hour. I also observed a group of at least five ravens perched on the dead cypress trees adjacent to Laguna Salada. Both species are likely to scavenge injured, dying, or dead snakes from the golf course during the day, and the fox would also take them at night. So on the golf course, where scavenging is safer than on the busy road, there is likely at least a 50% chance that a snake killed there will be scavenged within 4 hours. Given that potential for decreased detection and the fact that nobody is assigned to look for dead snakes at Sharp Park, I am certain that undocumented deaths of snakes occur annually, if not more frequently.

39. Similarly, golf cart operations, both on and off golf cart pathways, are likely to take San Francisco gartersnakes. Gartersnakes need to bask in the sun to regulate bodily functions such as body temperature and digestion, and the paved golf cart paths absorb and store heat, providing snakes exceptional opportunities for quick warming on cold sunny mornings, throughout the day, and even after the sun has set. Golf carts are particularly well known to cause harm to snakes, even at slow speeds. One researcher, needing dead snakes to study the effects of scavenging on roadkill detection rates, found that golf carts killed many snakes and collected dead snakes from areas with known golf cart activities. Snakes killed in this manner were used as a prey source in his study (DeGregorio 2011).

40. Because CRLF and treefrogs, both pond/pool breeders, are an important component of the snake's diet, the population size of these species directly impacts the population size of SFGS. Management of aquatic habitat that affects water depth during the egg laying and maturation season can significantly affect the size of the prey population. Golf course management activities that lower water levels once eggs have been laid will leave egg masses above the water level to desiccate and die. Reduced numbers of frogs means reduced foraging opportunities for the snake and an increased risk of death from starvation or predation due to spending more time actively foraging.

41. It is my professional opinion that mowing, golf cart use, and other habitat modifying activities like pumping are taking SFGS at Sharp Park, and will continue to do so unless these activities are stopped.

DEFENDANTS' COMPLIANCE PLAN IS NOT SUFFICIENT TO PREVENT TAKE OF SAN FRANCISCO GARTER SNAKES AT SHARP PARK

42. After 2008, the City released a Final Draft Endangered Species Compliance Plan for Sharp Park. Upon review of this plan it is my professional judgment that the plan is unworkable and cannot reduce take to levels that would obviate the need for Endangered Species Act permits.

43. Even if it were complied with, the City's compliance plan cannot eliminate take of SFGS by the golf course because under the plan mowing and golf cart use will still occur within the snake's known daily activity range around Laguna Salada and other foraging habitats at Sharp Park. Under the compliance plan, some of these areas will not even be monitored for SFGS before mowing and golf cart use occurs, virtually assuring that SFGS will be taken by these activities.

44. In other areas, the compliance plan relies on biological monitors to visually observe portions of the golf course before mowing occurs. Having spent hundreds of hours searching for SFGS along the edge of their aquatic habitat and in uplands I have personal experience that informs my opinion that these animals are too fast and difficult to detect effectively, especially where there is any change in vegetation or change in topography. It is simply unrealistic to expect even a trained eye to detect every SFGS that will be in harm's way. These snakes are fast and wary. The compliance plan relies on biological monitors being able to scan acres of habitat with 100% reliability and certainty that all frogs and snakes will be observed, moved, or lawn mowing delayed until the subspecies are clear from danger. However, the protocol implemented cannot reach this level of certainty, and will inevitably result in an under-observance of frogs and snakes. I know from experience that maintaining that kind of focus, especially when you have not seen your target species in a long time, requires uncommon levels of discipline, motivation, and focus.

45. Moreover, it is my understanding that in fact the only monitoring conducted before mowing activities is by the golf course mowing staff, and that monitoring may not occur at all or in some cases more than three hours before the mowing (Kappelman Deposition, pp. 51-56). Under these circumstances it is even more certain that SFGS and CRLF are being taken as a result of mowing activities at Sharp Park. As discussed above, an experience biologist may find it difficult to detect these animals when they have not seen one after hours or days of unsuccessful searching. These are professionals that likely have a search image in thought, gained from previous observations. In addition, I have often witnessed the difference in the level of vigilance between a professional biologist searching for an animal and a layperson trained to search for the same species. Though I cannot say that every biologist is more conscientious than every layperson, I can say with certainty that from my experience, the biologists do a far better job overall of detecting the target animal than the layperson. I believe this to be attributable to the biologist's training and the interest level being greater than that of the layperson with regard to the target animal. In addition, it is obvious that if the golf course staff are not searching for the snake or frog before they mow, there is a high likelihood that take of the SFGS and CRLF are occurring as a result.

46. For these reasons it is my professional opinion that to avoid take of these species all mowing and cart use within the known daily activity range of SFGS, roughly one to two hundred meters from the delineated wetland boundary area should be prohibited, which will provide upland habitat for basking and other essential SFGS upland activity and a buffer protecting SFGS and CRLF from the significant threats posed by mowing activities.

IF GOLF COURSE OPERATIONS ARE NOT SUBSTANTIALLY CHANGED, THE SAN FRANCISCO GARTER SNAKE POPULATION AT SHARP PARK MAY BE LOST, SPECIES RECOVERY WILL BE IMPEDED, AND THE ENTIRE SPECIES WILL BE PUT CLOSER TO EXTINCTION

47. It is my professional opinion that unless the golf course operations that cause take of the San Francisco gartersnake are halted in areas where the snake is likely to be found, the Sharp Park/Mori Point population will continue to decline, increasing the potential for the population to become extirpated. Because there are less than ten wild populations of SFGS known to exist,

each contributes significantly to the genetic diversity, distribution, and viability of the subspecies. The loss of even one population would result in the subspecies becoming more critically endangered, reduce genetic diversity, decrease its distribution, and ultimately make it more vulnerable to extinction through stochastic events.

48. It is my professional opinion that Sharp Park is an extremely important recovery area for the SFGS. Preservation and enhancement of this area is essential for the subspecies to recover, and if areas like Sharp Park are not preserved and enhanced for the benefit of the subspecies, the subspecies may go extinct. In my opinion, the potential for Sharp Park to provide a habitat connection from Coast Side to Bay Side populations of these species is critical to the conservation and recovery of both species. Genetic interchange across these small, isolated populations, even when infrequent, may preclude dangerous levels of inbreeding, disease, and other deleterious harms that face small populations.

1/20/12 — s/Wendy Dexter
Date — Wendy Dexter

I, Brent Plater, hereby attest that Wendy Dexter's concurrence in the submission of this document has been obtained.

Executed on: January 20, 2012 — [signature]
Brent Plater

EXHIBIT A

CONDOR COUNTRY
CONSULTING, INC.

Wendy Dexter
President/Principal Biologist

Ms. Dexter has twenty years of professional experience as a wildlife biologist, emphasizing herpetology, raptor biology, and large freshwater branchiopod biology. Over the years she has gained valuable experience with local, state and federal government projects. She has provided biological documentation, Section 7 consultation, and directed special-status species surveys for various private, county, state and federal clients including the San Francisco Public Utilities Commission, San Mateo County Public Works, the Federal Emergency Management Agency, Lawrence Livermore National Laboratory/University of California, California Energy Commission, Caltrans, Contra Costa County Public Works, and the City of Hercules.

Examples of projects she has participated in include endangered species recovery actions, habitat enhancement efforts, habitat management plans, numerous road construction and realignment projects, flood control projects, construction monitoring, long-term mitigation and monitoring for a dam project, hydroelectric facility recertification, timber harvest projects, natural community conservation planning, and numerous small development projects. Her involvement with these projects included performing habitat assessments, preparing Biological Assessments and Natural Environment Studies, GIS/GPS habitat mapping, mitigation site analysis, surveys and/or trapping for San Francisco garter snake, Alameda whipsnake, California red-legged frog, foothill yellow-legged frog, California tiger salamander, fairy shrimp, tadpole shrimp, western pond turtle, numerous raptors, bats, small mammals, and fish. She has also prepared habitat assessments, biology sections for CEQA and NEPA documents, and managed formal Section 7 consultation with NMFS and USFWS regarding salmonids, spotted owls, and other federally listed species.

EDUCATION
University of California, Davis
B.S., Environmental Planning and Management, 1990
California State University, Hayward
Biology, graduate coursework complete, 1996-1998

EXPERIENCE

- **Principal**, Condor Country Consulting, Martinez, CA (07/01-Present)
  Responsible for all aspects of a biological consulting business. Projects include managing large-scale biology surveys, monitoring, and mitigation projects. She has worked on projects with foothill yellow-legged frog, fairy shrimp, California red-legged frogs, San Joaquin kit fox, burrowing owls, California tiger salamander, small and large mammals, fish, Swainson's hawk, California and Northern spotted owl, Alameda Whipsnake and San Francisco garter snake. She is USFWS permitted for work with California red-legged frog, California tiger salamander, listed branchiopods, Alameda Whipsnake, and San Francisco garter snake.
- **Project Biologist**, Impact Sciences, Oakland, CA (06/00-06/01)
  Responsible for preparation of numerous CEQA documents for a wide variety of projects across northern and southern California. Directed habitat assessments and special status species surveys. Biological work within California included work pertaining to the following species: California red-legged frog, western spadefoot, California tiger salamander, Tehachapi slender salamander, yellow-blotched salamander, San Joaquin pocket mouse, vernal pool tadpole shrimp, and several species of fairy shrimp.
- **Wildlife Biologist**, MSE Group, Oakland, CA. (01/00 – 05/00)

Responsible for supervision and coordination of biological monitoring activities for the BART extension to the San Francisco International Airport on the West of Bayshore property. Supervised six biologists in providing monitoring for various construction activities. Coordinated with several levels of environmental compliance monitors, the US Fish and Wildlife Service representative, and the California Department of Fish and Game representative. Monitored construction activities for compliance with the biological opinion and other inter-agency agreements. Trapped work areas for San Francisco garter snakes. Captured and relocated California red-legged frogs and other animals in harm's way.

- **Wildlife Biologist**, URS Greiner Woodward Clyde, Oakland, CA. (10/97-01/00)
  Responsible for preparing documents and permits for varied projects requiring NEPA and CEQA compliance. These include biological assessments, natural environment studies, and mitigation plans. Practiced in compliance with the Federal and California Endangered Species Acts, the Migratory Bird Treaty Act, and other regulations relevant to the protection of biotic resources. Consulted with federal and state wildlife agencies on two FEMA projects in Mendocino County.
- **Research Assistant**, California State University, Hayward, Foundation. (2/96-6/98)
- **Teaching Assistant**, California State University, Hayward. (9/96-6/98)
- **Wildlife Biologist**, Jones and Stokes Associates, Sacramento, CA. (11/94-10/98)
- **Field Biologist**, North State Resources, Redding, CA. (6/94-11/94
- **Field Biologist**, Beak Consultants, Kirkland, WA. (6/93-8/93)
- **Wildlife Biology Technician**, U.S.D.A. Forest Service, El Dorado National Forest, Amador Ranger District, Pioneer, CA. (4/90-11/93)

SPECIAL STATUS SPECIES PERMITS

U.S. Fish and Wildlife 10(a)(1)(A) Permit for San Francisco garter snake, California tiger salamander, all listed Branchiopods in California, California red-legged frog, and Alameda Whipsnake.

California Department of Fish and Game Scientific Collecting Permit and MOU for San Francisco garter snake, Alameda Whipsnake, California tiger salamander, and California red-legged frog work under federal permit.

PROFESSIONAL MEMBERSHIPS

- The Wildlife Society, Western Section
- Society for Conservation Biology
- Society for the Study of Amphibians and Reptiles

CERTIFICATIONS/TRAINING

- Proficient use of Trimble Global Positioning System, ArcView GIS, and Microsoft Word/Excel. Comfortable with Macintosh and PC environments.
- Aerial Photograph Interpretation, 1992, USDA Forest Service, Placerville, CA.
- Wild Animal Handling and Restraint, 1991, California Dept. of Fish and Game, Sacramento, CA.
- Basic Firefighting, 1990, Sierra Community College, Placerville, CA.

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E-mail: wendy@condorcountry.com http://www.condorcountry.com

EXHIBIT B

WENDY DEXTER EXPERT REPORT
ATTACHMENT B
MATERIALS RELIED ON IN FORMING EXPERT REPORT OPINIONS

- Wade Fox Field Notes and journals, San Mateo County.
- U.S. Fish and Wildlife Service. 2006. San Francisco Garter Snake (Thamnophis sirtalis tetrataenia). 5-Year Review: Summary and Evaluation, Sacramento Field Office, Sacramento, CA. (Plaintiffs' Preliminary Injunction Ex. ("Pl. PI Ex.") 20) (DE 55)
- 2008 Swaim report for SFGS/CRLF at Sharp Park and Mori Point (attached)
- 2008 Swaim report for SFGS/CRLF at Sharp Park and Mori Point (Pl. PI Ex. 22) (DE 56)
- Compiled take evidence of CRLF and SFGS at Sharp Park]
- U.S. Fish and Wildlife Service. 2002. Recovery plan for the California red-legged frog (Rana aurora draytonii). Region 1, Portland, Oregon, USA.
- SFGS Recovery Plan
- McGinnis Geomatrix study 1986
- McGinnis Mori Point study 1988
- Barry Mori Point Report, 1978
- Rossman, D. A., N. B. Ford, and R. A. Seigel. 1996. The garter snakes, evolution and ecology. University of Oklahoma Press, Norman, Oklahoma, USA.
- background information on www.Californiaherps.com
- Youtube.com videos of snakes run over by lawnmowers
- Storer, T. L. 1925. A synopsis of the amphibia of California. University of California Press, Berkeley, California, USA.
- Final Draft Endangered Species Compliance Plan for SFGS (CCSF 4590-4608)
- Comments on Alternatives Reports from Wild Equity Institute and Peter Baye
- Conceptual Ecosystem Restoration Plan and Feasibility Assessment (attached)
- Antworth, L. R., D. A. Pike, and E. E. Stevens. 2005. Hit and Run: Effects of scavenging on estimates of roadkilled vertebrates. Southeastern Naturalist 4(4): 647-656.
- DeGregorio, B. A., T. E. Hancock, D. J. Kurz, and S. Yue. 2011. How Quickly are Road-Killed Snakes Scavenged? Implications for Underestimates of Road Mortality. Journal of the North Carolina Academy of Science 172: 184-188.
- Larsen, S. S. 1994. Life history aspects of the San Francisco garter snake at the Millbrae habitat site. Master's Thesis. California State University, Hayward, California (attached)
- Swaim, K. SFGS Improvement Project At Mori Point, Pacifica, Cal. (CCSF89390-443)
- Sept. 27, 2011 email from Christina Crooker to Brent Plater and Darren Fong re SFGS sightings at Mori Point (attached)
- excerpts of Dec. 15, 2011 deposition of Wayne Kappelman (pp. 51-56)
- excerpts of Jan. 9, 2011 deposition of Lisa Wayne
- Email From Karen Swaim to Peebles Corp.
- Email from Christina Cooker to Darren Fong
- Federal Emergency Management Agency (FEMA), 1987, Flood Insurance Study, Pacifica, California, San Mateo County, community number 060323, February 19, 30p.
- Geomatrix, 1987, Feasibility Study, Restoration of Coastal Embankment, Sharp Park Golf Course, Pacifica, CA. Prepared for: City and County of San Francisco, Department of Public Works, Bureau of Engineering, November, 91p.
- Swaim, K. San Francisco garter snake habitat improvement project at more point, Pacifica, California 2004 - 2008
- Faulkner History of San Francisco Golf Courses, 1979
- Natural Areas Program Draft and Final EIR and Management Plan for Sharp Park

EXHIBIT L

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

WILD Equity
INSTITUTE

February 10, 2011

The Honorable Edwin M. Lee
Mayor, City and County of San Francisco
City Hall, Room 200
1 Dr. Carlton B. Goodlet Place
San Francisco, CA 94102

The Honorable David Chiu
President, San Francisco Board of Supervisors
City Hall, Room 244
1 Dr. Carlton B. Goodlet Place
San Francisco, CA 94102

Dear Mayor Lee and President Chiu:

Over the last 18 months, an independent team of scientists and engineers with expertise in coastal restoration has worked to prepare the attached report on Sharp Park, *Conceptual Ecosystem Restoration Plan and Feasibility Assessment: Laguna Salada, Pacifica, California.*

This restoration alternative, the most in-depth and only peer-reviewed study of Sharp Park to date, was prepared to help San Francisco create a better public park at Sharp Park. Unlike the November 2009 restoration alternative put forth by the San Francisco Recreation and Parks Department, this report is responsive to the 2009 Board of Supervisors Sharp Park restoration planning ordinance and gives San Francisco a true range of alternatives and a science-based assessment for the future of the park.

The report is authored by ESA/PWA, a renowned coastal engineering firm, with the aid of preeminent coastal ecologists and biologists. The authors have unparalleled expertise in coastal restoration and ecology and the peer-reviewers are experts in local historical ecology and coastal ecology. The report contains the best available science regarding restoration options at Sharp Park and makes several key findings:

1) The least costly restoration alternative that would most benefit endangered species at Sharp Park would remove the golf course and restore the natural ecosystem, saving taxpayers tens of millions of dollars in a time of budget crisis;

2) Restoring the natural processes of Laguna Salada will preserve the Sharp Park beach, while the Park Department's proposal will result in the beach eroding away;

3) Sharp Park historically provided more extensive habitat for the California red-legged frog and the San Francisco garter snake, and only through reviving a natural functioning coastal lagoon system can a sustainable and resilient habitat for these endangered species be maintained at Sharp Park in the face of future climate change;

4) The proposed restoration will provide improved flood and erosion protection for surrounding properties.

Sharp Park is beset by many problems, but these findings should inform San Francisco in its planning and future development of Sharp Park for a new era of recreational users. Park users in San Francisco have overwhelmingly indicated in polls, city questionnaires and public meetings that a top priority is increasing sustainability of park resources while reducing expenditures on golf. This report will help the Recreation and Parks Department match modern recreation supply to modern recreation demand in the City.

The report findings run counter to many of the controversial and unsupported conclusions of the 2009 Recreation and Parks Department report on Sharp Park. The new report addresses and dispels several misconceptions about the ecology of Sharp Park and the constraints on restoration. It unearths new data to help understand the historic and modern conditions at the site and separate myths from fact. It puts forward a restoration design concept that is based on accepted scientific understanding of coastal lagoon processes and experience gained in other nearby coastal restoration projects, rather than predetermined conclusions to support the status quo.

Again, the restoration plan attached is estimated to be far less costly than and environmentally superior to the alternative favored by the Park Department, while addressing longer-term sustainability to both natural lagoon functions and endangered species populations. We hope that this vision of restoration is helpful to decision makers as long-term plans for Sharp Park are developed.

Sincerely,

Brent Plater
Executive Director
Wild Equity Institute
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San Francisco, CA 94119
(415) 349-5787
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CONCEPTUAL ECOSYSTEM RESTORATION PLAN AND FEASIBILITY ASSESSMENT: LAGUNA SALADA, PACIFICA, CALIFORNIA

Prepared for:

Wild Equity Institute
Center for Biological Diversity

Prepared by:

ESA PWA

with

Peter Baye, Ph.D.

Dawn Reis Ecological Studies

February 9, 2011

PWA

CONCEPTUAL ECOSYSTEM RESTORATION PLAN AND FEASIBILITY ASSESSMENT

LAGUNA SALADA, PACIFICA, CALIFORNIA

Prepared for

Wild Equity Institute
Center for Biological Diversity

February 9, 2011

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EXECUTIVE SUMMARY

Laguna Salada represents one of the best opportunities in the Central Coast region to improve and restore impaired lagoon wetland habitats for endangered species. Restoration opportunities for wetlands and endangered species are compatible with restoration of Salada Beach and broader recreational land uses in a coastal park setting. Other public benefits of restoring Laguna Salada and Salada Beach include improved flood protection to adjacent residential areas, with lower long-term costs and maintenance requirements. The restoration opportunities at Laguna Salada depend on a broad vision for long-term park land use with adaptations to sea-level rise, and without restriction to existing recreational land uses.

The Laguna Salada restoration concept presented in this report is aimed at restoring beneficial dynamics, resilience and adaptability to the Laguna Salada wetland ecosystem in a regime of changing climate, coastal processes, and sea level rise. The design concepts are based on historical and modern natural coastal lagoon reference systems that support California red-legged frog populations and garter snakes in specific sub-habitats. Key elements of the restoration design include: reduction in pumping freshwater out of the system, resulting in significantly higher and seasonally fluctuating lagoon water levels and expansion of fresh-brackish marsh landward; expansion of seasonal wetland and upland transition zones; creation of more freshwater pond refuge habitat landward of the lagoon; expansion of wildlife corridors within and beyond Sharp Park; set-back flood control levees located near the landward edge of Sharp Park and adjacent residential areas; restoration of a natural sand outlet of the lagoon; and phased replacement of the armored shoreline levee road with a boardwalk that allows the beach to retreat and adjust to rising sea level.

The existing Laguna Salada wetlands are impaired by past and ongoing impacts. Principal impacts include artificially low water levels with limited seasonal fluctuation, wetland loss due to historical fill of marsh and floodplain areas for conversion to turfgrass; eutrophication (nutrient loading from turfgrass fertilizer, at times at levels known to have toxic effects on frog larvae); excessive spread by dense, solid stands of cattails and tules across the shallow, drained lagoon; mowing of marsh and uplands, eliminating essential wildlife cover; and loss of connection to suitable upland and seasonal wetland habitats around the lagoon. Some impacts, like salinity seepage through the beach to the artificially lowered lagoon water surface, will increase as sea level rises. The existing degraded wetlands will not be sustainable in the long term as sea level rises, and will likely require increasing costs and maintenance with higher impacts to the wetlands and the beach.

The historical Laguna Salada, prior to Sharp Park construction, supported fringing marshes with cattails and hulrushes that were intolerant of high salinity. Laguna Salada was not a salt pond with salinity near seawater salt concentrations, but merely a brackish to fresh-brackish wetland like other seasonal or non-tidal coastal lagoons in the region. California red-legged frogs, and San Francisco garter snakes that prey on them, occupy seasonal fresh-brackish lagoons with cattail and bulrush vegetation south of Laguna Salada today. In the following report, we used both the historical conditions of Laguna Salada as well as reference conditions from neighboring natural lagoons to provide scientific guidance for designing the restoration of a dynamic, adaptable coastal lagoon ecosystem, including recovery measures for the endangered frogs and snakes at Sharp Park.

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1. SUMMARY

The San Francisco Parks and Recreation Department (SFPRD) is currently considering enhanced management alternatives at Laguna Salada, a lagoon within Sharp Park, located in Pacifica, CA. While the Sharp Park Conceptual Restoration Alternatives Report (SPCRAR) by Tetra Tech et al. (2009) formulated and evaluated a range of alternatives, the report focused primarily on maintaining existing land uses. The SPCRAR plans have a range of concerns including: endangered species protections, the cost and quality of the restoration alternatives, management of an ecological area in an unnatural configuration, including a levee / seawall structure extending more than 3,000 feet. In contrast, this conceptual restoration plan and feasibility analysis considers what is possible for interim and long-term wetland restoration aimed at sustainable habitat for multiple endangered species without the constraint of maintaining specific recreational land uses in the future.

This report provides additional ecological assessments of historical and modern conditions at Laguna Salada. This report also develops a conceptual plan to restore the ecologic processes, structures, and functions of Laguna Salada and Sanchez Creek, while maintaining the beach. This report more fully evaluates an alternative not previously considered that would restore more natural lagoon hydrology and expand freshwater and fresh-brackish marsh habitat and transition zones back to the eastern (landward) floodplain of Laguna Salada, at higher elevations above tides and farther from ocean influence. The natural lagoon wetland ecosystem structure and function would significantly expand endangered species habitat at more stable and sustainable positions in the landscape. Restoration goals of this alternative include long-term sustainability, restoration of endangered species habitat, flood and erosion hazard management for the surrounding community, beach restoration, public access, and low cost.

Our findings show that the Laguna Salada prior to golf conversion was a fresh-brackish, non-tidal coastal lagoon that supported populations of San Francisco Garter Snake and California red-legged frog. Available data are also consistent with the hypothesis that Laguna Salada was a dynamic fresh-brackish lagoon with a landward freshwater gradient prior to agricultural conversion. We find that only through full rehabilitation of the physical and ecological processes at Laguna Salada can a natural, sustainable, and resilient habitat for these species be maintained in the face of future climate change. In addition, the genetic health of the local populations of both frogs and snakes are dependent on a restoration plan which provides gene flow via connective corridors to outside populations. Moreover, such a restoration can, with the use of setback levees and smaller relocated pump stations, provide improved flood and erosion protection for the surrounding areas. The plan described here is estimated to be less costly than and environmentally superior to the SPCAR, while addressing longer term sustainability to both natural lagoon functions and endangered species populations. We hope that this "vision" of restoration is helpful to decision makers as long-term plans for Sharp Park are developed.

1.1 KEY CONSIDERATIONS

This and prior studies have identified topics that require further evaluation. The following "Key Considerations" are addressed by this study at a conceptual level and should be evaluated further.

1. *Coastal flooding:* our analysis indicates the coastal flood risk to the Fairway Park neighborhood is limited to about a 1' inundation around the homes on the far northwestern corner of the neighborhood, for an extreme event (approximately once in 100-year recurrence). A low earth berm or levee along the west and north side of the development is one approach that appears less costly and more reliable than the existing coastal levee. This is because a levee "set back" to the neighborhood is buffered by the seaward land and would not be exposed to significant wave action. We recommend a more detailed analysis to better assess the flood risk and flood management.

2. *Ecological Enhancement Feasibility and Cost:* Enhancement of the Laguna Salada area for ecological function (aka "restoration") is found to be feasible and have a low cost relative to other published alternatives. We recommend that these prior evaluations be updated to better represent the enhancement / restoration alternative and point out that prior decisions based on more costly plans may be revisited. While additional analysis and engineering are needed, we do not anticipate major increased costs that would reduce feasibility. The largest possible additional cost would be additional earthwork to expand the lagoon eastward or otherwise provide greater habitat resilience (see Habitat Resilience, below), and would not increase the project cost by more than 10% to 30%.

3. Historical Morphology: We conclude that Laguna Salada in its pre-disturbance state was a back-beach lagoon that was predominantly non-tidal and primarily formed by rainfall runoff pooling behind the beach ridge. The coarse-grained beach was built and maintained by strong wave action and adequate sediment supply. Our analysis indicates that the lagoon was not big enough to maintain a tidal opening against the large waves that would close it off. However, waves were (and are) large enough to overwash the beach and bring in salt water. Therefore, we conclude that salinity was controlled by fresh runoff but was variable fresh-brackish (low salinity) due to wave overwash and brief tidal incursions following breaching We anticipate a more detailed analysis of salinity under restored conditions would be required to ensure that CRLF and SFGS habitat would be sustained during wave overwash.

4. Historical Ecology: We conclude that fresh-brackish CRLF and SFGS wetland habitat existed at Laguna Salada before the golf course was constructed, when the site was modified for agriculture. We also conclude that pre-agricultural conditions could have, and likely did, include CRLF and SFGS habitat. Further research and review of historical ecology would be needed to confirm the pre-agricultural ecology of Laguna Salada. Such analysis has been instructive for other lagoon systems (Striplen et al. 2004).

5. Habitat Resilience: Salt inflow during wave overwash events poses a threat to CRLF and SFGS habitat. This risk exists and will increase with sea level rise, and the existing CRLF habitat is particularly vulnerable to ocean salt water via groundwater intrusion if managed water levels in the lagoon fall farther below rising sea level. The conceptual restoration plan mitigates this risk by expanding habitat to the east at higher freshwater flooding elevations, where overwash has less potential effect. The proposed lateral expansion of freshwater marsh landward is driven by vertical rise in lagoon freshwater levels due to a reduction in pumping which we estimate would substantially increase the width of the lagoon and extend habitat 200 to 500 feet eastward (See Figures 6 and 8, restoration plan and sections). Also, additional riparian and freshwater marsh habitat would be created along the restored Sanchez Creek Corridor, which would extend an additional 1000 feet inland. Populations in these landward areas would not likely be impacted by wave overtopping even with very high sea level rise and storm surges, providing freshwater refuges for populations that could recolonize the lagoon wetlands following a severe overwash event. Raising lagoon water levels also limits salt intrusion into groundwater, dilutes salt concentrations, and impedes salt water overwash and trapping. We recommend further evaluation of habitat resiliency and consideration of lagoon expansion to the east, including topography and vegetation that could impede wave overwash. The evaluation should include water and salt balance calculations (see below).

6. Water and Salt Balance: The hydrology and salinity of the restored lagoon should be analyzed to support further design and environmental review of the proposed alternative. The analysis conducted by Kammen Hydrology (2008) is an example of the type of analysis that should be applied, and has been applied for other projects (PWA, 2005).

2. INTRODUCTION

2.1 PROJECT BACKGROUND

Sharp Park is a 417-acre multiple use park facility owned and maintained by the City of San Francisco Recreation and Parks Department (SFRPD) in Pacifica, CA (Figure 1, Figure 2). The Park occupies a historical lowland coastal lagoon wetland complex and adjacent stream valley floodplain landward of the Sharp Park State Beach. The modern Laguna Salada is the remnant of a natural back-barrier coastal lagoon (wave-sheltered waterbody or wetland formed behind a barrier beach) within the floodplain of the historical Sanchez Creek watershed (Figure 3). The Laguna Salada lagoon lacked a persistent tidal inlet, and formed a predominantly non-tidal aquatic habitat. Its wetlands and floodplain were drained and converted to crop agriculture, and later filled to construct the Sharp Park Golf Course in the 1930s. From the 1930s to 1970s, various modifications to the beach and lagoon altered the natural hydrology of the system (Appendix A describes this process in detail). An artificial coastal embankment (levee) was constructed in the 1980s, eliminating the natural barrier beach processes that regulate lagoon outlet formation and natural lagoon drainage. The artificial coastal embankment (levee) requires pumping and artificial water management which has lowered the lagoons' natural water levels and resulted in an engineered, managed coastal lagoon wetland complex of reduced extent relative to historical conditions. Surrounding development, including HWY 1, acts as a barrier to wildlife migration and genetic exchange with wildlife populations outside the park.

Despite these significant alterations to the natural hydrology, the remnants of the Laguna Salada wetland complex continue to provide some habitat for isolated populations of the federally listed threatened California red-legged frog (CRLF; *Rana draytonii*) and endangered San Francisco garter snake (SFGS; *Thamnophis sirtalis tetratenia*). The GGNRA has worked hard to restore and provide suitable habitat for these species and enhance public access to the south of the park at Mori Point. The long-term viability of their populations and habitats at Sharp Park is a key issue for wetland management, particularly in view of 21st century climate change and accelerated sea level rise.

The U.S. Fish and Wildlife Service (USFWS) has identified the wetland complex at Sharp Park as important habitat for the SFGS (USFWS 1985, 2002). Most of the historical habitat for SFGS and CRLF at Sharp Park has been displaced by human development (e.g., fill, channelization and draining of the lagoon for agricultural practices, and construction of the golf course; Appendix A). Further, habitat quality for these species at Sharp Park has declined over the past few decades due to altered hydrology, sedimentation, vegetation, reduction of open water habitat, and lack of adjacent upland habitat (Appendix A, D; Tetra Tech et al. 2009). Concrete barriers on both sides of HWY 1 act as movement barriers and development has reduced and perhaps eliminated the connectivity of existing populations of SFGS and CRLF from other inland populations such as Arrowhead Lake, San Andreas Lake, and Crystal Springs Reservoir.

Freshwater inflows into Laguna Salada would naturally cause water levels to rise and fall seasonally, but peak and average lagoon levels are drained to artificially low levels by year-round operation of electric pumps to prevent flooding of low-lying portions of the golf course. Artificial stabilization of lagoon levels to maintain existing land uses minimizes the natural breadth and diversity of seasonal freshwater and fresh-brackish wetlands bordering Laguna Salada marshes. Maintenance of permanent low water levels in the lagoon, mowing of the floodplain, and degradation of water quality have significantly altered wetland habitat quality for wildlife. Management of drained uplands in the floodplain, including mowing, fertilizer applications, and elimination of native vegetation and burrowing mammals, have degraded and eliminated upland habitat for SFGS and CRLF, which need sheltered upland areas such as mammal burrows to survive. Pumping also harms CRLF in winter and spring by stranding adhesive egg masses on vegetation as the water surface is abruptly lowered (Tetra Tech et al. 2009). State and Federal wildlife agencies have recommended that SFRPD enhance habitat conditions in and around the wetland complex to ensure the viability of these populations and to obtain permits from them (USFWS 2005).

SFRPD retained a team of consultants to prepare a conceptual alternatives report to "develop and analyze various alternatives for restoring SFGS and CRLF habitat" within the wetland complex and surrounding areas (Tetra Tech et al. 2009). The SFRPD analyzed three habitat enhancement alternatives, presented in the Sharp Park Conceptual Restoration Alternatives Report (SPCRAR) (Tetra Tech et al. 2009), which vary with respect to configuration and extent of enhanced areas. In November 2009, the SFRPD recommended that the City pursue the alternative that maintains existing land uses at the park, while providing some enhancement of existing habitat areas in and around the lagoon (Alternative A18, Tetra Tech et al. 2009). In response to concerns about coastal erosion and sea level rise, and specifically that the managed system is not sustainable, the SFRPD is pursuing construction of a seawall along the 3,200 ft length of shore (ARUP, 2009). These combined projects are estimated to cost approximately $13 to 20M of public money as an interim measure along with operations and maintenance costs on the order of $100,000s per year (not including existing land use costs such as golf course maintenance, etc., ARUP, 2009; Tetra Tech et al., 2009).

The previous habitat enhancement plans developed by the SFRPD (PWA 1992; Tetra Tech et al. 2009) have been constrained by existing land uses and infrastructure. These constraints include the Sharp Park Golf Course and the levee constructed along the barrier beach. These plans did not compare habitat alternatives based on long-term dynamics of wetlands and coastal processes as they affect endangered species or consider long-term sustainability of existing infrastructure and hydrology in response to future sea level rise. The past filling of the Laguna Salada wetlands, land use, coastal erosion, sea level rise, and managed hydrology and maintenance (i.e., pumping, lagoon drainage, mowing), have displaced endangered species habitats out of the landward floodplain areas and confined these habitats into a vulnerable, narrow zone immediately behind the coastal levee. These changes have "squeezed" the CRLF and SFGS into the artificially drained lagoon, with uncertain long-term viability.

Even with the habitat enhancements proposed by the SPCRAR, this habitat will become increasingly vulnerable and difficult to maintain in the coming decades. Sea level rise will induce erosion and recession of the shoreline. The beach will narrow and the risk of levee overtopping and failure will increase. Eventually, the beach will become so narrow that larger and larger waves will impact the levee and the beach could be lost. This scenario is a fragile, brittle (not resilient) system prone to catastrophic failure which depends on maintenance of the levee and pumping infrastructure.

In response to the SPCRAR, the Wild Equity Institute (WEI), with support from the Center for Biological Diversity, has requested the current study to provide a long-term vision for Laguna Salada that considers coastal processes and is not constrained by existing uses on the site. This is a new restoration alternative not previously considered. This proposal expands on the previous work by proposing additional corridors to areas outside of Sharp Park so that the existing CRLF and SFGS populations have the potential to maintain long-term viability via genetic flow to outside areas. A related purpose of this report, from a scientific perspective, is to critically examine assumptions and gaps in previous studies, and introduce additional relevant scientific literature, data, analyses, and conceptual models to better understand the historical and modern ecosystem functions at Laguna Salada. Our hope is that our findings will be a platform upon which informed discussions of future restoration alternatives can be based. The team was also scoped to describe near-term actions to transition from present land use and identify aspects of the SPCRAR that conflict, if any.

The study approach was to integrate geomorphology, coastal engineering, hydrology, and ecological sciences to formulate a robust conceptual model of Laguna Salada (i.e., an integrated multi-disciplinary working hypothesis of back-barrier beach and wetland dynamics in response to sea level rise). Prior work was used to the extent appropriate. Prior work was considered well-developed in some areas such as rainfall-runoff modeling, existing species use, and the need to create suitable upland habitat for SFGS. Other areas were not adequately addressed in prior studies to inform long-term planning: these included physical processes of coastal lagoons and beaches, sea level rise, and historical ecology.

2.2 PURPOSE, GOALS, AND OBJECTIVES

The intent of this study was to evaluate the feasibility of rehabilitating or restoring the full ecosystem supporting Laguna Salada, including the beach and watershed, not just the remnant wetlands and ponds below the golf course We consider long-term restoration opportunities unconstrained by existing land uses and compare those opportunities with alternatives previously developed in other studies.

Key elements of this report include a conceptual model of coastal and lagoon physical processes and expected changes in the lagoon function with sea level rise. This conceptual model was used to develop an ecosystem "restoration" plan that provides long-term support for local endangered species populations and also accounts for adjacent suburban land use, infrastructure, recreational opportunities, and management requirements. The plan is not to be constrained by existing recreational land uses or ownership, and emphasizes natural ecology and adaptation to sea level rise. The plan considers and evaluates potential future habitat linkage for California red-legged Frog (CRLF) and San Francisco Garter Snake (SFGS) to adjacent inland areas.

In keeping with the overall biological and ecological goals of the 2009 Sharp Park Conceptual Restoration Alternatives Report (SPCRAR), we retain or adapt the following site-specific management goals adopted by the SFRPD:

- Maintain and restore aquatic habitat for listed species, particularly the SFGS and CRLF.
- Maintain and restore upland habitat for listed species, particularly the SFGS and CRLF.
- Meet the recommendations of the SFGS Recovery Plan (USFWS 1985).

- Restore high-quality, dynamic, complex non-tidal coastal lagoon wetland and terrestrial ecotone habitats that are sustainable with low maintenance.
- Comply with the requirements of state and federal regulations, including the Endangered Species Act and the Clean Water Act.
- Preserve and enhance recreational opportunities consistent with the goals for the listed species.

We modify or add the following goals to embrace a more comprehensive concern for large-scale processes and long-term population viability and resilience, and realistic long-term assumptions about external physical processes (e.g., sea level rise, coastal erosion, etc.) that drive fundamental ecosystem dynamics and trends:

- Enhance and restore ecosystem processes, structure, and functions that support listed species, particularly SFGS and CRLF.
- Adapt habitats of target species to long-term climate change and sea level rise to promote long-term sustainability of wetland dynamics and habitat quality.
- Adopt an adaptive management program promoting the need and priority to develop a long term CRLF and SFGS monitoring plan with clear feedback communications so that specific future management actions can be implemented for both species. Adaptive management must address water and sediment quality, all amphibian species populations, non-native aquatic species, and lagoon hydrology.
- Meet the recommendations of the CRLF recovery plan (USFWS 2002) and SFGS recovery plan (USFWS 1985) by creating a suite of habitats and increasing on-site viability and connectivity with neighboring populations.
- Minimize direct, indirect, and cumulative adverse impacts due to flooding and erosion to adjacent private residential properties and beaches.
- Enhance and promote sustainable long-term recreational uses, coastal access, and scenic coastal views while minimizing long-term maintenance costs.
- Adapt coastal wetland design to minimize or reduce coastal and fluvial flooding risks to adjacent residential property and roads.
- Rehabilitate native plant communities within a landscape structure adapted to long-term coastal and watershed processes.

This is a preliminary assessment subject to revision based on further analysis. This plan is intended to be the first phase of a conceptual vision for rehabilitating sustainable, resilient, improved wetland and terrestrial habitats at Laguna Salada. It does not intend to include the specific permitting requirements required for the concept to be implemented. If the concept is chosen to be implemented, specific documents for planning, environmental review, and permitting will need to be made under a different scope.

Given the multiple objectives of the full range of stakeholders, we anticipate that a range of alternatives will be developed, evaluated, and compared. The alternative described here emphasizes the objectives of natural ecology, flood protection for surrounding areas, public access, sustainability, and low public cost. It is the authors' desire that this report conveys an environmental vision, and fosters informed planning toward an effective plan supported by stakeholders.

3. HISTORICAL ECOLOGY AND CONCEPTUAL MODELS

The restoration or rehabilitation of a damaged ecosystem requires some basic understanding of its natural structure, dynamic processes, and composition. Historical ecology and paleoecology (study of ancient ecological conditions and trends over geologic time) can help establish reasonable ecological goals and natural models for effective ecological and geomorphic restoration designs. At Laguna Salada, careful examination of historical ecology is also important to understanding how the pre-agricultural and pre-urban wetland complex supported endangered species habitats and how those habitats were structured.

This section provides an overview and synthesis of a more detailed assessment of historical ecology evidence and analysis presented in Appendix A: Historical Ecology and Conceptual Models. The analysis and interpretation of historical ecology at Laguna Salada is informed by a physical conceptual model of seasonal and non-tidal coastal lagoons, based on detailed review of the scientific literature in coastal geomorphology. The reader should refer to Appendix A for additional discussion and references.

3.1 BACKGROUND

Laguna Salada is a type of coastal lagoon. Coastal lagoons are widespread features in stream valleys and coastal lowlands of the Central California coast. They are formed by gradual inundation of stream valleys or other lowlands as sea level slowly stabilized over the last several thousand years, following a long period of rapid sea level rise during glacial melt. Lagoons are formed by barrier beaches that enclose and shelter wetlands behind them. There are various types of coastal lagoons prevalent along the California coast ranging from tidal, to seasonal tidal, to non-tidal lagoons. Tidal lagoons, like Bolinas Lagoon, Bodega Harbor, and Drakes Estero, form where relatively large-volume back-barrier lagoons support permanent tidal inlets that are sheltered by headlands from full ocean wave exposure (Figure 4a). Tidal lagoons are regularly flooded by marine waters and generally support salt marshes dominated by highly salt-tolerant plants like pickleweed.

In contrast, small coastal lagoons and small streams fronted by beaches with direct ocean wave exposure are generally either seasonally or intermittently tidal when high winter streamflows cut through the beach at the stream's mouths. These lagoons are typically non-tidal during the low-flow dry season. When their mouths are closed and the lagoons are non-tidal, the barrier beach acts like a permeable dam and impounds freshwater inflows. These inflows fill the lagoon level above adjacent sea level during the spring-summer growing season and cause dilution of salinity in the lagoon. Heavier salt or brackish water normally forms a bottom layer in deeper parts of the lagoon, while lighter freshwater or dilute brackish water remains near the top of the lagoon, where marsh vegetation grows. This layering, or segregation, of water masses by density is referred to as "stratification" of the water column. The "perched", or higher, lagoon water level (relative to sea level) causes seaward seepage through the permeable sandy beach.

Examples of seasonal lagoons (seasonal estuaries) occur at nearly all coastal stream months of the Central Coast and North Coast (Figure 4b). Well-known contemporary examples include Gualala River, Russian River, Salmon Creek Lagoons (Sonoma), Redwood Creek (Big Lagoon; Marin), Pescadero Creek Lagoon, San Gregorio Creek Lagoon (San Mateo County), Laguna Creek Lagoon (Santa Cruz), Salinas and Carmel River lagoons (Monterey) -- all of which support fresh-brackish water marsh (tule, cattail, bulrush, silverweed, spikerush marsh assemblages. See Appendix A for scientific names.).

Lagoons with a small size and small tributary streams are often non-tidal drainage lagoons. In this case, the wave-driven sand transport is stronger than the discharge from the lagoon, and waves build the beach berm above tidal levels. These non-tidal lagoons have a surface water connection with the ocean during the wet season, when water drains over and down the beach. These drainage lagoons are non-tidal with fresh to brackish salinities. Examples of non-tidal or intermittent seepage lagoons with fresh to fresh-brackish water marsh include Rodeo Lagoon, Abbott's Lagoon, historical Lake Merced, and historical San Pedro (Linda Mar, Pacifica) Lagoon (Figure 4c).

Salinity gradients within seasonal and non-tidal coastal lagoons generally occur with brackish marsh closest to the barrier beach and fresh-brackish to freshwater marsh upstream (landward).

Nontidal and intermittently tidal lagoons breach from back to front when they rapidly overfill with stream inflows or wave overwash and spill over and cut a channel through the beach. This generally occurs in winter storms with high rainfall and stream flow. Wave action rapidly re-closes their outlets when the lagoon levels drop. While their outlets are open, overwash or tides briefly flood the drained lagoon with seawater, but only to the level of tidal inundation (e.g. ocean tide levels). Perennial and seasonal freshwater marsh habitat above the limit of tides persists largely unaffected. After the lagoon outlet is closed by wave action and sand deposition, freshwater inflows start to fill the lagoon with freshwater, which mixes and dilutes seawater to brackish concentrations, and later stratifies fresher water over the brackish bottom water.

3.2 HISTORICAL ECOLOGY OF LAGUNA SALADA

A detailed preliminary investigation of Laguna Salada's historical ecology, and a supporting conceptual model based on the scientific literature on coastal lagoons, is presented in Appendix A. An investigation of Laguna Salada's historical ecology was important for habitat restoration planning because different scientific assumptions about Laguna Salada historical ecology support contrasting approaches to restoration. Incorrect or insufficiently tested assumptions may lead to infeasible or counter-productive habitat restoration and management plans, or important lost opportunities for recovery of endangered species in changing environments.

One widespread popular assumption about Laguna Salada's ecological history was that it was a kind of salt pond, as a literal and uncritical interpretation of its place-name suggests. This perception was reinforced by the experience of wildlife biologists who witnessed the effects of extreme marine overwash events at Laguna Salada in the 1983 El Nino storm, which resulted in flooding of the low lagoon with seawater and reported subsequent decline in red-legged frog and San Francisco garter snake populations. The assumption that Laguna Salada was historically and naturally a salt pond implied that Sharp Park construction and maintenance artificially converted it to a freshwater or fresh-brackish wetland that became colonized by snakes and frogs that could not tolerate saline lagoon wetland habitats. Recently, this assumption was adopted in the SFPCAR report's habitat enhancement design approach, but without

additional scientific investigation of the historical or ecological accuracy of the "saline pond" assumption.

To investigate historical ecological and land-use conditions of Laguna Salada, with a focus on its evolution prior to Sharp Park, we compiled historical herbarium collection data, reviewed published floras, carefully analyzed and interpreted historical maps and ground photos, and compared our findings with other reference lagoons in old maps and in modern studies. Our historical ecology investigations were guided by conceptual model of coastal lagoon processes, dynamics, structure, and composition, based on careful review of applicable scientific literature and regional studies of coastal lagoons. The methods and results of this investigation are presented in Appendix A.

The results of the preliminary historical ecology investigation of Laguna Salada reveal that it was not a salt pond/saline lagoon prior to Sharp Park golf course construction. Botanical records and photographic documentation of Laguna Salada vegetation and landforms from the early 20th century indicate that the wetlands of the lagoon supported <u>extensive marsh typical of fresh-brackish emergent marsh</u> in decades prior to the early Sharp Park Golf period. There is strong photographic evidence that tall emergent grass-like marsh vegetation with structure like bulrush or cattail was prevalent around the lagoon prior to Sharp Park. This vegetation type is associated with California red-legged frog habitat in comparable coastal lagoons in the Central Coast region.

Despite evidence of earlier artificial breaching of the barrier beach to drain the lagoon when Laguna Salada valley flats were farmed, there are no associated records of salt marsh plants or visible (photographic evidence) indicators of historical salt marsh dominance in the marsh. This evidence is consistent with the hypothesis of relatively little change in fresh-brackish salinity range of wetland types between the agricultural (farming) and golf periods of 20th century Laguna Salada.

Laguna Salada was one of only two historical coastal lagoons in Pacifica present in the mid-19th century. San Pedro Creek lagoon (now Linda Mar) was influenced by a larger watershed and more freshwater discharge. The only other potential pond frog habitats in the Pacific watershed south of Lake Merced indicated in detailed historical topographic maps were the Skyline sag ponds. If red-legged frogs and San Francisco Garter Snakes were not indigenous to a fresh-brackish Laguna Salada, they would have had to have colonized Sharp Park jointly or in sequence before the 1950s from considerable distances to suitable remnant habitats.

Our findings support a conceptual model of Laguna Salada in its dynamic, natural condition that is based on similar coastal lagoon reference systems in the Central Coast region. Like similar lagoons, Laguna Salada maintained environmental gradients between fresh-brackish marsh at its landward end, and more brackish marsh closer to the beach. Salinity and water levels likely fluctuated strongly among seasons, filling with varying proportions of freshwater from the watershed, diluting ocean water from winter storm overwash. Most marsh occurred at the landward fringes, where it was influenced by freshwater discharge from the creek, surface flows, and groundwater from the valley. The landward edge of the marsh likely graded into broad seasonal wetland meadows and coastal grassland and scrub. Frog breeding habitat was probably concentrated along the fresh-brackish landward fringing marshes, where winter runoff and streamflow established fresh-brackish habitat in wet years. Fringing marsh elevation range in the lagoon was higher than normal tidal marsh elevation range, associated with higher lagoon levels dammed by the beach, as in most seasonal or non-tidal coastal lagoons in the region today that support California red-legged frog and garter snake populations.

These historical ecology and conceptual model findings provide important guidance for restoration design and rehabilitation of Laguna Salada habitats. They indicate the value of impounding freshwater runoff and establishing high, fluctuating lagoon levels that establish wide fresh-brackish marshes above tidal elevation range. They also indicate the importance of marsh location at the landward fringes of the lagoon, where freshwater influence is greatest (brackish dilution), and where seawater flooding potential is most attenuated. These features are reflected in the proposed restoration design, in addition to natural gradients (transition zones) between uplands, seasonal wetlands and marsh.

3.3 MODERN OPERATIONS AND ECOLOGY

The prior Enhancement Plan (PWA 1992) recommended habitat enhancement to the south and east, but at the time much of the property was privately held. Recent efforts by the National Park Service (NPS) Golden Gate National Recreation Area (GGNRA) have expanded CRLF and SFGS habitat by creating ponds at higher elevation in more sustainable areas farther east and south on Mori Ridge.

In addition to the new ponds, changes to the maintenance of the remnant Laguna Salada and surrounding golf course operations have been proposed. These changes include limitations on pumping in Laguna Salada during frog breeding season, in order to protect the frog eggs, limitations on chemical and mechanical lawn treatments, monitoring, and development of an enhancement plan (Tetra Tech et al., 2009). However, these plans rely on the levee/seawall and pump station to maintain habitat where it would not have existed historically (i.e., immediately behind the beach berm). These efforts do not address the key issue of future sustainability of critical habitat within Laguna Salada-Sharp Park.

4. COASTAL PROCESSES AND FLOODING

Coastal processes and flooding relevant to the restoration planning are summarized below and discussed in detail in Appendix B: Coastal Processes and Flooding. Coastal processes and their interaction with the Laguna Salada ecosystem were not directly considered in prior enhancement plans. An understanding of the coastal processes at Sharp Park is important to inform our expectations of future site evolution under various management alternatives.

4.1 COASTAL HYDROLOGY

The central California coast experiences mixed semidiurnal tides (i.e., two high and two low tides of unequal height each day). The tides exhibit a strong spring-neap[1] variability over a two week cycle; spring tides exhibit a large difference between high and low tides while neap tides show a smaller than average range. The highest monthly tides occur during summer and winter months. The mean diurnal range (Mean Lower Low Water to Mean Higher High Water) is 5.8 ft.

The climate in this region is primarily influenced by the Pacific High, a persistent zone of high pressure located over the eastern North Pacific Ocean. During the winter months, north Pacific storm systems affect the central portion of the state. Longer term climate variations are linked to the El Niño-Southern Oscillation (ENSO), which has a cycle of 3-8 years. During El Niño years, Central California's climate is characterized by above average rainfall and increased freqnency and intensity of Pacific storms.

Storm surges during these events can act to elevate the water level above predicted astronomical tides by as much as 2-3 ft. These estimates do not include wave action and wave setup, which can significantly increase water levels at the coast temporarily during storms. The wave climate exhibits significant spatial and temporal variability due to seasonal and annual weather patterns, offshore topography, and coastline orientation. Wave heights generally range from 5-30 ft with periods from 10-25 seconds. The shoreline at Sharp Park is very exposed to large waves during coastal storm events. The 100-yr deepwater[2] wave height offshore of Sharp Park is estimated to be 32-38 ft.

Sea level rise over the past century at the Presidio tide gage has been about 8 inches (0.7 ft). For long-term planning purposes, current California State guidance recommends incorporating future rates of sea level rise of 16 inches by 2050 and 55 inches by 2100.

[1] Spring-neap refers to a twice-monthly cycle in tide range, with spring tides having higher high tides and lower low tides due to alignment of the moon and sun with the earth: Neap tides have lower ranges.

[2] Deepwater, or offshore, wave heights are not affected by wave transformations such as shoaling, breaking and refraction and are used as an indicator of local wave climate. In contrast, shallow water, or nearshore, wave heights can vary substantially along the shore.

4.2 COASTAL EROSION

4.2.1 Historical and future rates of shoreline change

A review of prior studies indicates that the shore has eroded substantially. PWA (1992) estimated historical long-term erosion rates of approximately 3-5 ft/yr since the golf course was constructed in 1932. The U.S. Geological Survey (Hapke et al. 2006) estimated long-term shoreline erosion at Sharp Park to be 1.5-2.5 ft/yr. Recent short-term rates at Sharp Park indicate even more rapid rates of shoreline recession on the order of 2-6 ft/yr. A large fraction of this erosion likely occurred during the 1983 El Niño storms. Based on our understanding of coastal erosion processes and future projections of climate change, it is expected that future erosion rates will meet or exceed historical rates. Pending further study, long-term erosion rates on the order of 1-2 ft/yr can be expected as a minimum. The coastal erosion rates and associated maintenance costs at Sharp Park are expected to increase and may accelerate in the future.

4.2.2 Beach response to seawalls

Seawall effects on beaches are typically categorized as either "passive" or "active." Passive erosion refers to the narrowing of a beach in front of a seawall due to the continuation of erosion processes that occurred before the seawall was built. The presence of the seawall prevents natural landward recession of the shoreline, thereby "squeezing" the fronting beach and reducing beach width over time.

Active erosion refers to an acceleration of beach erosion due to the presence of the seawall, resulting from its interaction with the surf zone. In Pacifica, the negative impacts of seawall construction can be seen directly north of Laguna Salada along Beach Boulevard (Figure 5). The photographs show the reduction of beach width over time.

The loss of beach seaward of the structure also increases the extent, duration and persistence of wave loading[3] on coastal structures, making the armoring increasingly expensive and difficult to maintain. The City of Pacifica has regularly instituted repairs to the seawall at Beach Boulevard, and now places hazardous conditions signs due to wave overtopping, and occasionally closes the road due to unsafe conditions.

In addition to passive and active effects, the footprint of the structure on the beach narrows the accessible beach width (this is called "placement loss") (see Appendix B, Figure 4).

[3] Wave loadings refers to forces imparted by waves on the structure, and overtopping of the structure. These increased "loads" lead to increased potential for failure of the structure (e.g. collapse) and failure of its intended function (to limit flooding and prevent erosion).

4.3 MORPHOLOGY OF SHARP PARK BEACH

The beach fronting Laguna Salada is coarse grained and steep. The beach narrows northward towards the developed areas and seawalls at Clarendon Road. The sediment at Sharp Park beach is dark and coarse, contrasting with the predominant sediment farther north in the Manor District of Pacifica. Anecdotal evidence indicates that there are several sand sources in the area:

- The eroding bluffs of Mori and Mussel Rocks, possibly augmented by historical deposits of offshore sediments. These are typically coarse (pebble/gravel size to sand size) and dark; and

- The eroding bluffs of Manor (district of north Pacifica) and Daly City comprised of unconsolidated dune sands and weekly lithified sandstone. These are typically fine to medium sands, tan to brown in color.

A comprehensive study of coastal processes along the Pacifica and Daly City shoreline has not yet been completed. It appears that the Sharp Park beach is comprised primarily of sediment derived from erosion of Mori Point, accumulated over the last 20,000 years as sea level rose and stabilized. The coarser sediment can move onshore and northward under westerly and southwesterly swells. The finer, brown sands from the Manor area most likely move southward and offshore at Mori Point, unable to remain on the high energy steep beach at Sharp Park. The armoring near and north of the pier inhibits northward movement of sediment from southern Sharp Park. Therefore, except for offshore exchange[4], a natural beach at Laguna Salada should be relatively stable, neither accreting nor eroding significantly in the long term. However, historical shoreline positions show that the beach was eroded and the shore receded, as described below.

4.3.1 Historical conditions

Historical maps and photographs show that the Sharp Park beach was wide and low, with a morphology that allowed relatively infrequent wave overwash (as opposed to coastal dunes which are eroded by overwash) south of the present day Clarendon Road. The entire area was a sandy deposit that formed as sea level rose over the last 20,000 years. Wave power and sediment supply were sufficient to build a ridge of sand that typically blocked drainage from the lagoon, resulting in the formation of Laguna Salada.

A regional comparison with unaltered barrier beach reference sites indicates that the berm would equilibrate to around +18 ft NAVD (range of 15 to 20 ft NAVD). (NAVD refers to the elevation data set used and stands for North American Vertical Datum.) This condition is approximately represented by Rodeo Lagoon Beach in Marin County (Figure 4). Appendix A provides the supporting data. This elevation is close to the typical annual runup elevation[5] based on calculations conducted by PWA (2009).

[4] Offshore exchange refers to the movement of sand between shallower and deeper depths, often also referred to as "cross-shore transport." Offshore exchange is typically forced by a change of wave conditions, which are typically observed as seasonal changes to beach width and storm-induced changes.

[5] Annual runup elevation is total water level elevation that is exceeded about once per year.

4.3.2 Existing conditions

The Sharp Park beach exists in front of an armored coastal structure. The back beach appears to be artificially elevated against the earth levee, which directs wave runup upward, and creates a narrower but locally higher and steeper beach than would occur naturally. Narrow steep beaches tend to increase wave reflection and the size and intensity of shorebreak waves, and enhance the potential erosion during extreme events. Additionally, the steep beach conditions enhance wave runup, and the potential to overtop the levee crest. Conceptually, wave runup is a process of dissipating wave momentum, which is dissipated by frictional effects and gravity: For a given amount of momentum, runup can be dissipated by being forced high into the air (against gravitational acceleration) or by horizontal travel. A levee forces wave runpup upward while a natural shore allows greater lateral travel.

While dune building and stabilization in the 1920s to 1940s altered the natural beach berm morphology, a significant coastal structure did not exist until decades later. A review of historical photographs and documents indicates that the existing levee was not constructed until the 1980s. The majority of the coastal levee/seawall was constructed in 1989-1990. Approval for this (and future) construction appears to be partly based on the assumption that a contiguous levee or seawall existed prior to the 1983 storms, based on a declaration of categorical exemption from CEQA from the City of Pacifica (see Appendix B of Geomatrix 1987). A review of available photos prior to 1983 shows an earth embankment at the north and south ends of the shore, with no embankment in the middle third. The embankments are not as large as the existing levee and proposed seawall structures, and do not extend the full length of the shore. Therefore, the implication by Pacifica's categorical exemption that the existing levee and proposed upgrades are a replacement and/or maintenance of a similar prior structure is not supported by available information.

To our knowledge, a review of the potential adverse effects of the berm (or levee, seawall) on the coastal and lagoon habitat has not yet been completed. This is astonishing, given its dimensions of about 3,200 linear feet, a crest elevation of +30 ft NAVD, and its construction more than a decade after the California Coastal Act (1976).

We recommend that future modification of the levee (as proposed by SFRPD) should be subject to a full environmental review of potential impacts to the beach, lagoon hydrology, and habitat over the long term and relative to historical conditions.

4.3.3 Future conditions

4.3.3.1 Managed conditions with seawall

Relative sea level rise will induce erosion and recession of the shore. If the hard edge of the levee/seawall is maintained, the beach will narrow and the levee will be overtopped more frequently (or raised to prevent overtopping). If the levee is maintained, the beach will become so narrow that larger waves will frequently impact the levee/seawall and the beach will be largely lost. This condition has already occurred north of the pier at Beach Boulevard (Figure 5), which is overtopped multiple times each winter, and

requires frequent, intensive maintenance. Therefore, over time, progressively increasing risk of failure can be expected. While levee/seawall failure at Laguna Salada may not harm CRLF and SFGS populations on the inland/east side of the lagoon, failure of the levee or wave overwash could devastate the existing CRLF population and SFGS habitat at artificially low marsh elevations where they currently exist.

The proposed SFPRD enhancement plan of Laguna Salada relies on a seawall and highly managed pumping system to maintain the habitat closer to the ocean than would exist naturally. As sea level rises and beach erosion continues, the risk to the habitat will increase and make its maintenance difficult and likely not feasible.

4.3.3.2 Natural conditions without seawall

If the levee is not maintained, it will erode and a wide sand barrier beach will re-form. The elevation of the berm will be close to the existing beach elevation (approximately 18-20 ft NAVD), with relatively gentle shallow wave overtopping occurring annually. The wave action will transport sand inland and build up the beach-barrier, conceptually rising and migrating landward with sea level rise. A phased shift of habitat from its existing location at Horse Stable Pond to the eastern fringe of Laguna Salada would occur over time (discussed later in Section 6.4). CRLF and SFGS habitat along the eastern side of Laguna Salada, away from high salinity ocean water, would expand and likely occur naturally in most years.

4.4 RAINFALL/RUNOFF FLOODING

Rainfall runoff enters Laguna Salada from Sanchez Creek and storm drains serving adjacent neighborhoods. Discharge entering Laguna Salada is impounded behind the seawall, which prevents natural drainage to the ocean, where it collects and is later pumped out onto the beach. Assessments of rainfall/runoff flooding in Laguna Salada were completed by PWA (1992) and Kamman Hydrology & Engineering (KHE 2009). KHE (2009) estimated 2, 5, 10, 25, 50, and 100-yr flood levels in Laguna Salada for a 24-hr rainfall event. The modeling assumed operational pumps at Horse Stable Pond (southwest portion of lagoon, Figure 2) and an initial lagoon water level of 6.8 ft NAVD. Peak flow rates were found to be approximately 5 to 25 times greater than the pumping capacity, and added an additional 2 to 8 feet of water to the lagoon for a 2 and 100-yr storm, respectively. Flood levels ranged from 9 to 15 ft NAVD. Failure of the pumps during a storm, or an initially elevated lagoon water level (e.g., due to adjustment to keep CRLF egg masses from stranding or a prior rainfall event), would result in even higher flood levels. Detailed results are discussed in KHE (2009) and summarized in Appendix B.

4.5 COASTAL FLOODING

The Sharp Park site is very exposed to large waves. The long period waves result in strong wave setup, which can elevate water levels at the shoreline and allow much larger waves to impact the beach and levee. As waves break and runup on the beach, waves can overtop the crest of the levee. The following sections describe previous coastal flood studies for Pacifica and evaluate the present day coastal flood hazards at Laguna Salada.

4.5.1 Summary of previous coastal flood studies

The effective flood study is the 1987 FEMA Flood Insurance Study (FIS) for the City of Pacifica, CA, San Mateo County (FEMA 1987), which estimated the Base Flood Elevation (BFE), or 100-yr wave runup elevation, to be 27 ft NGVD (29.8 ft NAVD). FEMA is currently in the process of updating the Pacifica Flood Insurance Rate Map (FIRM). The BFE for the revised preliminary map is 30 ft NAVD.

The BFE estimate indicates the highest **potential** runup elevation attained by waves breaking and running up the beach and levee surface. This potential elevation is the elevation that the structure or other barrier would need to achieve to prevent water from overtopping it, and this potential runup elevation is used in FEMA flood maps in the vicinity of barriers. This is the 30 ft NAVD elevation identified in the previous paragraph. In reality, water rushing up the face of the levee or other barrier typically has forward momentum and it takes a trajectory that reaches a lower height but overtops the structure. When the runpup is calculated to exceed the barrier crest, a process called "wave overtopping" occurs. The rate and volume of overtopping is used to estimate the potential for flooding inland of the levee or other barrier. Once the wave overtops the levee and carries water over the crest of the levee, the water propagates in shallow but rapid flow and then collects and ponds on the landward side. Thus, the wave runup elevation is not the same as the resulting flood inundation level on the landward side of the levee (or other barrier such as a beach and dune or seawall). Therefore, the flood inundation level on the landward side of the levee is different than the FEMA BFE. Geomatrix (1987) estimated the volume of wave overtopping of the 1980s unprotected coastal embankment; however, modifications to the beach over the past 20 years and construction of the levee have rendered this assessment out of date.

4.5.2 Landward coastal inundation by wave overtopping

Coastal flood hazards for the 100-yr coastal storm event were evaluated for three cases at Laguna Salada:

1) **Existing levee** – wave overtopping of existing levee
2) **Degraded levee** – wave overtopping of existing levee with levee crest degraded by 2 ft during coastal storm event
3) **Natural barrier beach** – wave overtopping of natural wave-built barrier for restored lagoon conditions

Details of the landward inundation calculations are described in Appendix B. A 4-hour overtopping duration was selected, which conceptually allows for overtopping to occur before and after peak high tide. Inundation calculations assume that wave overtopping occurs over 800 ft of levee, which is the existing length with average crest elevation of 29 ft NAVD. For the degraded levee case, we assume that erosion of the levee during a coastal storm event would lower the levee crest by approximately 2 ft to an elevation of 27 ft NAVD. The implication is greater wave overtopping and inland flooding.

Overtopping rates and volumes for the existing and degraded levee cases were estimated to determine the extent of landward inundation assuming an initial lagoon water level of 6.8 ft NAVD. Wave overtopping of the levee was found to raise lagoon water levels by approximately 3 and 10 ft to an elevation of 10 ft NAVD and 17 ft NAVD, respectively, for the existing and degraded levee cases. The methods used for

these calculations are simple and conservative (provide high overtopping estimates). Lagoon inundation is likely overestimated. The calculated elevations are close to the elevations for rainfall-runoff flooding (see Section 4.4 Rainfall/Runoff Flooding).

Overtopping rates of the natural barrier beach (restored lagoon) case for a 100-yr coastal flood event were not estimated, although substantial overtopping would occur. However, the presence of an unarmored natural barrier beach would allow both overtopping and free outflow from the lagoon to the ocean during a storm. As a result, the maximum lagoon flood elevation would be controlled by the elevation of the barrier beach berm. As discussed in Section 4.3.1, we estimate a maximum restored natural beach berm elevation of approximately 20 ft NAVD, and therefore estimate a high water level of about the same elevation: That is wave overtopping would be balanced by a backflow of water to the ocean. Under this scenario, wave action would scour the beach, create one or more drainage channels and limit lagoon water levels. Once one or more channels form, the lagoon level can rapidly drop and end up lower than pre-event levels.

This analysis indicates that the flood elevations published for the beach at levees, seawalls, and cliffs (+30' NAVD) is much higher (at least 10') than can be expected farther inland at Fairway Park even without a levee present (maximum flood elevation estimated to be +20' NAVD). Accounts of overtopping into Laguna Salada in 1983 are not precise but are consistent with lagoon levels lower than +20'. More detailed analysis methods are recommended for future studies.

4.6 COMBINED FLUVIAL AND COASTAL FLOODING

Flood levels within Laguna Salada are due to the combined effects of rainfall runoff, discharge from Sanchez Creek, and wave overtopping of the outboard levee. As previously discussed, the landward coastal inundation flood level has not previously been determined for a combined event under existing (or future) conditions at Laguna Salada. Using the fluvial flood results from Section 4.4 and the coastal flood results from Section 4.5, we estimate the lagoon flood level due to a combined coastal and rainfall/runoff event. An initial lagoon water level of 6.8 ft NAVD was selected based on assumptions made in KHE (2009) for the rainfall/runoff modeling.

While the joint probability of coastal flooding and elevated rainfall runoff are not known, a 10-year rainfall event coincident with a 100-yr coastal event is recommended for conceptual planning until more detailed analysis is accomplished. For this storm event, we estimate flood levels of between 13 and 20 feet depending on the condition of the levee. Since some degradation of the levee is likely during a severe overtopping event, the higher elevation may be more likely.

The 1983 coastal flood event was reportedly severe and is considered to be representative of the 100-year coastal flood event. Rainfall runoff reportedly contributed to the flooding. The resulting flood levels did not achieve the elevations described herein (e.g., +20' NAVD), and hence the combined flood elevations reported are expected to be high, probably due to the overestimate of wave overtopping volumes.

4.7 GROUNDWATER AND PUMPING

Water levels within Laguna Salada are currently maintained by the operation of a pumping station (combined capacity of 11,500 gpm) at the southern end of the historical lagoon at Horse Stable Pond (Figure 2). The pumps are activated when lagoon water levels exceed 6.9 ft NAVD. The pumps convey runoff from the lagoon to an outfall on the beach and prevent flooding of the golf course by continually pumping down the lagoon water level.

The direct ecological implications of pump operations are discussed in Section 1. An indirect effect of artificially lowering the lagoon water level is increased vulnerability to groundwater salinity seepage from the ocean to the lagoon. While the typical direction of groundwater seepage is from the lagoon to the ocean, a lowered lagoon water level reverses the gradient. KHE (2009) noted that under certain conditions, the groundwater gradient may reverse and allow higher salinity groundwater to flow into the lagoon. Field observations by the ESA PWA team in spring 2010 revealed saline seeps emerging in golf turf patches immediately behind the coastal levee at the north end of Sharp Park (see Appendix D. Ecological Assessment and Appendix F. Summary of Salinity Intrusion at Laguna Salada). The saline seeps occurred coincident with high winter tides and storm waves, which act to elevate beach groundwater levels, which in turn cause a reversal in the typical seaward groundwater flow through the beach berm (Isla and Bujalensky 2005; Carter and Orford 1984).

Landward salinity intrusion to Laguna Salada by reversal of groundwater gradients at the barrier beach is already happening, and is likely to increase and accelerate as sea level rises, storm waves increase in magnitude and frequency (Allan and Komar 2000), and as the shoreline retreats (Hapke et al. 2006, Hapke et al. 2007).

5. EXISTING CONDITIONS ECOLOGICAL ASSESSMENT

The ecological functions of the existing Laguna Salada wetland complex are affected by past and ongoing impacts within the wetland complex, and indirect influences of the surrounding landscape and watershed. In this section, we reassess past and present impacts to the back-barrier wetland ecosystem at Laguna Salada, with emphasis on factors that affect current and long-term habitat for special-status wildlife species (San Francisco Garter Snake, California red-legged frog, and western pond turtles). Both long-term cumulative impacts and short-term impacts are considered. Special-status species habitat abundance, distribution, quality, and dynamics depend on larger-scale coastal lagoon ecosystem processes that must be considered in this context. Detailed analysis and interpretation of ecological conditions are presented in Appendix D: Laguna Salada Ecological Assessment. An overview is presented here.

5.1 LONG-TERM ENVIRONMENTAL IMPACTS

5.1.1 Urban Development and Genetic Isolation of SFGS and CRLF at Sharp Park

The existing population of SFGS at Sharp Park is thought to be small and not very robust. SFGS were documented to occur at Laguna Salada in 1951 by W.L Fox, but not in great numbers.
SFGS were detected at Horse Stable Pond as recently as 2008, but have not been detected during the most recent (2009) surveys at this location (Swaim 2009). Although SFGS have not been seen during other species surveys, the status of SFGS at Arrowhead Lake, Sanchez Creek, or the lagoon or should not be assumed as absent as these areas have not been thoroughly assessed. SFGS are known to occur in the North Pond, on the hill-slope a few hundred feet to the east of the Horse Stable Pond by GGNRA Staff Biologist and at the nearby Mori Point Ponds (Swaim 2008). The existing potential SFGS habitats at Sharp Park's Arrowhead Lake, Sanchez Creek, the Lagoon and Horse Stable Pond need well timed and focused SFGS surveys that include sex ratios so that the population and potential for future viability at Sharp Park can be better understood. It is critical to focus the upland as well as aquatic habitat enhancements and creations (see 2.2 goals and objectives) for the SFGS so that the existing population has a chance to become more robust. It is equally important to provide dedicated SFGS movement corridors with a mix of basking and vegetative cover (not shared with recreational use such as walk or bike paths) for SFGS within Sharp Park and to adjacent areas. If such dedicated SFGS corridors are made, populations from the neighboring Mori Point or North Pond have a better chance for successful range expansion attempts.

The Laguna Salada SFGS population is on the northernmost edge of the species range (USFWS 1985), and may be important for genetic interchange between other populations further south. However, surrounding development has become a barrier to SFGS movement into and out of the park, isolating park populations from outside genetic flow. Concrete highway barriers occur on both sides of HWY 1 adjacent to Sharp Park and Mori Point. While these barriers protect SFGS from vehicular traffic they also act as movement barriers. Dense urban development immediately north of Sharp Park and south of Mori Point and the quarry in Pacifica, combined with HWY 1 to the east, have isolated the existing population in what ecologists refer to as a "land locked island habitat". These modifications have isolated Laguna Salada populations from the east side of Sharp Park, Arrowhead Lake and other undeveloped areas.

The east section of Sharp Park is adjacent to undeveloped lands with existing passage for wildlife (snakes, frogs, and their prey and predators) to other known locations of SFGS at San Andreas Lake and Crystal Springs Reservoir. This potential corridor area is critical to the long-term recovery of the snake as it is the only place where such a "land bridge "from Sharp Park to other populations can occur.

5.1.2 Filling of floodplain and permanent lagoon drainage

The filling of the floodplain and permanent drainage of the lagoon to artificially low water levels are the primary controls of ecosystem structure, dynamics, and functions at Laguna Salada. These alterations are the primary constraint on quality and sustainability of endangered species habitats (freshwater marsh, seasonal wetlands, riparian scrub, and terrestrial ecotones). The artificially pumped down water level (maximum of +7.5 ft NAVD) is the primary hydrologic control of marsh elevations within the lagoon relative to (rising) sea levels. The marsh fringing the lagoon is forced to occupy an artificially narrow zone, within a few feet of the lagoon bottom, and close to the elevation of the highest tidal elevations.

The most fundamental consequence of maintaining perpetual "drought" lagoon levels at a narrow elevation zone near high tide elevation is that almost all the fresh-brackish marsh habitat is forced down to a low elevation behind the levee where there is a potential for flooding by seawater from overwash. Fringing marsh elevations at natural non-tidal coastal lagoons support fringing fresh-brackish marsh at elevations mostly above the tidal range, where they occupy a zone in equilibrium with lagoon water levels maintained by beach-impounded stream inflows and groundwater. Examples include managed Laguna Creek Lagoon and Rodeo Lagoon. Elimination of high lagoon flood levels that approach the beach crest elevation (at Laguna Salada, close to 20 ft NAVD), i.e., draining all wet-season freshwater storage of the lagoon, confines the marsh habitat to near the bottom of the lagoon.

When natural lagoons breach, or when waves overwash, seawater flows into the lagoon basin. Overwash and brief tidal inflows have relatively little impact on the marsh habitat that exists above tidal range, and almost no impact on the landward freshwater reaches of lagoon gradients, which function as freshwater refuges. At Laguna Salada, where the marsh zone is mostly at or below the high tide elevation range, almost all the marsh habitat today is subject to seawater flooding. The potential salinity impacts of seawater flooding at Laguna Salada are due primarily to indirect effects of long-term drainage by pumping in low marsh elevations relative to sea level. This impact risk will inevitably increase as sea level rises, while marsh zone elevations and topography remain fixed.

The potential freshwater refuge habitat at Laguna Salada is almost non-existent because the landward end of the salinity gradient – the floodplain at the east end of the lagoon - is filled and converted to well-drained turfgrass, and because Sanchez Creek is channelized and forced to discharge at elevation ranges subject to extreme high tidal flooding. In natural lagoons, the landward freshwater end of the floodplain wetland complex extends beyond the reach of maximum tidal surge or overwash. The 1869 U.S. Coast Survey map of Laguna Salada shows no single-thread Sanchez Creek channel, but it shows three slender distributary channels extending through the eastern floodplain marsh of the lagoon (Figure 3). This

structure indicates that freshwater discharge was distributed through floodplain wetlands before crop agriculture and ditching for drainage occurred. Artificial fill for golf links, placed in the late 1920s, steepened the seasonal wetland gradient of the drained floodplain, compressing all freshwater wetlands in a narrower zone closer to Salada Beach – resulting in "coastal squeeze". The freshwater compression towards the coast forced potential freshwater marsh refuge habitat into the seaward fresh-brackish lagoon zone, where it is more vulnerable to episodic overwash flooding. This precarious landscape-level wetland habitat structure is maintained today for recreational land uses. The "coastal squeeze" of the lagoon wetland complex to a narrow zone behind the barrier beach – the zone that is naturally the most brackish and disturbed – forces a conflict between natural beach migration in response to rising sea level (adapting shoreline position and elevation, conserving the beach) and maintenance of the freshwater refuge end of the fresh-brackish lagoon wetland gradient.

Other indirect effects of "perpetual drought" caused by lagoon drainage include the interaction between tule and cattail depth tolerance and the depth gradient of the drained lagoon. The drainage of the lagoon brings most of the lagoon bed shallows within the depth tolerance for tules and cattails, which can grow in standing water depths under 1 m (3.3 ft). Eliminating the natural prolonged high seasonal lagoon stands results in widespread deepwater conditions above the submersion tolerance of tules and cattails and restricts their lateral expansion. Draining the lagoon to a constant shallow depth enables tule-cattail marsh to spread over the shallow gradient (water less than 3 ft deep) of the lagoon, progressively encroaching into open water at variable rates inversely proportional with depth. In contrast, natural lagoons with prolonged periods of widespread deepwater restrict the spread of tules and cattails, due to submersion intolerance. Some open water areas are needed for SFGS to forage on tadpoles. Artificial drainage and elimination of prolonged high lagoon stands, not sedimentation, are primarily responsible for marsh encroachment of Laguna Salada. This is a key component of the conceptual restoration plan presented in Section 1.

Perpetual artificially low lagoon levels relative to saline beach groundwater levels, which are raised by wave runup above still-water tidal elevations, increases the lagoon's risk of salinity intrusion as sea level rises. Lagoon water levels above sea level and beach groundwater levels are needed to maintain positive seaward seepage flows and exclude salt or brackish water inflows from the beach to the lagoon. Salt seeps, indicated by efflorescent salts on turfgrass patches during rainless periods in winter when high waves and tides occur, were observed in 2010 (Appendix C), and brackish groundwater near the western lagoon edge has been confirmed by previous analyses (KHE 2009). Simply put, more freshwater retention (less pumping and artificial drainage) is needed to buffer against salt water intrusion and wave overtopping.

Natural deepwater lagoons behave differently than shallow water lagoons as greater water depths allow for stratification (or separation) of the water column. This allows heavier saltwater to sink to the bottom with fresher water on top (see Appendix A). CRLF have porous skin and require freshwater conditions to survive, with salinity intolerance levels of approximately 9 – 10 ppt for adults (Smith, 2007 and pers. comm. 2010, McGinnis 1986), 5-6.5 ppt for tadpoles (McGinnis 1986; Jennings and Hayes 1990; Reis 1999), and <4 ppt for eggs. The fresh surface layer can be important to adult CRLF movement to refuge areas. Shallow water lagoons subject to wave overtopping do not have the same ability to stratify captured salt water, and the salty surface layer can act as a barrier to adult CRLF movement. SFGS have scales and impermeable skin, and therefore do not have tbe same salinity intolerances as do frogs. However, SFGS rely on frogs and tadpoles as a food source, and therefore habitat loss occurs with the loss of frog populations.

5.2 SHORT-TERM ENVIRONMENTAL IMPACTS

5.2.1 Pumping for lagoon drainage

Artificially abrupt and recurrent fluctuations of lagoon water levels are caused by pump activation during the breeding season of California red-legged frogs. CRLF will lay eggs from November (with earlier records in more southern locations USFWS) to late May (Reis 2006-2009) depending on the water year and site location. At Laguna Salada, including Horse Stable Pond and the connecting channel, and Arrowhead Lake, CRLF eggs have been observed in January and February (Swaim Biological 2008). The artificially abrupt fluctuations have caused stranding of adhesive egg masses on vegetation at the water surface – an impact that has been documented in previous years (SFRPD 2006). This is a current and ongoing impact, rather than legacy impact of past fill and landscape structure that has been maintained.

5.2.2 Terrestrial ecotone displacement and exclusion

The natural transition between perennial freshwater marsh, seasonal freshwater marsh and willow thickets (swamp), and transitional (ecotone) terrestrial habitats at the landward edges of the lagoon is maintained as an abrupt mowing line that extends into freshwater marsh: golf turf encroaches directly into the marsh. The "turfgrass" bordering the marsh is composed of strong wetland indicator species (brass-buttons, bulrush, silverweed, creeping bentgrass) that dominate the adjacent marsh, mown down to the height of turfgrasses. The ongoing mowing and drainage of the golf turf in wetland habitat zones, and elimination of seasonal bigh lagoon stands, erases the natural wide transition zone between terrestrial vegetation, seasonal wetland rush and sedge meadows, and emergent marsh. No buffer zones between primary wetland habitats and uplands occur above or even within a seasonal wetland zone.

Adult CRLF forage on rodents (mice) along the water's edge, insects and treefrogs. CRLF need moist upland areas and will spend as much as 77 days away from water (Appendix D). Tbe SFGS needs a mix of small basking areas with immediate or nearby cover from predatory birds and mammals. Elimination of gophers and other burrowing small mammals to maintain smooth turfgrass eliminates essential burrow habitats to which treefrogs and CRLF retreat for moisture refuges in summer while they forage in upland areas, and where San Francisco Garter Snakes forage for them. Mowing and turf maintenance also eliminates tall vegetation canopy (including rusb mats) and large woody debris that provide moist cover for frogs, basking area for SFGS, as well as emergent dispersal corridors inland of the marsh for both snakes and frogs.

Optimal upland basking and refuge habitat for SFGS consists of native grassland and shrubs which provide a combination of small open patches immediately adjacent to vegetation cover. Rodent burrows or large soil crevices that remain unsaturated throughout winter provide upland retreats. SFGS basking

and refuge habitat should be located within close distance to the water's edge. Under existing conditions, this type of habitat is limited to an area south of Horse Stable Pond.

5.2.3 Nutrient loading and biogeochemical impairment

Fertilizers applied to turfgrass, regardless of chemical form (organic or soluble salt), load nitrogen in the immediate watershed of Laguna Salada. Nitrogen compounds are the most abundant nutrient in turfgrass fertilizers (Goss 1972). Turfgrass fertilizers are apparently applied adjacent to and even within mown marsh turf at the lower turfgrass edge bordering the marsh at eastern Laguna Salada. Past measurements of nitrate and ammonium (forms of nitrogen) in Laguna Salada have occurred within the range known to have ecotoxic effects on treefrog and CRLF tadpoles (see Appendix D). Swaim Biological (2008) observed unexplained absence of California red-legged frog tadpoles in the main lagoon, despite egg masses and suitable salinity ranges. Previous assessments of Laguna Salada habitat expressly declined to evaluate fertilizer impacts on water quality and habitat of frogs (Tetra Tecb et al. 2009, Swaim Biological 2008). Nitrate, nitrite, and ammonium (all inter-convertible forms of nitrogen produced by microbial activity in marshes) even within allowable EPA standards for buman drinking water can have ecotoxic effects on treefrog and CRLF, causing developmental problems, disorientation, and death (Marco and Quilchano 1999, Nebeker and Schuytema 2000, Greulich and Pflugmacher 2003).. The use of nitrogen fertilizers on the golf greens at Sharp Park is a potentially negative impact that urgently requires analysis.

Phospborus loading and warm summer temperatures may interact to facilitate blooms of toxic blue-green bacteria and microalgae that have recently caused acute wildlife toxicity and mortality in California (Appendix D). Fertilizers for golf greens are known to create overloads of phosphorus which can result in both terrestrial and aquatic cyanobacteria blooms (Colbaugh 2002). Trematode outbreaks, which cause deformities in tadpoles during development, are known to occur as a result of excessive nutrient loading to freshwater habitats (Appendix D). Appendix D contains a summary of nitrate, nitrite, and ammonia concentrations found during water quality monitoring at Laguna Salada by PWA (1992) and Curtis & Thompson Laboratories (2009), which are at harmful levels. Nitrogen fertilizers applied regularly to the turfgrass surrounding eastern Laguna Salada is likely causing degradation of water quality and habitat suitability for amphibians and therefore, SFGS. The recovery plan for the San Francisco Garter Snake recommended monitoring of fertilizer use at Sharp Park to ensure no adverse impacts (USFWS 1985 p. 43, recovery task 253).

Riparian scrub and grass-like seasonal wetland vegetation (sedge-rush meadows) are highly efficient at uptake of nitrate in runoff and seepage. Riparian scrub and seasonal wetland areas are also good foraging areas for CRLF. Vegetative biomass, especially decay-resistant fibrous sedge, rusb peat, and leaf litter, stabilizes nitrogen and sequesters it. Broad zones of seasonal wetland sedge meadows and riparian scrub naturally intercept potential transport of mobile nitrogen to lagoon surface waters. These zones at Laguna Salada are effectively eliminated or severely truncated by turfgrass encroachment down to the freshwater marsh zone, eliminating nearly all potential nutrient buffer zones, and creating a low-biomass transport pathway for nitrogen runoff to directly enter the lagoon's fringing marsh.

The bottom sediments of the lagoon are naturally anoxic (free of oxygen) and accumulate fine organic matter that fuels microbial activity. Anoxic, slightly brackish organic-rich lagoon and wetland sediments generate hydrogen sulfide and iron sulfides at the lagoon bottom. Concentrated sulfides are toxic to plants and most amphibians that are adapted to marsh surface or edge environments (Appendix D). When sulfides are exposed to oxygen when lagoons are drained and bottom sulfidic sediments emerge, they oxidize and form iron oxides and acid sulfates, causing extremely low pH (Appendix D). The artificial summer drawdown of Laguna Salada exposes bottom sediments to oxidation, and surface films of orange-brown iron oxide form, with jet-black iron sulfide muck immediately below the surface. These effects are widespread at both the north and south ends of the lagoon in summer (Peter Baye, personal observation). These acid sulfate soils at the marsh surface or edge are usually restricted to infrequent extreme drought conditions affecting natural non-tidal lagoons, but they are a regular feature of Laguna Salada due to pumping to low levels through the early dry season.

5.3 CONCLUSIONS

The primary limiting factors for habitat quality (in the lagoon and surrounding terrestrial environment), sustainability, and population persistence of SFGS and CRLF are likely to be consequences of three primary influences: lack of suitable upland habitat paired with ongoing golf course maintenance and operations; stabilization of artificially low lagoon levels and the lack of an available corridor to connect these populations to the eastside of HWY 1. Golf maintenance impacts result from the following: mowing of marsh and upland edges, exclusion of dense native vegetation cover by wetland and riparian vegetation and large woody debris, and chronic nitrogen loading of the lagoon due to fertilizer application to turfgrass. Stabilization of artificially low lagoon levels with minimal seasonal fluctuation has multiple significant short-term and long-term impacts to the habitat quality and sustainability of the lagoon wetland complex. These impacts include elimination of the lagoon floodplain hydrology and habitat connectivity; increase in the proportion of the lagoon area within depth ranges suitable for rapid spread of cattail and tule vegetation. Artificial stabilization of lagoon wetland elevations within tidal elevation ranges makes them increasingly susceptible to increased marine flooding risks as sea level rises. In addition, pumping the lagoon to fixed, low levels relative to wave runup as sea level rises over decades is likely to induce increasing frequency and rates of salinity intrusion due to reversal of beach groundwater gradients. Therefore, salinity intrusion over decades is a potentially significant threat to CRLF and should be a consideration in area management.

6. CONCEPTUAL RESTORATION PLAN

6.1 GOALS, OBJECTIVES, AND APPROACH

The ecological goals and objectives for Laguna Salada were outlined in Section 2.2. These goals are synthesized here with our understanding of existing ecosystem conditions at Laguna Salada (Section 1), natural lagoon analogs, and local historical ecology (Section 1) to develop a sustainable, long-term plan to rehabilitate the damaged wetlands, reunite them with related habitat and wildlife in the watershed, and enable them to adapt to future climate change and sea level rise. The restoration vision presented here breaks with past habitat management approaches of increasing or intensifying management activities to address habitat degradation. Instead, it aims to restructure the ecosystem so it requires less frequent and intensive management (i.e., cost-effective) while delivering increased ecosystem services including endangered species habitat.

This ecosystem-level approach is essential given the coastal setting of the wetlands and their inherent exposure to coastal geomorphic processes. The same coastal processes that originally created and maintained the wetlands of Laguna Salada are now, ironically, considered "threats" to the survival of the existing artificially stabilized wetland ecosystem. The core of our restoration vision is to correct these basic structural constraints and restore flexibility, diversity, dynamics, and extent of the lagoon ecosystem. The most fundamental feature of this restoration vision is to reduce artificial drainage of the lagoon and allow water levels to rise to natural levels, expanding freshwater perennial and seasonal wetlands in the floodplain at higher elevations farther inland than they currently exist. It also restores the freshwater-dominated, landward end of the lagoon wetland gradient, and re-establishes essential linkage with terrestrial and transitional habitats. These habitats will be naturally protected from the reach of storm overwash and will naturally migrate landward with sea level rise. The alternative approach, to increase engineering complexity and management intensity in an effort to sustain the inherited degraded and reduced wetland extent, is likely to be infeasible in the long-term (decades) and very costly in the short-term.

The restoration vision developed herein includes the goal of maintaining an uninterrupted (undeveloped) corridor along Sanchez Creek so that future SFGS restoration opportunities and funds can be identified to provide a viable HWY 1 underpass or overpass specific to SFGS needs. This identified future corridor also includes room to create additional ponds and upland refuge habitat for the snake as "stepping stones" to expand and connect populations to Sharp Park's Lake Arrowhead and ultimately to undeveloped areas outside and east of the park. This potential corridor area is potentially critical to the long-term recovery for the snake. This corridor will allow the populations of SFGS and CRLF to move in and out of Sharp Park so that the existing population can have the opportunity or chance for genetic flow. This is an essential concept to strive for, otherwise the existing populations at Sharp Park and Mori Point will remain isolated.

The Laguna Salada restoration vision is outlined below as a set of interim or near-term actions and long-term actions that will be implemented by project phasing. Phasing is essential for a number of reasons, most important of which is the need for step-wise ecological actions to be taken to enable local resident special-status wildlife species habitats and populations (primarily CRLF, SFGS, and western pond turtles) and their prey base species to adapt and expand to changing conditions.

6.2 OPPORTUNITIES AND CONSTRAINTS

The existing conditions described here, and elsewhere (PWA 1992; Tetra Tech et al. 2009), represent a number of physical and ecological opportunities and constraints that influenced the development of the conceptual restoration plan. Opportunities for restoration previously identified include (PWA 1992; Tetra Tech et al. 2009):

- Existing freshwater inflow is capable of sustaining a viable natural lagoon and wetland system
- Multiple special status species exist in or near Sharp Park, including San Francisco garter snake, California red-legged frog, San Francisco forktail damselfly, and salt marsh yellowthroat
- Sharp Park clubhouse is a historical feature that can be incorporated into public access plans for the restored site
- Sharp Park is publically held and not threatened by further development

We add the following additional opportunities for restoration:

- Laguna Salada represents a unique opportunity to restore a natural coastal lagoon system of regional significance
- Sharp Park beach seaward of Laguna Salada is wider than the beaches to the north, which have narrowed due to erosion and armoring. The wider beach is consistent with its location against the Mori Point headland which results in a curvature to the planform (the shore faces a slightly more northward direction). This wider beach is an opportunity (asset), while the erosion potential is a constraint.
- Southern Sharp Park, in front of the golf course, is one of the few sections of shore in Pacifica where there is room to maintain a beach without removing private development. It is the only section of shore north of Mori Point which has enough space to allow shore migration without substantial loss of development. With sea level rise, this is the most likely location in Pacifica north of Mori Point to maintain a beach through 2100.
- The existing coastal levee can be removed and a new levee can be constructed in a more landward location. This will restore the natural beach and place coastal flood protection in a less exposed, sustainable location. The more landward location is considered more sustainable because it is less exposed to wave action and overtopping.
- The east section of Sharp Park is adjacent to undeveloped lands with existing passage for wildlife to other known populations of SFGS at San Andreas Lake and Crystal Springs Reservoir. This potential corridor area is critical to the long-term recovery for the snake as it is the only place where such a "land bridge" to other populations can occur.
- Connective corridor for SFGS and CRLF can be demonstrated in the future by seeking restoration opportunities and partners (e.g., Caltrans) to design either a HWY 1 underpasses or overpasses to promote genetic flow among populations.

Previous overriding project constraints included existing and historical land use, reliance on coastal seawall/levee and pumps, impacts to existing wetlands and CRLF breeding areas, and poor runoff water

quality. The conceptual restoration plan presented here is not constrained by these factors because it is not based on the underlying assumption that existing land use will continue indefinitely into the future. Restoration of a natural functioning coastal lagoon system renders many of these constraints irrelevant. Constraints relevant to the proposed conceptual restoration plan include:

- Critical habitat is presently concentrated along the western edge of Laguna Salada, where it is especially vulnerable. A mechanism for phased inland migration of snake and frog habitat will have to be developed.
- Existing upland habitat suitable for SFGS is lacking or deficient along most of the lagoon wetland edge. Upland habitat areas for the SFGS will need to be created.
- Flood protection will need to be provided for adjacent neighborhoods at Fairway Park and along Clarendon Road/Lakeside Avenue
- Existing stormwater runoff infrastructure will require retrofit or new elements to allow drainage to the restored lagoon
- HWY 1 east of Laguna Salada is a barrier to wildlife movement. Partnerships with Caltrans will need to be developed to secure a future SFGS corridor underpass or overpass of HWY 1 that provides protection, refuge, and safe passage for wildlife.

6.3 DESCRIPTION OF PLAN ELEMENTS

The proposed conceptual restoration plan includes several new elements that will allow for the rehabilitation of the natural hydrologic and ecologic processes of the Laguna Salada system, including the natural barrier beach, the non-tidal lagoon and associated wetlands, and the Sanchez Creek freshwater/seasonal wetlands and riparian corridor. Restoration actions and plan elements are generally described below and shown in Figure 6 and Figure 7. Project phasing and implementation of the natural lagoon is described in Section 6.4 and shown conceptually in Figure 8. Figure 8 contains a conceptual plan for the lagoon, and does not depict the final/exact elevations to be implemented, especially for the frog ponds adjacent to the lagoon. Figure 9 depicts a conceptual plan for SFGS upland and corridor restoration. The overall strategic elements are:

- **Lagoon hydrology management.** Reduce the current artificial drainage of freshwater inflows for flood protection to allow higher lagoon water levels and increased open water marsh vegetation extent. Flood protection is addressed by different proposed actions.
- **Sanchez Creek riparian corridor restoration.** Culverted sections of Sanchez Creek will be daylighted (culverts will be removed) as distributaries[6] through the restoration site to restore natural fluvial processes, including establishment of a natural riparian corridor and freshwater/seasonal wetlands within Laguna Salada and east of Highway 1. Daylighted creek areas will also enhance habitat for CRLF and SFGS.
- **Habitat enhancements for breeding CRLF and foraging SFGS.** Depressions in the seasonal wetland zone of the eastern floodplain (along the margin of the main lagoon) will be created, similar to the wetland habitats constructed by GGNRA at Mori Point, to provido breeding habitats for CRLF. Large woody debris will be added to wetland-terrestrial transition zones to provide

[6] A distributary channel is a channel that splits off from the main river or creek channel, and is often one of several channels that form over flat slopes, and are often found near the river or creek mouths within the delta formations.

emergent unvegetated basking and roosting sites. Additional basking sites for snakes and frogs will be provided as small gaps in vegetation. Dense vegetation or the underside of logs can provide refuge habitat from predator birds.

- **Expand floodplain and upland transitional habitat.** Excavate artificial fill to expand habitat. Excavated fill will provide source material for other restoration elements (e.g., setback berms, higher elevation mounds for coastal scrub and terrestrial areas for SFGS, etc).
- **Designate the land area for a future SFGS Corridor**. Adopt and identify the areas adjacent to and including Sanchez Creek as a future viable SFGS corridor that provides the potential for safe passage, either under or over road and HWY 1. Work towards finding additional funds and partnering with Caltrans.
- **Upland habitat enhancements for SFGS.** Habitat enhancements for SFGS upland habitat, similar to those proposed by the 2009 SFRPD plan will be included.
- **Existing seawall/levee.** The existing coastal seawall will be allowed to erode and reconfigured, as needed, in phases over time to restore the natural barrier beach berm fronting the lagoon. Existing armor and riprap on the levee and beach will be removed.
- **New setback berms.** New setback berms (small levees) will be constructed along the western and northern edge of the Fairway Park neighborhood (south Laguna Salada) and along Clarendon Rd/Lakeside Ave (north Laguna Salada). The setback berms will provide flood protection against inundation and help accommodate the increased lagoon extent.
- **Existing pump infrastructure.** The existing pump house and drainage culverts at Horse Stable Pond, including the beach outfall, will be removed with the phased levee removal. Artificial water level management will be phased out to allow natural equilibrium water levels to establish in the lagoon.
- **New stormwater runoff detention basins.** New detention basins will be excavated along Lakeside Avenue and Fairway Park to collect stormwater runoff from adjacent neighborhoods.
- **New stormwater runoff drainage infrastructure.** New culverts (Fairway Park) and a new pumping station (Clarendon Road/Lakeside Avenue) will allow drainage of the detention basins to the lagoon.
- **Public access.** Public access elements similar to those proposed by the 2009 SFRPD plan's restoration alternative will be included. Possible enhancements include: pedestrian trails, boardwalks, viewing platforms, modular seasonal bridge, clubhouse enhancements, etc. Public access will be integrated with existing public access at Mori Point.
- **Interim habitat management actions.** As described in Section 6.8.

The long-term conceptual restoration vision proposed here focuses on the new large-scale elements listed above (i.e., those that will drastically alter the functioning of the lagoon system). The small-scale elements and details of the localized lagoon and fluvial habitat enhancements and public access would likely be similar to those described by Tetra Tech et al. (2009).

Taking a broader perspective (i.e., as part of a longer-term master plan or restoration vision), modifications to HWY 1 could greatly enhance restoration by reconnecting the ecotone on either side of the roadway. Highway One forms a barrier to wildlife (and people) which is a stressor to the natural east-to-west orientation of the coastal ridges and valleys. Figure 9 shows a connection across HWY 1 for

SFRPD lands. Mori Ridge provides another connection opportunity. Reconstruction of the highway with an elevated and or depressed alignment would allow reconstruction of the functional landscape and a contiguous coastal valley and ridge (Mori Ridge) habitat. Such realignment could also improve the connection for people, whether going to the beach from neighborhoods or hiking through GGNRA lands In particular, this is an opportunity for re-establishment of a genetically resilient and dispersed SFGS population. The ongoing planning for improving traffic flow in the area provides an opportunity to consider these ecologic and social objectives. We recommend that these considerations be incorporated in the HWY 1 planning. While modifying a road for human access and environmental enhancements may seem impractical to some, there are recent precedents. One example of a multi-objective roadway renovation project is the Doyle Drive Reconstruction in San Francisco, which includes elevated and depressed sections which will allow ecological and pedestrian connections from uplands to the shore.

6.4 DESCRIPTION OF PLAN PHASING

The Laguna Salada Restoration Plan is comprised of the elements described above, implemented in phases. Phases 1-3 extend over an approximately 10-year timeline. Phase 4 is expected to be implemented over a 30 to 60-year timeline.

6.4.1 Phase 1. Expansion and Redistribution of Habitat

Trigger: Completion of planning, design, environmental review and permitting.

Estimated time frame to start: Five years minimum to accomplish alternatives analysis, environmental review, permitting, funding, and design.

Description: The first Phase will expand and improve wetland habitat on the site, providing the conditions for expanded CRLF and SFGS habitat around the lagoon perimeter, primarily on the east side. To accomplish this, the water management must change. Improved flood protection for the south Sharp Park area of Pacifica is proposed to occur during this stage, to rectify the chronic flooding problems. It is also beneficial, although not essential, to complete earthwork close to the expanded wetland area in their existing highly disturbed state before the wetlands form. Restoration of the Sanchez Creek riparian corridor and associated floodplain wetlands will directly improve habitat on both sides of the highway. Construct depressions in the seasonal wetland zone to form freshwater ponds and marshes and add abundant large woody debris.

- **Expand lagoon by raising water levels.** Pump operations will be modified to allow higher lagoon water levels and increase wetland area and habitat for CRLF and SFGS, among other species. Winter maximum lagoon levels will increase to 12 ft NAVD and summer lagoon levels will increase to near 10 ft NAVD (current upper limit is approximately 7.5 ft NAVD). This will result in a broad shallow wetland fringe and deepen the rest of the lagoon. Raised lagoon water levels will achieve a rapid increase of seasonal and perennial freshwater marsh above the limit of tidal inundation, with significantly lower risk of salt water flooding, even during overwash events. Higher water levels will deepen and freshen the lagoon and initiate drowning of tules and cattails that have encroached upon the lagoon bed in recent decades. Expanding floodplain seasonal wetlands would trap sediment and nutrients, improving water quality of the lagoon and reducing eutrophication.

- **Expand Lagoon by additional excavation and grading.** Additonal earthwork excavation and grading to expand Laguna Salada inland (away from the ocean). This action would increase CRLF habitat farther landward and away from the effects of wave overwash. Topographic barriers could be graded to create overwasb barriers and shallow areas where emergent vegetation mats would further impede salt intrusion. This is an option not included in the restoration plan descriptions (graphics, engineer's estimate), but recommended for further consideration in prelimainry design and environmental review.
- **Restore Sanchez Creek and floodplain.** Sanchez Creek will be restored to a natural morphology through the site, on both sides of the highway. On the west side, new creek channel will be graded with a two-stage shallow channel and floodplain. The surrounding area will be planted with riparian vegetation transitioning to riparian scrub or woodland. Multiple distributary channels will be excavated near the lagoon, to facilitate saturated wetland conditions. Depressions in the seasonal wetland zone of the floodplain will be excavated to provide breeding habitat for CRLF.
- **Restore SFGS Upland Habitat.** Upland basking and refuge habitat for SFGS consisting of small open patches of native grassland and shrubs adjacent to vegetation cover will be created. SFGS basking and refuge habitat will be located within close distance to the water's edge along the eastern section of the lagoon.
- **South Sharp Park surface drainage management facility.** This facility will consist of an excavated water storage basin, a setback levee, and a pump station. The facility will prevent ocean and lagoon water from flooding the surrounding neighborhood. The setback levee (a compacted earth berm) will be constructed along the north and northeast boundary of Laguna Salada. The levee will be approximately 5 to 10 feet high with a crest at elevation +22' NAVD. The elevation is approximately set at two feet above the estimated 100-year recurrence flood level (one percent annual chance of occurrence), which is the standard FEMA uses. The levees would transition and end at existing high ground. The water storage basin will provide a reservoir for storm water from the tributary area. Behind the new setback levee, a depression will be excavated to form a storage hasin for rainfall runoff from adjacent developed areas. A pump station will be installed to pump water from the detention basin to the lagoon.

6.4.2 Phase 2. Complete Set-back Flood Management Facilities.

Trigger: Expanded Endangered Species Habitat.

Estimated time frame: 2 to 5 years after start of Phase 1. Phase 2 starts after CRLF and SFGS habitat is expanded and populations have increased and redistributed to the new wetland areas along the lagoon perimeter. A key consideration is the establishment of habitat farther east and upland so that CRLF populations can survive extreme wave overtopping events.

Description: Phase 2 consists of flood management for Fairway Park and adaptively phased restoration of the beach.

- **Fairway Park surface drainage and flood protection facility.** A set back levee will be constructed to protect Fairway Park from coastal and lagoon flooding. The design elevation of +22' NAVD is about 3 to 5 feet above existing grades. The elevation is approximately set at two feet above the estimated 100-year recurrence flood level (one percent annual chance of occurrence), which is the standard FEMA uses. The levees would transition and end at existing high ground. The new levee will be aligned to provide a detention basin for rainfall runoff from the Fairway Park area. A culvert with a tide gate will allow drainage by gravity during most lagoon water levels, and prevent backflow.
- **Remove armor from coastal levee, allow natural erosion.** The coastal levee will erode over time as waves attack it. Armor will be removed to facilitate this process, cleaning up the beach and restoring a more natural shoreline.
- **Restore back beach overwash zone at eroded sections.** As needed, as erosion of levee progresses. As sections of the levee degrade, beach sediments will be placed to restore the beach berm to an elevation of approximately +20' NAVD and extending eastward toward the lagoon.
- **Install boardwalks or other public access.** As part of the gradual levee degradation and beach restoration, the levee trail will be lost and a new boardwalk or other trail will be installed to maintain the access amenity.

6.4.3 Phase 3: Remove Existing Levee and Pump

Trigger: Expanded Endangered Species Habitat.

Estimated time frame: 5 to 10 years after start of Phase 1. Once habitat expansion and species redistribution objectives have been attained, the existing pump station and levee can be removed, fully restoring the natural structure and function of the beach and west side of the lagoon.

Description: Phase 3 completes the restoration of natural coastal and lagoon processes with the following elements.

- **Remove remaining levee.** The remaining levee will be removed and the back beach restored. Alternatively, the levee can be allowed to erode and the Phase 2 method of adaptive restoration continued.
- **Install boardwalks or other public access.** This is continuation of Phase 2, where the levee trail is replaced by a boardwalk or other coastal trail.
- **Remove existing pump station at Horse Stable Pond.** With the levee mostly or completely removed, and setback levees installed, there is no need for the existing pump station.

6.4.4 Phase 4: Adapt to Sea Level Rise

Trigger: Sea level rise of two feet or more.

Estimated time frame: 30 to 60 years.

Description: Sea level rise will cause the beach berm to rise and migrate landward. This will raise lagoon water levels, and wetlands will spread upward and inland. Large runoff and wave overtopping events will result in rapid drainage of the lagoon and drawdown that will scour the lagoon bottom farther eastward. Hence, the entire wetland system will migrate up and inland with sea level rise. In response, setback levees will be raised. Also, a pump will be needed to discharge storm water from the Fairway Park area.

- **Install pump at Fairway Park detention basin.** A pump station will be installed at Fairway Park to provide storm drainage with higher sea levels.
- **Raise setback levees to account for sea level rise.** Setback levee crests will be elevated by placement of additional fill to prevent overtopping and provide flood protection.

6.5 ENGINEER'S ESTIMATES OF LIKELY CONTRUCTION COSTS

Table 1 presents the estimate of construction costs for the conceptual restoration described above. For planning purposes we have provided order of magnitude estimates to allow cost comparison of alternatives or previous plans (e.g., Tetra Tech et al. 2009). This cost estimate is intended to provide an approximation of total project costs appropriate for the conceptual level of design. These cost estimates are considered to be approximately -30% to +50% accurate, and include a 35% contingency to account for project uncertainties. These estimates are subject to refinement and revisions as the design is developed in future stages of the project. This table does not include estimated project costs for permitting, design, monitoring and maintenance. Estimated costs are presented in 2010 dollars, present value, and would need to be adjusted to account for price escalation for implementation in future years. This opinion of probable construction costs is based on: ESA PWA's previous experience, bid prices from similar projects, consultation with contractors/suppliers, and R.S Means 2007 edition. Please note that in providing opinions of probable construction costs, ESA PWA has no control over the actual costs at the time of construction. The actual cost of construction may be impacted by the availability of construction equipment and crews and fluctuation of supply prices at the time the work is bid. ESA PWA makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bids or actual costs.

Table 1. Likely Construction Costs for Restoration

Project Action	Estimated Cost in 2010 Dollars, Present Value				
	Phase 1	Phase 2 (2-5 years)	Phase 3 (5-10 years)	Phase 4 (30-60 years)	All Phases
South Sharp Park Drainage[1]	$1,000,000			$130,000	$1,130,000
Fairway Park Drainage[2]		$210,000		$350,000	$560,000
Sanchez Creek Restoration[3]	$420,000	$100,000			$520,000
Coastal Levee/Berm/Trail[4]		$680,000	$980,000		$1,660,000
Subtotal	$1,420,000	$990,000	$980,000	$480,000	$3,870,000
Mobilization & Contingency (35%)	$500,000	$350,000	$350,000	$170,000	$1,370,000
Total	**$1,920,000**	**$1,340,000**	**$1,330,000**	**$650,000**	**$5,240,000**

Notes:

[1] Includes setback levee, storm water detention basin, pump station, and future levee maintenance.

[2] Includes setback levee, drainage culvert, future levee maintenance, and future pump station.

[3] Includes channel and floodplain excavation, planting, and large woody debris placement

[4] Includes riprap removal, beach berm grading, trail with boardwalk, levee excavation, and Horse Stable Pond pump station removal.

The estimated cost for the Coastal Levee / Berm assumes that all of the existing levee will be mechanically excavated and all of the sand berm enhancement will be accomplished with imported material. However, the proposed phasing includes the allowed erosion of the levee, which would reduce the amount of levee excavation and estimated costs.

6.6 DISCUSSION

The restoration plan presented above represents a hydrologic regime change for the present-day Laguna Salada. The existing lagoon is a managed system in which water levels are artificially pumped down to levels below that which they would naturally occur. The proposed plan would:

- Raise lagoon water levels to restore landward floodplain wetlands above sea level, naturally reducing exposure to seawater flooding and overwash
- Significantly expand acreage and complexity of freshwater wetland and terrestrial habitat gradients, especially at the landward end of the lagoon and its floodplain
- Allow freshwater wetland habitats of special-status wildlife species to expand significantly and shift landward ahead of coastal retreat
- Allow the natural barrier beach and intermittent outlet channel to be maintained by waves and stormwater runoff and serve as a natural line of coastal flood defense
- Significantly increase lagoon open water extent and buffering against salinity intrusion and wave overwash
- Increase lagoon depths without dredging, avoiding water quality impacts of mobilizing sulfidic (toxic, anoxic) bottom sediments

- Restore submerged aquatic vegetation beds providing favorable habitat for waterbirds, SFGS, and CRLF
- Improve coastal and fluvial flood protection through inland perimeter floodwall locations instead of along the high energy wave-dominated shoreline. This would allow for smaller-scale less expensive flood protection infrastructure and preserve the natural beauty and ecologic benefit of the beach.
- Reduce nutrient loading of the lagoon and increase natural biogeochemical water quality functions of lagoon wetlands, including denitrification and nutrient sequestration
- Increase ecological resilience to climate change and sea level rise, and increase ecosystem tolerance of natural perturbations (extreme flood events, seasonal flooding, etc.)
- Promote compatibility between beach protection, shoreline access, and increased public recreational access of Sharp Park

The proposed plan is a long-term restoration vision that makes sense for the sustainability of critical habitat while minimizing initial and ongoing maintenance costs. This plan also restores and maintains the natural shore. This element cannot be over-emphasized given that most of shore north of Mori Point is armored and narrowing. This section of shore, approximately 3,200 linear feet from Mori Point to Clarendon Road, is perhaps the only section of Pacifica where a beach can he maintained for the next 100 years of projected sea level rise without loss of private property and large infrastructure costs. From the perspective of adaptation to sea level rise, Laguna Salada is perhaps the greatest opportunity for maintaining an accessible beach in the region stretching from San Francisco to Pedro Point.

The restoration vision includes future actions to improve habitat by modifying the barrier formed by HWY 1. The primary objective is further improving SFGS habitat, although other ecological benefits are likely and recreational/social and economic benefits may also accrue. Creating additional CRLF/SFGS ponds as well as restoration of upland habitat areas for SFGS along Sanchez Creek and east of HWY 1 past Arrowhead Lake are valid "stepping stones" towards the goal of sustaining viable, not isolated, SFGS populations at Sharp Park. The idea of connecting populations and expanding species range back within original range areas is both consistent and essential with endangered species recover plans. Therefore, additional work is recommended to:

- Respond to the need for the long term viability of existing SFGS populations at Sharp Park by considering genetic flow to outside populations.
- Set aside areas of Sharp Park that could have profound positive impact for the SFGS, so that when opportunities arise in the future, recovery actions for the SFGS are not missed.
- Identify areas worthy of future and collaborative SFGS restoration, which are expected to include the eastern portion of Sharp Park which extends up to, and past, Arrowhead Lake, and areas contiguous with Mori Ridge and GGNRA lands.
- Consider the adverse effects to SFGS resulting from Highway One, and consider elements to mitigate these adverse effects as part of future Highway modifications.

6.7 COMPARISON WITH SFRPD'S PREFERRED PLAN

The restoration plan presented here has several fundamental distinctions from the SFRPD preferred plan (Alternative A18):

- **Pre-existing land use constraints.** All SFRPD alternatives save one were constrained by existing land uses. The plan proposed here is not constrained by existing land uses, and instead presents a long-term restoration vision for the site.
- **Sustainability of restoration plan.** The SFRPD plan places critical habitat in a vulnerable position in the landscape (i.e., directly behind a coastal levee). The cost of maintaining CRLF and SFGS habitat in this configuration will increase over time. The viability of maintaining the habitat will decrease as sea level rises in the future. The plan proposed here creates a dynamic natural system that will evolve in response to sea level rise.
- **Location of endangered species habitat.** Under existing conditions, CRLF habitat is primarily concentrated in the freshwater wetlands at Horse Stable Pond. The proposed SFRPD plan attempts to enhance this existing habitat and promote expansion of CRLF and SFGS into Laguna Salada proper. Locating this critical habitat along the levee in a coastal flood hazard zone, especially considering possible salinity seepage into the lagoon with sea level rise, is not sustainable. In 1986, McGinnis found that this area was hypersaline and not viahle for either SFGS or CRLF. Over time, this habitat will become increasingly difficult, if not impossible, to protect. The restoration vision presented here locates critical habitat along the eastern edge of Laguna Salada – where it existed historically and is most resilient to sea level rise, while maintaining connectivity to Mori Point. The expanded and deeper lagoon serves as a buffer to protect the freshwater habitat from salinity pulses due to wave overtopping and salinity intrusion.
- **Designate a corridor area and land bridge for SFGS.** We concur that there is a need to create suitable upland habitat for SFGS near the water's edge. There is ample room to do this along the east side of the proposed lagoon area. This approach would be consistent with the previous analysis and need for SFGS upland habitat as well as maintaining a connective corridor to the Mori Point SFGS populations.
- **Scope of restoration/enhancement.** The SFRPD plan was too narrowly focused on specific minor habitat enhancements for target species within the constraints of the existing landscape, and did not have an opportunity to consider a larger restoration vision. The plan proposed here seeks to restore the full ecosystem function – including ecologic and geomorphic processes – to benefit the endangered species and ecosystem-level function.
- **Increased open water extent.** A chronic problem at Laguna Salada is the loss of open water habitat due to encroachment by emergent vegetation. This is primarily due to existing water level management (i.e., pumping) within the site. The SFRPD plan proposes increasing open water depth and extent by dredging accumulated sediment and biomass. The plan proposed here would increase open water depth and extent passively by simply allowing the lagoon water level to increase, thereby progressively expanding the lagoon footprint over time.
- **Reliance on pumping and seawall.** The SFRPD plan relies on pumping to provide flood protection from rainfall runoff due to impoundment behind the coastal levee. The plan proposed here allows natural breaching and drainage of high lagoon levels through a natural restored barrier beach.

- **Loss of beach.** The SFRPD plan proposes to maintain the coastal levee/seawall at the Sharp Park beach. Over time, coastal erosion will result in loss of the fronting beach. The plan proposed here allows natural inland migration of the beach, thereby maintaining its width over time in response to sea level rise.
- **Cost of full restoration.** The restoration plan presented herein is estimated to cost about $5 million dollars over a 50 year time frame. In contrast the SFRPD plan costs between $6 and $11 Million, with another $6 to $7 Million for levee upgrade (called "seawall" in other reports) construction, totaling approximately $12 to $18 Million. The SFRPD "full restoration" alternative was estimated to cost between $9 and $22 Million, without an explicit treatment of costs associated with the levee /seawall. The costs of the SFRPD plans do not include ongoing land management operations by SFRPD, or the costs needed to adapt to sea level rise. Consequently, the plan proposed herein has lower initial and total costs, and has a longer design life. From a cost perspective, the plan proposed herein is greatly superior to the SFRPD plans.
- **The restoration plan presented here is broader than the SFRPD plan.** While the detailed plan presented here is primarily limited to the SFRPD lands, we identify a broader restoration objective for future consideration. The objective is to restore a connective corridor for the Sharp Park/Mori SFGS populations to the east side of HWY 1 and ultimately to Crystal Springs.

6.8 INTERIM HABITAT MANAGEMENT ACTIONS

Interim management actions are those actions considered to be applicable during continuation of existing operations or the transitional time period prior to long-term restoration actions.

I-1. Stop mowing marsh. Discontinue marsh mowing along eastern and northern Lagoon. Allow existing fresh-brackish marsh vegetation at lower edge of golf greens to regenerate marsh canopy cover all year.

I-2. Allow higher winter lagoon levels. Increase winter surface water elevation of Lagoon: allow higher winter-spring lagoon stands (to approximately 10 ft), increase wetted area of lagoon during winter (Dec-March), widen perennial and seasonal fresh-brackish and fresh marsh, riparian scrub (see I-3); wetlands recapture wider shallow flooded edge of floodplain, increase consolidated (unfragmented) primary marsh area remote from risk of back-barrier saline seeps or overwash.

I-3. Place large woody debris along upper edge of lagoon. Place large woody debris (obtained from local large tree removal sources) along upper edge of lagoon shores (high water line), providing cover, permanently unvegetated basking sites, moisture refuge for treefrogs, and/or invertebrate prey base for frogs.

I-4. Establish willow thicket nutrient and disturbance buffer. Establish discontinuous but prevalent willow thicket borders around eastern and northern edges of Laguna Salada, creating buffer zones between marsh and golf greens for nutrient (nitrogen fertilizer) seepage and runoff interception, sediment detention and stabilization. Establish sedge-rush meadow vegetation in gaps between willow stands. Place patches of willow thickets to maximize net nutrient assimilation capacity.

I-5. Establish marsh ponds along buffered eastern lagoon. Excavate a series of sheltered depressions well below mean summer groundwater elevations to form isolated marsh ponds with sago pondweed and fringing bulrush/sedge/tule marsh (similar to Mori Point hillslope toe ponds) along the eastern and northern edges of Laguna Salada, within the area that is currently mown marsh. This area should then be sheltered by the willow thicket buffer zone (I-4). Shift CRLF breeding habitat to the landward edge of Laguna Salada, remote from risk of back-barrier saline seeps or overwash.

I-6. Establish upland San Francisco garter snake habitat along buffered eastern lagoon. Use the excavated soils from I-5 to create high elevation mounds, out of the highwater zone, that can be used by SFGS during winter months for hibernation. These areas should be at elevations above natural marsh plant colonization and contain mammal burrows (gopher or ground squirrel). These areas should be then vegetated with native grass and coastal scrub species.

I-7. Facilitate movement corridors for snakes and frogs between lagoon and upper watershed populations. Increase dispersal connectivity for CRLF and especially SFGS between Arrowhead Lake (upper Sanchez Ck watershed) and Laguna Salada through modified design of HWY 1 widening during EIR and permit process; provide either underpass corridors or an overpass land bridge, with cover specific to the needs of SFGS to facilitate dispersal and protection from predators, vehicles (including bikes), and people.

I-8. Replace iceplant and weeds with native scrub and perennial grassland vegetation. Replace iceplant mats and ruderal non-native vegetation on barrier and lagoon flats with native low-growing coastal scrub and grassland assemblages.

I-9. Monitor salinity seeps and groundwater salinity. Monitor salinity seeps and groundwater salinity along back-barrier transects placed along the entire N-S axis of Sharp Park Beach.

I-10. Reduce fertilizer application and risk of lagoon wetland eutrophication. Minimize applications of nitrogen fertilizers to Sharp Park turfgrass.

I-11. Re-establish sago pondweed in lagoon remnants. Re-establish sago pondweed in main Laguna Salada pond following hydrologic modification (I-2).

I-12. No Seawall Construction or Armoring. Allow the existing levee to erode and the beach to restore over time.

I-13. Comprehensive Habitat Planning and Management. Extend habitat management, and particularly species recovery planning, to include natural habitat ranges rather than institutional boundaries. In particular, link with GGNRA actions and consider opportunities associated with the HWY 1 modifications (presently proposed for widening) and Quarry property south of Mori Point (presently proposed for development).

7. NEW FINDINGS

7.1 BACKGROUND

The previous sections of the report present our best interpretation of the historical ecology and natural functioning of the Laguna Salada system, and provide a sound restoration vision. Here, we identify findings that are new or different than prior work. The goal here is to help foster informed discussion and promote a new vision for the restoration of the lagoon, free of previous constraints and assumptions.

7.2 PROBLEM DEFINITION

Previous restoration planning at Laguna Salada has been hampered by an incorrect formulation of the problem. There is a perception that the frog and snake habitat must be defended from the encroachment of the ocean, which would otherwise degrade the freshwater habitat through salinity intrusion and wave overtopping. The true problem is encroachment of development and "squeezing" of the critical habitat into a narrow, vulnerable, non-sustainable location directly behind the coastal levee. The SFRPD restoration planning process is constrained by the existing land use and water management, such that the only apparent feasible enhancement options within the lagoon environment rely on indefinite pumping and levee maintenance. Only by taking a broader view, free of those constraints, can a sustainable, resilient natural system be restored at Laguna Salada.

7.3 FINDINGS

The following findings are new and may contradict prior studies and the public perceptions resulting from the prior studies. While awkward, we feel it is necessary to correct what we feel are misconceptions that may facilitate counter-productive actions.

1. **The historical Laguna Salada was a brackish-fresh lagoon, not a saline tidal lagoon**
   Direct translation of the common place-name "Laguna Salada" (salty lake, lagoon, pond) leads to an incorrect interpretation of its historical ecology (see Appendix G, Laguna Salada Place Name Analysis). In the 19th century, the term "salada" applied to all seasonally brackish or fresh-brackish coastal waters that were frequently too saline for agriculture, stock, or human use. Evidence presented in this report from historical ecology, comparison with present-day reference sites, and analysis of physical processes supports the assertion that Laguna Salada was indeed a fresh-brackish non-tidal coastal lagoon with intermittent overwash – not a saline tidal lagoon.

2. **The seawall/levee did not "create" freshwater habitat for the frog and snake**
   The assumption that the seawall and golf course created habitat at Laguna Salada for the CRLF and SFGS is inconsistent with our findings. We find that habitat is degraded by present land use and restored physical processes will greatly enhance habitat.

3. **A contiguous levee/seawall did not exist prior to 1983 storms**
   Proposed levee modifications (and a categorical exemption from CEQA by the City of Pacifica) are founded upon the assumption that a contiguous levee or seawall existed prior to the 1983 El Niño storms. A review of historical aerials photos and anecdotal evidence from Pacifica residents indicates that such a structure did not exist prior to its construction in the 1980s.

4. **The existing levee/seawall is not required to protect flooding of neighborhoods**
   The general public perception is that the levee and pump infrastructure must be maintained indefinitely to protect existing developments from flooding. This assumption was the primary reason that removal of the seawall was not considered to be a feasible component of the full restoration alternative (Alternative A-0, Tetra Tech et al. 2009). The existing seawall actually prevents natural drainage of the lagoon during rainfall runoff events and necessitates the current pumping practices. If the natural lagoon processes were restored, setback levees could be reconstructed farther inland away from direct wave attack, in sheltered areas. These levees would be lower, narrower, and cheaper to maintain.

5. **The seawall is not required to protect Laguna Salada from sea level rise**
   If the natural lagoon processes were restored, the barrier beach would naturally migrate landward and upward in response to sea level rise. Over time, the lagoon and CRLF and SFGS habitat would naturally migrate inland and upslope as well. Setback levees could be raised at some point in the future as ocean and lagoon water levels increase.

6. **The seawall is not required to protect the frog and snake habitat**
   The existing seawall does protect the existing frog and snake habitat – in its present non-natural location at Horse Stable Pond – but this protection is not complete and is difficult to maintain. If the natural lagoon processes were restored, a greater expanse of freshwater wetland habitat would be created in the floodplain along the eastern side of Laguna Salada and along the restored Sanchez Creek riparian corridor – where it likely existed historically and will be more sustainable in the future.

7. **Sedimentation is not the primary cause of reduced lagoon extent**
   Artificial management of lagoon hydrology (e.g., pumping, artificial drainage, elimination of natural lagoon high stands) has allowed emergent vegetation to progressively encroach upon open water, thereby reducing the lagoon extent.

8. **The proposed SFRPD plan is not the most feasible and ecologically superior alternative**
   The restoration proposed herein provides greater ecological benefits; our conceptual analysis indicates it is less costly and more reliable.

9. **Full restoration is the cheapest rather than the most expensive alternative**
   The SFRPD has not had the opportunity to evaluate and compare the costs associated with the full restoration alternative proposed in this report. The restoration plan proposed here would be implemented at a lower cost using construction and phasing methods consistent with other large-scale restoration efforts up and down the west coast. This would also aid in directing unused funds to the

much needed upland wildlife corridor either above or under HWY 1, pond creation, recreation, and educational opportunities, ideas which are consistent with and further support the enhancement opportunities for CRLF and SFGS. Additionally, we believe the costs to construct and maintain the type of coastal structure proposed in prior studies are underestimated and should be re-evaluated.

8. CONCLUSIONS

We propose a new restoration concept not previously considered by prior studies. The new plan restores CRLF and SFGS habitat where it existed historically – along the eastern edge of a non-tidal fresh-brackish Laguna Salada. The plan increases the open water extent and depth of the lagoon, providing a buffer against ocean salinity pulses, while restoring the natural coastal processes at the beach. The plan is resilient with sea level rise, and satisfies flood protection and public access objectives.

A preliminary cost estimate for the conceptual design shows that the plan is feasible and comparable with other alternatives considered by the SFRPD.

The proposed plan offers the following:

1) a new vision (conceptual model) for the Sharp Park's Laguna Salada restoration and maintenance
2) flood protection for surrounding development
3) restoration of a naturally functioning lagoon ecosystem
4) expansion of habitat for federally protected SFGS and CRLF
5) a vision for a designated corridor for future SFGS and CRLF movement and genetic flow from the ocean side of HWY 1 to the inland side of HWY 1 so that these populations have a chance to survive over time
6) Recreation, including a beach / coastal trail and augmentation of the adjacent Mori Point (GGNRA) experience. The existing buildings and parking area could be maintained for public use and private concessions.

The findings presented in this report attempt to fill in gaps in previous research related to historical ecology and coastal lagoon processes to promote well-informed development and evaluation of restoration actions at Sharp Park. Failure to consider these key components of restoration design may result in actions that could limit habitat viability in the future, and in this way would be counter-productive.

The conceptual restoration plan presented here creates enhanced CRLF and SFGS habitat along the eastern side of the lagoon, where it will be naturally buffered and protected from high ocean salinity. Restoration alternatives that attempt to maintain habitat for these salt-sensitive species directly behind the coastal levee (at Horse Stable Pond) run the risk of loss in the event of catastrophic levee failure. Over time, habitat maintained within the coastal hazard zone will become increasingly susceptible to severe wave overtopping events and salinity intrusion – factors which will increase in the future due to sea level rise. We do not believe this approach is consistent with the Endangered Species Act and species recovery plans.

Maintenance costs for the coastal levee and pump station at Horse Stable Pond will increase over time with coastal erosion and rising groundwater, while degrading lagoon and beach habitat, making these elements less feasible over the long term. Previous restoration plans rely on indefinite maintenance of the seawall and pump station and do not address the adverse effect on the beach. The restoration vision presented here utilizes the inherent ability of coastal lagoons to regulate coastal and runoff floods, and sets back constructed flood protection elements where they are less exposed, have lower demands, and protect the surrounding community better.

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11. FIGURES

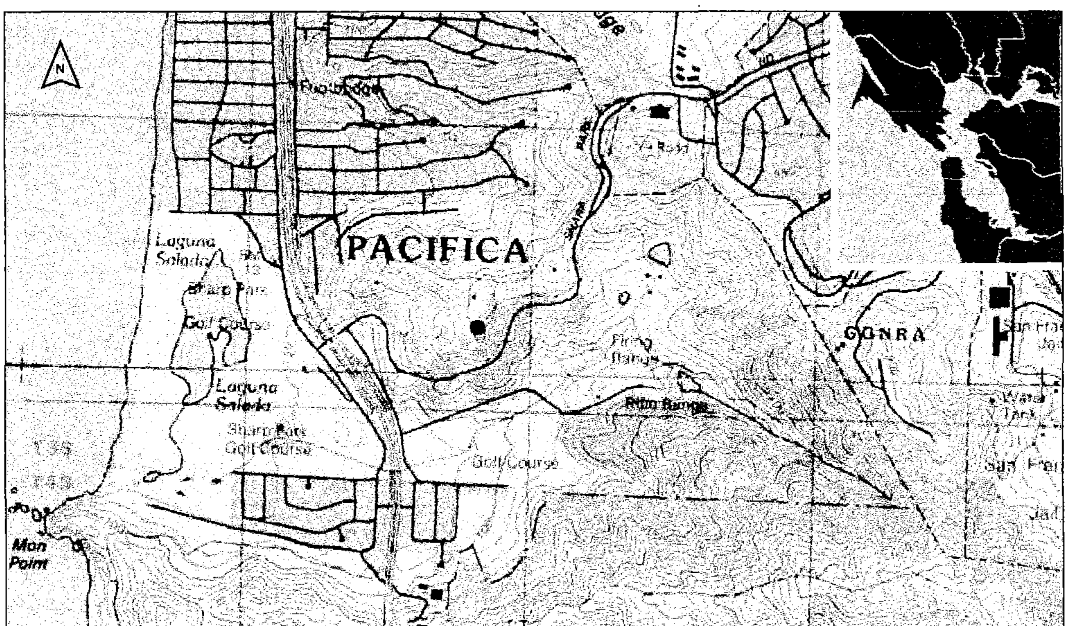


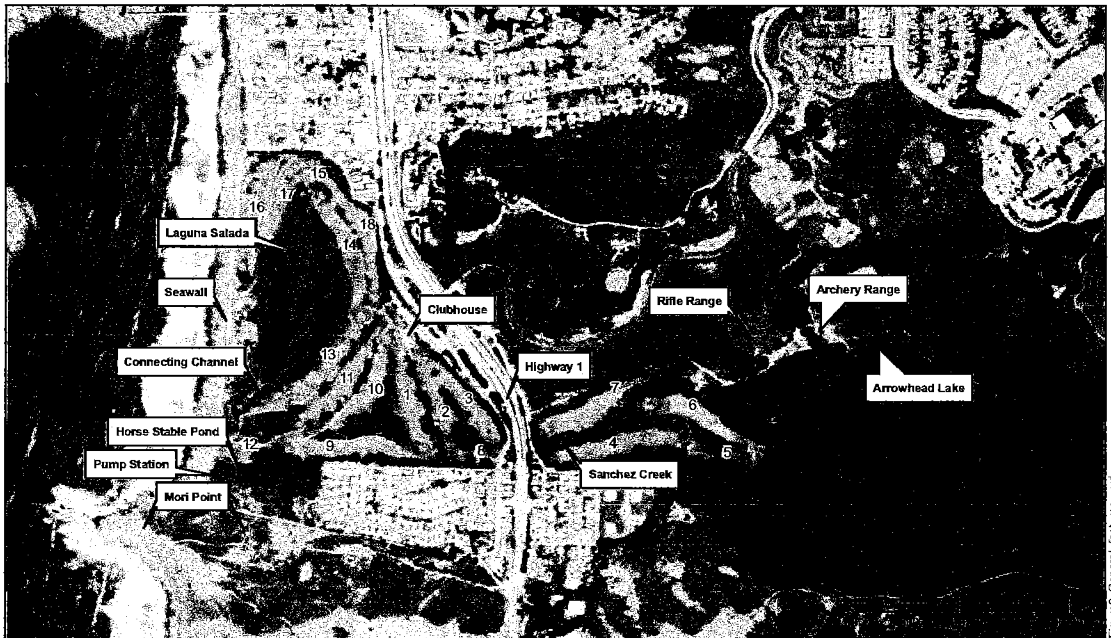
figure 1

Laguna Salada Restoration Feasibility Study

Project Location and Vicinity Map

Source: KHE (2009)

PWA



Sharp Park General Features

Sharp Park Conceptual Restoration Plan

Pacifica, CA

Figure 2

TETRATECH

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#2028 Report/figures

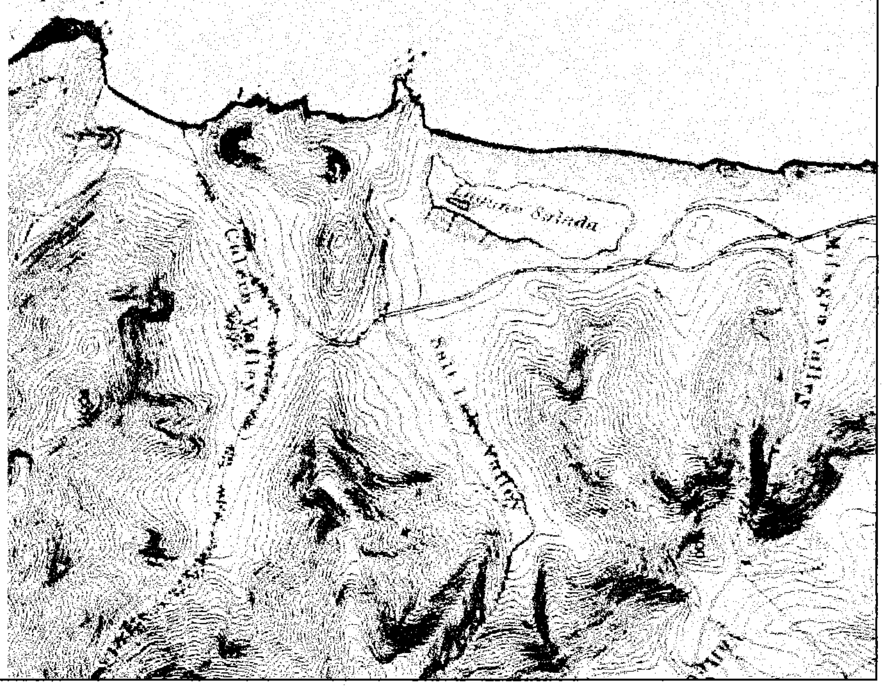


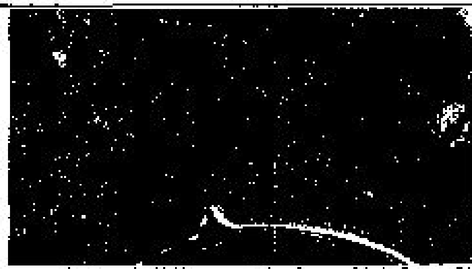
figure 3

Laguna Salada Restoration Feasibility Study

1869 USCS Topographic Map

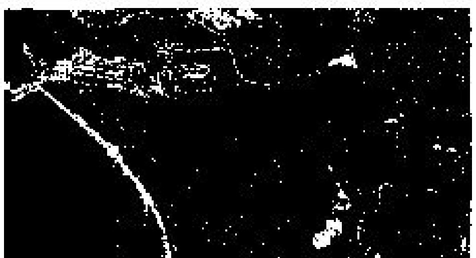
Source: U.S.C.S. 1869

PWA



a) Example tidal lagoon – Bolinas Lagoon, Marin County, CA

b) Example seasonal lagoon/estuary – Russian River, Sonoma County, CA



c) Example seasonal lagoon – Rodeo Lagoon, Marin County, CA

Source: Google Earth Imagery

figure 4

Laguna Salada Restoration Feasibility Assessment

Types of Central California Coastal Lagoons

PWA Ref# 2038

PWA

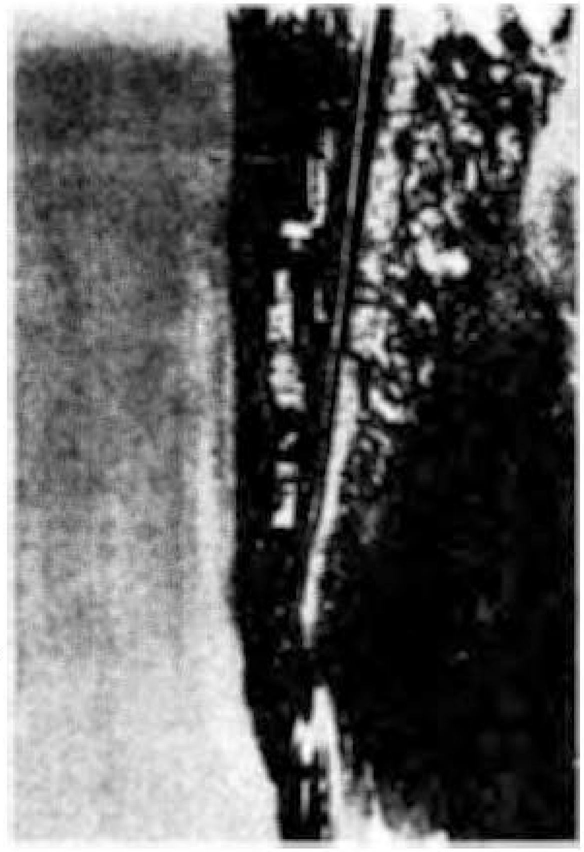


figure 5a

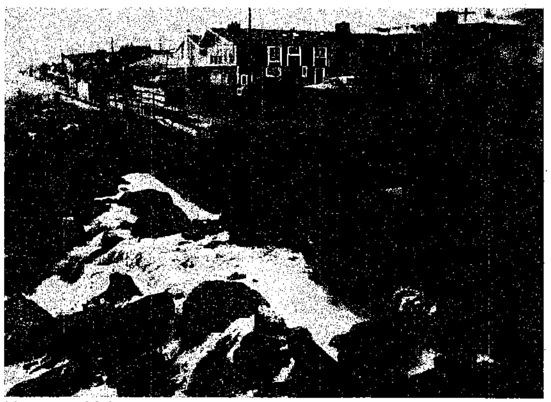
Laguna Salada Restoration Feasibility Assessment

Beach Boulevard Seawall, 1983

PWA Ref# 1938

PWA

(b) Sharp Park Seawall about 20 years after construction, with no beach at high tide.
Typical Winter conditions



(c) Structural failure of Sharp Park Seawall during January 11, 2001 event

figure 5

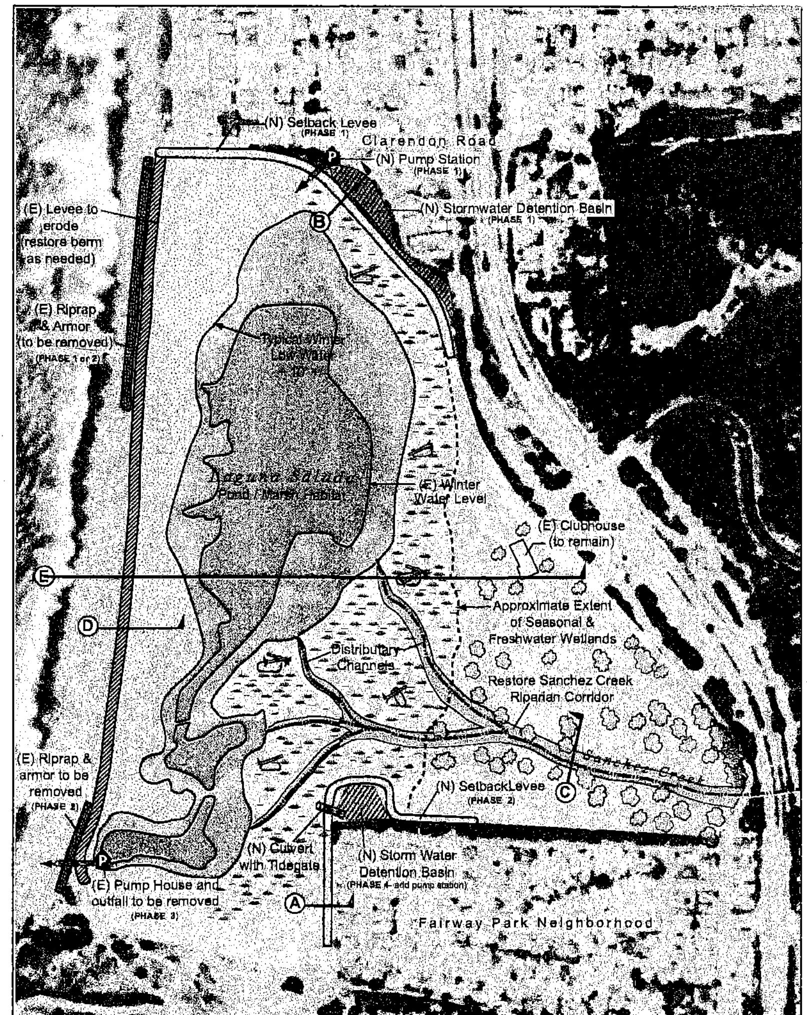
Laguna Salada Restoration Feasibility Study

Sharp Park Seawall Photos

Photo Source: Bob Battalio

PWA

#2028 Reportfigures



Levee
Riprap /Armor
Pump House
Culvert
Typical Section
Sanchez Creek
Riparian Corridor
Lagoon - Open Water
Stormwater Detention Basin
Winter Water Level
Sandy Overwash
Seasonal & Freshwater Wetlands
Trees / Woodland
Large Woody Debris
& Freshwater Ponds

Feet
0 250 500 1,000

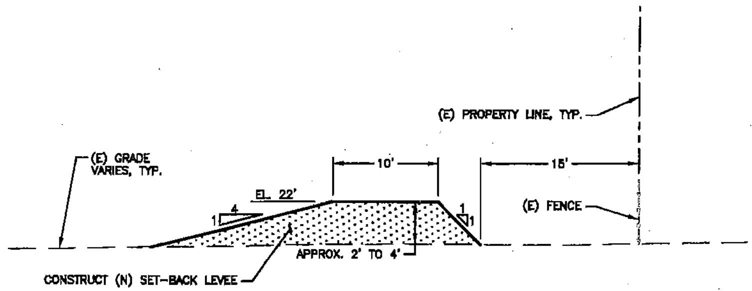
figure 6

Laguna Salada Restoration Feasibility Study

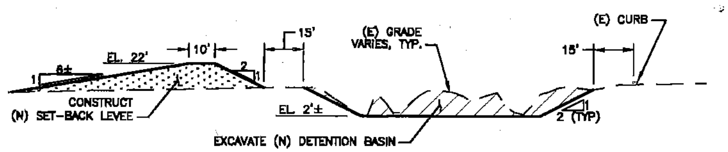
Restoration Plan

PWA # 2028

PWA



A SET-BACK LEVEE
TYPICAL SECTION @ FAIRWAY PARK
SCALE: 1"=10'



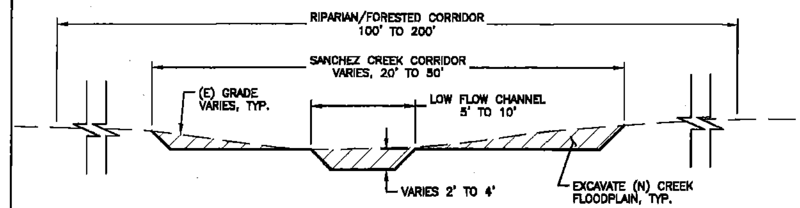
B STORM WATER PUMP STATION
TYPICAL SECTION @ DETENTION BASIN
SCALE: 1"=40'

figure 7a

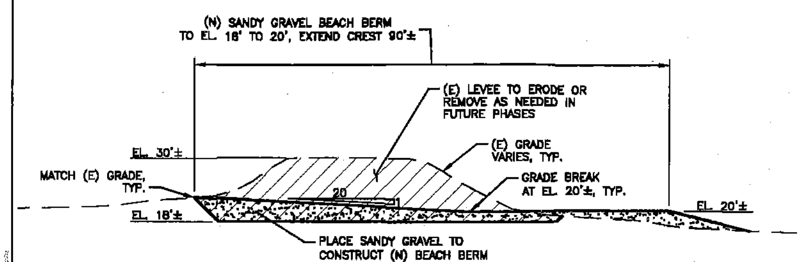
Laguna Salada Restoration Feasibility

Typical Sections at Fairway Park and Detention Basin

PWA



C SANCHEZ CREEK CORRIDOR
TYPICAL SECTION
SCALE: 1"=10'



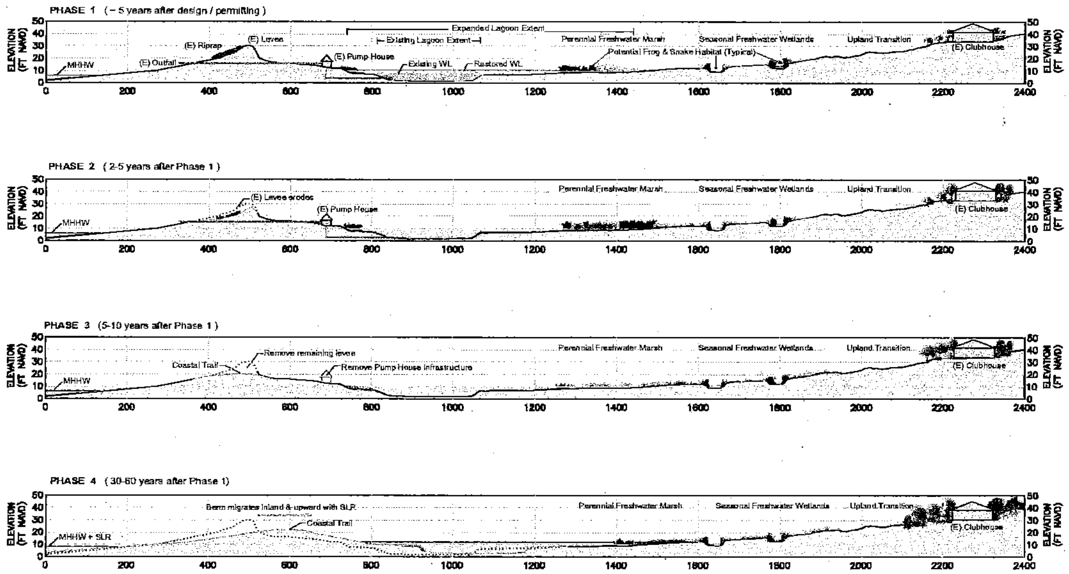
D BEACH BERM RESTORATION
TYPICAL SECTION
SCALE: 1"=20'

figure 7b

Laguna Salada Restoration Feasibility

Typical Sections at Sanchez Creek and Beach

PWA



(E) RESTORATION EVOLUTION
TYPICAL SECTION

SCALE
HORIZ: 1" = 200'
VERT: 3x EXAGGERATION

figure 8

Laguna Salada Restoration Feasibility Study

Restoration Typical Section and Evolution

PWA © 2008

PWA

Habitat Types / Composition
Perennial Fresh (& fresh-brackish) marsh, tule, cattail, bulrush
Seasonal Freshwater Wetlands - sedge rush meadow, woody riparian scrub, ponds
Upland Transition - coastal grassland, sedge, meadow and scrub

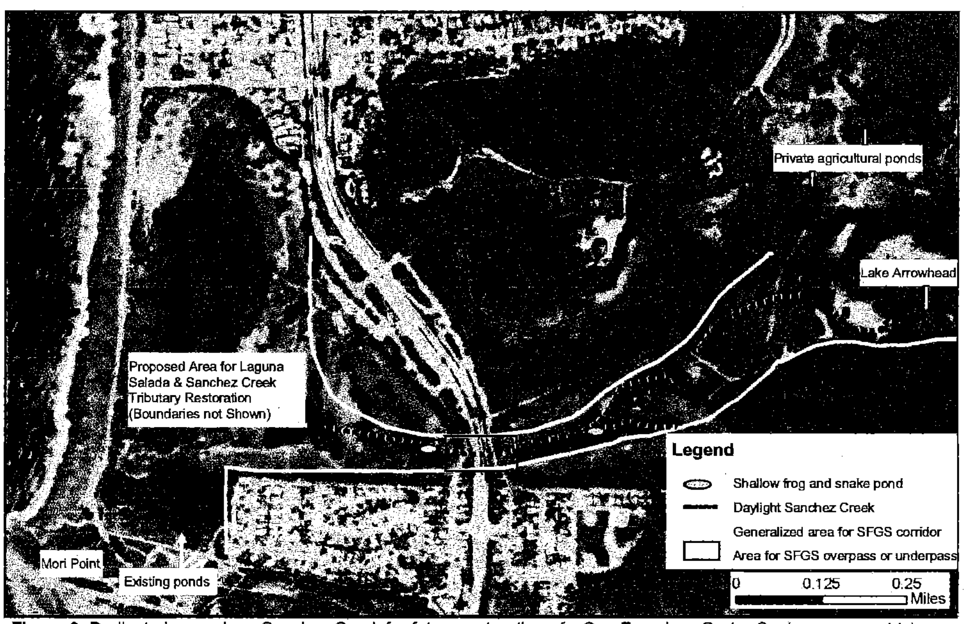


Figure 9. Dedicated area along Sanchez Creek for future restoration of a San Francisco Garter Snake movement into and out of the Lagoon at Sharp Park and Mori Point to Lake Arrowhead east of HYW1, with a land bridge, either under or over HWY and roadways.

12. APPENDICES

APPENDIX A: HISTORICAL ECOLOGY AND CONCEPTUAL MODELS

A-1 HISTORICAL ECOLOGY OF LAGUNA SALADA: A PRELIMINARY ASSESSMENT

A-1.1 Introduction

An important first step in assessing impairment of California coastal lagoon wetland ecological functions, and objectives for corrective or restoration measures, is accurate reconstruction of historic ecology (Stein et al. 2010, WWR et al. 2009, WWR et al. 2008, Simenstad et al. 2006, Striplen *et al.* 2004, Engstrom 2004, Goals Project 1999). Foremost among Laguna Salada wetland restoration issues in recent years is the historical ecology of endangered species habitat and population change in relationship to artificial hydrologic modifications. The vegetation, geomorphology, and hydrology of Laguna Salada during its early historical periods of crop agriculture (20th century prior to 1930s, and late 19th century), and relatively "natural" dynamic backbarrier lagoon conditions prior to intensive agriculture and engineered drainage (European settlement and earlier Ohlone occupation during the late Holocene epoch) have not been investigated previously. Limited direct data are available on status of California red-legged frog and San Francisco Garter Snake habitat around Laguna Salada during the later decades of the land-use period defined by golf links construction and use (1930s to present). No local data are currently available on paleoecology or stratigraphy (depositional record of ancient pollen, plant remains, sediment deposition sequences) of Laguna Salada's development during the late Holocene.

Purpose and Scope

The purpose of this preliminary investigation of Laguna Salada's historical ecology is to provide new data and analysis supporting better resolution and understanding of the historical development of habitat changes and geomorphic and hydrologic dynamics. The purpose and scope of this assessment is set within the context of preliminary feasibility assessment for ecosystem rehabilitation. This investigation was prepared to provide sound premises for the alternative ecosystem rehabilitation approach for Laguna Salada, and to test hypotheses and assumptions about historical ecology of Laguna Salada – particularly in relation to marsh salinity, hydrology, vegetation, and habitat suitability for endangered species. It is limited to available historical data from photographic archives, maps, herbarium records, and interpretation guided by comparison with coastal lagoon reference sites and studies of other lagoons in the Central Coast region. Emphasis is placed on evidence concerning early 20th century geomorphology, vegetation structure and composition during the because of their relatively clear documentation, their value as indicators for endangered species habitat suitability, and their strong relationship to environmental controls of salinity, hydrologic processes. This synthesis of historical geography, geomorphology, and vegetation data, and particularly our detailed analysis of aerial and ground photo interpretation, is guided by the PWA team's extensive long-term field experience in California coastal lagoons and barrier beach systems.

APPENDIX A. HISTORICAL ECOLOGY AND CONCEPTUAL LAGOON MODELS

Previous assessment of Laguna Salada historical ecology

Two previous reports on Laguna Salada wetland restoration provided very brief assessments of its historical physical geography and ecology. The account of historical ecology presented by the San Francisco Recreation and Parks Department report on Sharp Park marsh habitat restoration alternatives (Tetra Tech et al. 2009) was limited to a brief summary of the earlier PWA Sharp Park resource enhancement plan's conclusions (PWA 1992), an interpretation salinity range from the place-name of the lagoon, and a general reference to "historic aerial photographs":

> Prior to the development of the Sharp Park Golf Course beginning in the 1920s, the Laguna Salada site was characterized by ranch lands, sand dunes, and a large lagoon (PWA 1992). Although it is likely that some freshwater wetlands existed behind the dunes, the common name of Laguna Salada (Salty Lagoon) suggests that the lagoon was formerly brackish to saline. In one of the early photographs of the region, a small channel that connected the lagoon with the Pacific Ocean can be seen, along with a shoreline of relatively low relief. Assessment of historic aerial photographs of the Laguna Salada area indicates that prior to development of the Sharp Park Golf Course and the seawall located west of the wetland complex, environmental conditions at the project site were representative of a coastal lagoon system.
>
> (Tetra Tech et al. 2009, p. 10)

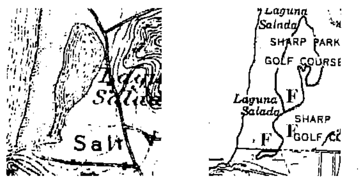
These conclusions require critical re-evaluation based on additional site-specific and regional evidence about historical and modern conditions of coastal lagoons. Some of the key issues raised by the Tetra Tech (2009) assessment of historical ecology include:

Key questions, concepts and hypotheses

One of the fundamental wetland restoration and historical ecology issues for Laguna Salada is whether its "restoration" to a modified approximation of an earlier historical condition would improve endangered species habitat and population viability in the long-term. If earlier historical or more "natural" states of Laguna Salada were incompatible with endangered species habitat, or provided less reliable or productive habitat than enhanced versions of the existing condition, then ecological objectives for lagoon "restoration" (more accurately, ecosystem habilitation informed by local historical ecological models) would differ from objectives for endangered species habitat enhancement.

Therefore, an outstanding question for of historical ecology of Laguna Salada is whether the pre-golf lagoon wetland complex likely supported suitable and substantial habitats for California red-legged frogs and San Francisco Garter Snakes, and if so, where within the lagoon complex it did so, and when. Prior to golf course conversion, the lagoon's landward floodplain and barrier beach were apparently modified to support crop agriculture, and were not in a "natural" condition when filled for golf course construction. This raises a further question of whether the pre-golf agricultural phase of the Laguna Salada wetlands from the golf-era condition, and earlier ranching or pre-agricultural states, in terms of red-legged frog and garter snake habitat. These questions can be reformulated as testable hypotheses.

One hypothesis is that prior to golf conversion, Laguna Salada, as its name suggests, a saline waterbody with relatively uniform saline to brackish fringing marsh (unsuitable for red-legged frogs and snakes) prior to golf course development. This "saline lagoon" hypothesis predicts a relatively uniform salt marsh vegetation, and implies that prevalent salinity ranges or tidal flooding effectively excluded intermittent fresh-brackish habitat suitable for California red-legged frogs – and therefore also no prey base for San Francisco Garter Snakes. This hypothesis implies that contrasting fresh-brackish marsh habitat that exists now developed following (or as a result of) hydrologic changes caused by golf course development and associated shoreline stabilization.



late 19th-early 20th agricultural Laguna Salada 1930s and later Laguna Salada/Sharp Park

SALINE TO FRESH-BRACKISH GOLF CONVERSION HYPOTHESIS: FB – Fresh-brackish salinity range (prevalent bulrush-cattail-tule) = saline-brackish range (prevalent saltgrass-pickleweed) B = brackish range (prevalent alkali-bulrush/pickleweed/saltgrass/jaumea)

A "null" hypothesis that the marsh types and hydrology of Laguna Salada prior to golf management were not significantly different from conditions in the golf period, regardless of net filling of Laguna Salada for construction of golf links. "Significantly different" in this sense refers to important ecological contrasts in marsh vegetation types, wildlife habitat, salinity regimes relevant to the threshold between fresh-brackish and brackish marsh habitat and viability of California red-legged frog populations.

late 19th-early 20th agricultural Laguna Salada 1930s and later Laguna Salada/Sharp Park

NULL HYPOTHESIS (no significant net change): FB – Fresh-brackish salinity range

APPENDIX A. HISTORICAL ECOLOGY AND CONCEPTUAL LAGOON MODELS

An alternative hypothesis is that a complex and dynamic freshwater-brackish gradient (not a uniform or stable marsh type) prevailed in the "natural", pre-agricultural range of variability of Laguna Salada. This hypothesis, based on the regional conceptual model for coastal lagoons (this Appendix volume), predicts a more complex, graded vegetation pattern between seaward brackish and landward fresh-brackish (oligotrophic) and true freshwater floodplain wetlands above normal tidal elevation range that were associated landward supratidal delta of Sanchez Creek. The marsh structure would reflect a dynamic salinity gradient, including stratified lagoon water (fresher on top, more brackish on bottom), variable emergent lagoon flats within (intermittent) tidal elevation range, and fringing marsh associated with higher lagoon levels, above normal tides. This hypothesis predicts persistent fresh-brackish marsh and amphibian habitats concentrated at the landward edge of the marsh, particularly in association with a creek delta or distributary channel system. This alternative "salinity gradient" hypothesis would be consistent with more saline or brackish marsh nearer the seaward (beach) side of the lagoon.

pre-agricultural Laguna Salada late 19th-early 20th agricultural Laguna Salada 1930s and later Laguna Salada/Sharp Park

DYNAMIC LAGOON SALINITY GRADIENT HYPOTHESIS: FB – Fresh-brackish salinity range (prevalent bulrush-cattail-tule) = saline-brackish range (prevalent saltgrass-pickleweed) B = brackish range (prevalent alkali-bulrush/pickleweed/saltgrass/jaumea) Ag – agriculture (crop)

A "hybrid" hypothesis, combining the null and salinity gradient hypotheses with aspects of Laguna Salada's agricultural history, is that the natural salinity range of the lagoon was artificially increased (relative to natural variability) by routine lagoon breaching for drainage of cropland during the growing season. This hybrid hypothesis implies that breaching drained impounded freshwater and caused aseasonal influx of tidewater at lower lagoon elevations, resulting in prevailing brackish open water lagoon and flats, and reduced, marginal fresh-brackish marsh at the landward edge. The transition from breaching to pumping the lagoon for stable drainage and water management (which may have preceded golf conversion, but was at prevalent during golf period) returned the lagoon to a less saline (fresh-brackish) and less fluctuating salinity range.

pre-agricultural Laguna Salada | late 19th-early 20th agricultural Laguna Salada | 1930s and later Laguna Salada/Sharp Park

'HYBRID' HYPOTHESIS: pre-agricultural dynamic salinity gradient converted to more saline or brackish lagoon due to agricultural drainage high lagoon levels from impounded freshwater, achieved by barrier breaching during the growing season. FB – Fresh-brackish salinity range (prevalent bulrush-cattail-tule) = saline-brackish range (prevalent saltgrass-pickleweed) B = brackish range (prevalent alkali-bulrush/pickleweed/saltgrass/jaumea) Ag – agriculture (crop).

Salinity range classification corresponds with the modified Venice system classification of brackish waters in Cowardin 1979: (fresh 0-0.05 parts per thousand [ppt]; oligohaline = below 5 ppt; mesohaline, 5-18 ppt ppt; euhaline, polyhaline 18-30 ppt; euhaline 30-40 ppt)

These hypotheses generate predictions that would be tested by kinds of evidence that could be recovered in historical botanical, photographic, and map information. They could also potentially be tested definitively by direct paleoecological methods (sediment cores revealing marsh stratigraphy, pollen, diatoms, stable isotopes), but no such data are currently available. Some highly useful kinds of data that are readily available from on-line databases, historical floras, and historical photography from local archives, include:

- Plant species records. Plant species with known tolerances for salinity and water depth fluctuations are associated with California red-legged frog habitat today, and may (in part) predict past habitat. Historical herbarium collections (with locality specific to Laguna Salada) are a primary source of plant indicators of past marsh plant communities.

- Historical photographs of vegetation and landforms. Black-and-white photographs from the late 19th or early 20th century often provide identifiable images of vegetation at least to the level of genus or subgenus of dominant species, within the context of landforms (geomorphic features) associated with specific depositional environments and processes. These can be verified by comparison with existing, known reference sites.

- Historical topographic maps. Detailed topographic maps with hydrologic features and major vegetation features were prepared by the U.S. Geologic Survey, and a precursor agency, the U.S. Coast Survey. One map in particular, the USCS 1869 map of the San Francisco Peninsula, provides a simultaneous overview of all mapped coastal marshes and lagoons. The detailed features recorded in this map (a composite based in part on 1850s topographic maps, T-sheets) provide "snapshot" views of shoreline configurations

and channel forms that correspond with known forms and hydrologic processes of lagoon outlets or tidal inlets, as well as artificial drainages.

A-1.2 Methods

Preliminary review of historical ecology data was based on comparisons of historical plant records (herbarium label data), available historical ground and aerial photographs, and two historical topographic maps dated 1869 (based on 1850s topography and updated in 1860s) and 1892. The Consortium of California Herbaria database (2011) was queried for all coastal wetland, beach, and dune plant species currently known from Sharp Park and reference coastal lagoons in San Mateo County and Santa Cruz County. Collections with explicit locality references to Salada, Laguna Salada, and Sharp Park were noted, and these localities were queried for all species. Date, collector, and habitat data were noted and compiled into a partial wetland flora and beach-dune flora. Physical herbarium searches in California Academy of Sciences/Dudley-Stanford herbarium specimen collections (not all of which are currently in databases) were not conducted. One flora with specific locality reference to Laguna Salada or Sharp Park was also reviewed for the candidate wetland species (Thomas 1961), after older floras were searched and found to lack Laguna Salada locality references.

Available historical photographs from published sources and private collections (including photos not previously reviewed in coastal engineering and wetland reports on Sharp Park) were enlarged and examined in detail, with qualitative comparisons among photographs and historical maps. Vegetation and plants were identified to the level of family, subfamily, genus or species based on recognizable vegetative characteristics visible in photographs, based on comparison with modern reference photos and reference site floras. Geomorphic features were interpreted based on comparisons with modern reference lagoons and the conceptual geomorphic model (this Appendix volume) and vegetation and botanical records.

The scope of this preliminary historical ecology review did not include new research in geographic descriptions from earliest U.S. history, European explorer accounts, the Mission period, or Mexican land grant sketches (diseños) accounts. The prospects for ecologically informative information from these sources were reviewed in one recent published historical ecology study of a reference lagoon (Rodeo Lagoon). One early explorer account (Menzies) of lagoons of northern San Francisco is included because it provided explicit descriptions of both freshwater and saline backbarrier lagoons of the San Francisco Peninsula.

A-1. Results

Botanical, photographic, and map data were integrated into chronological interpretations of Laguna Salada's ecological development. These were categorized into broad periods based on land uses visually evident in photographs: the 20th century Sharp Park golf course construction and development period (1930s through modern times), the intensive agricultural period associated with row crops in the landward floodplain of Sharp Park and tillage of the marine terraces in the early 20th century before golf development (and likely late 19th); and the pre-(intensive) agricultural period that likely included dairy ranching (grazing) and earlier aboriginal land uses, including vegetation burning. Most detailed data currently available are concentrated in the 20th century intensive agricultural and golf periods.

Mid-20th century Laguna Salada: Sharp Park Golf Course

Vegetation and plant community composition. Herbarium records from Laguna Salada/Sharp Park dated later than 1930 (Table A-1) show that botanical collections included a mix of species adapted to brackish, fresh-brackish (oligohaline), and freshwater marsh soils with variable water depth ranging from deeply flooded to shallow emergent. No golf era records of common or dominant salt marsh species were found with explicit locality reference to proximity or occurrence within Laguna Salada or Sharp Park in the mid-20th century, even though two occur today in local abundance on the west shore of Laguna Salada and Horse Stable Pond (pickleweed, saltgrass). Only one plant typical of brackish or salt marshes was reported from Laguna Salada during golf period (*source*).

Most of the historical fresh to brackish species occur at Sharp Park today, but some, notably the submerged aquatic plants (pondweeds, wigeongrass) are apparently now absent within Laguna Salada. Some collectors, such as M. Nobs and S.G. Smith, collected a wide range of wetland plants in 1949, suggesting that their purpose was comprehensive local marsh plant collection. The breadth of the 1949 (golf period) Nobs and Smith Sharp Park plant collection strengthens the interpretation of species presence and absence data as indicative of prevalent fresh-brackish marsh normally lacking prolonged periods of near-marine salinity (polyhaline, euhaline marsh salinity) during the growing season. This is similar to the modern condition of Sharp Park, where fresh-brackish (oligohaline) to brackish marsh is prevalent. This fresh-brackish marsh assemblage is consistent with the records of San Francisco Garter Snakes and California red-legged frogs by Wade Fox as early as the mid-1940s, about the same time Nobs and Smith collected their plant specimens. W. Fox recorded San Francisco Garter Snakes at Sharp Park/Laguna Salada on multiple dates in 1946 (contemporary with the aerial photo), on 3/31, 4/6, 4/17, 7/15, 8/13, 8/24, 8/30, 9/12, and 10/11 1946. Fox entry of April 6, 1946 describes the transitional wetland vegetation of the lagoon with regard to snake habitat: "The narrow band of **grass and water plants at the border of the lake** is the only really secure place for the snakes - we found one dead one, presumably killed by golfers - They probably die frequently in this manner." This evidence indicates that fresh-brackish marsh suitable for supporting an ample population of red-legged frogs (prey base for San Francisco garter snakes) was well-established at least as early as the mid-1940s.

Geomorphic and hydrologic features. The July 1946 aerial photograph of Sharp Park (Figure A-1) shows a relatively discontinuous stand of Monterey cypress plantings remaining from earlier 20th century plantations that extended continuously along the back of the Salada barrier beach. This is consistent with either the artificial creation of gaps in the cypress stands, or the natural development of washover fans, or both. The lagoon in its summer condition appears to be drawn down, exposing emergent flats and vegetation, and retaining little open water. The extent of prevailing seasonal water level fluctuations could be estimated only from a large and seasonally well-distributed sample size of aerial photographs. A photo of Mori Point reportedly from 1966 shows shallow surface channel outlet draining Laguna Salada across the beach above tide and swash elevation of the beach foreshore (Figure A-8).

Figure A-1. July 1946 aerial photo enlargement of Laguna Salada. U.S. Geological Survey Aerial Photo (B&W) 7-28-1946. The beach and backshore zone indicates dark grey irregular, continuous woody vegetation, likely Monterey cypress remnants evident in 1930s ground photos (A) on the landward side of the barrier beach. Traces of lightly shadowed lines in the ... zone are likely remnants of early fences and ... of ... planted ... from 1930s plantations. At the north end of the foredunes, unvegetated or very sparsely vegetated sand spreads landward among scattered patches of darker (woody) vegetation, indicating migrating sand from eolian or low-energy overwash processes. Most of the lagoon bed is mottled dark gray with variable texture, indicating emergent (marshy) vegetated condition with relatively little open water habitat. Lagoon fringing marsh vegetation is fresh and fresh-brackish marsh, based on herbarium collections of marshes at Sharp Park by Nobs and Smith in August 1949.

Early 20th century Laguna Salada: intensive agriculture around Laguna Salada

Vegetation and plant community composition. There are fewer botanical records of wetland plants from Laguna Salada prior to 1930, but none of the the five species recorded are emergent salt marsh plants tolerant of brackish to saline (mesohaline to euhaline) soil conditions in the growing season, and two marsh rush species from this era is typical of freshwater to oligohaline marsh, and is intolerant of brackish soil salinity (brown-headed rush, *J. phaeocephalus*). The other rush reported from Laguna Salada prior to 1930, *J. lescurii*, is prevalent in fresh-brackish sandy marsh soils, but is not tolerant of brackish to saline marsh salinity. One of the submerged aquatic plants from the intensive agricultural Laguna Salada era is tolerant of brackish to saline water (wigeongrass, *Ruppia* spp.), but grows better in fresh-brackish salinity range (Kantrud 1990). The other wetland plant recorded from this era, *Chenopodium chenopodioides*, is found on fresh-brackish to brackish sandy flats along the emergent summer bed of Abbott's Lagoon and Rodeo Lagoon today.

The coastal sand dune flora of Laguna Salada prior to 1930 was sampled by W.S. Cooper, who conducted state-wide biogeographic surveys of coastal dune vegetation (Cooper 1930, 1967), as well as other botanists making incidental collections (Table A-2). The dune flora prior to the mass plantings of beachgrass and Monterey cypress included mostly native early-succession beach and foredune species adapted to active sand accretion (yellow and pink sand-verbena, silvery beach-pea, dunegrass,), and at least two species associated with more stable dune vegetation and relatively low rates of sand transport (Franciscan wallflower, dune bluegrass, beach strawberry). Prior to Monterey cypress and beachgrass plantings, photos of the beach seaward of the lagoon show little topographic relief indicating significant dune building, but dunes at the north end of the beach (possibly associated with the low marine terrace) exhibit dune mounds with apparently rapid accretion of fine sand (Figure A-9) – a feature no longer present at Salada/Sharp Park Beach or the shoreline to the north.

Pre-golf photographs of Laguna Salada include one associated with crop agriculture and valley (visible in the in the landward drained floodplain in the background) showing a prevalence of extensive emergent bulrush and cattail vegetation along the landward shoreline of the lagoon. Cattails (*Typha* sp., likely *T. latifolia*) are clearly identifiable; other species are bulrushes including alkali-bulrush (*Bolboschoenus maritimus*), and other bulrush species undetermined, but including likely small patches of tule (*Schoenoplectus acutus* or *S. californicus*) (Figure A-2). Cattail-bulrush marsh is associated with fresh, fresh-brackish, or brackish marsh, but not salt marsh, and robust, vigorous growth of cattails is associated only with relatively low salinity early in the growing season. The date of this key agriculture-period photograph is likely from the late 1920s or early 1930s.

Geomorphic and hydrologic features. Salada Beach during the later crop agriculture period was modified with either windbreak or stabilization plantings of Monterey cypress, forming a continuous young evergreen plantation landward of two sand-fence lines planted with European beachgrass, which formed two low foredune ridges (Figure A-3). The lack of gaps in these plantings indicates a prolonged period in which overwash was not occurring. This may have been due to the modified elevated dune topography, or from insufficient winter storm energy coinciding with high tides. The lagoon appears to have been drained at the south end, adjacent to

Mori Point, where there was a contemporary gap in the beachgrass and Monterey cypress plantation. At this gap, sandy flats (Figures A-2, A-3) occur. Figure A-2 shows a wooden structure (likely a flume and gate) are visible on the beach below Mori Point, next to an electrical utility pole also installed on the beach (Figure A-2). Evidence of the intermittently drained lagoon condition is provided by a photograph showing emergent flats around discrete or coalescing tall emergent marsh stands (likely bulrush, bulrush-cattail), occurring landward of the Monterey cypress windbreak plantation on the beach, associated with the south end gap/bare beach sand flats. Figure B2 also shows the extensive water surface of a flooded lagoon behind the Monterey cypress plantation.

Some cropland-era photos of Laguna Salada and Salada Beach precede the stabilization plantings of beachgrass and Monterey cypress. They show a fringing (dark) marsh along the landward edge of the barrier beach and open sandy washovers, and low dunes at the north end of Salada Beach and northward (Figure A-4). The lagoon photos prior to the Monterey cypress plantation exhibit very extensive (full, deeper) open-water lagoons with little emergent marsh, and at least one narrow, parallel-edged canal extending perpendicular to the shoreline through the fringing marsh and partially across the beach profile (Figure A-5). The canal in Figure A-5 terminates in a dark (likely wooden) linear structure in the beach. This canal feature is associated with a light, linear feature in fringing marsh on the north side of the canal, but not washover fans that would be associated with a natural breach closure.

This channel feature is interpreted as an excavated canal with side-cast sandy dredge spoils. The canal would likely have functioned as a pre-constructed breach, allowing rapid breaching and drawdown of the lagoon on low tides by excavating beach sand seaward of the canal terminal structure (flume gate). No dune topography is visible on the flat-topped beach ridge. Artificial breaching would be expected as necessary for establishing positive drainage or lowering groundwater of the farmed floodplain. Breaching during the agricultural growing season would be expected to allow seawater pulses to enter the lagoon until constructive wave action sealed the breach with a sand (swash) bar.

Above Laguna Salada, perched in the steep lower hillslopes above its lowland crop agriculture fields, is an artificial impoundment (likely a reservoir) (Figure A-6). Below the impoundment is a creek channel draining south (with riparian vegetation descending towards the lowlands), and a smaller ditch (possibly an irrigation ditch) draining west. The impoundment is apparently associated with crop agriculture irrigation below. This freshwater impoundment suggests a potential freshwater pond and wetland habitat capable of providing additional California red-legged frog and San Francisco Garter Snake populations in the watershed. No impoundment or antecedent pond in shown in the 1892 topographic map covering the Laguna Salada watershed (Figure A-7); only the Skyline sag ponds are evident in earlier topographic maps of the Peninsula (Figure A-8).

Figure A-1. Late agricultural period (early 20th c, pre-golf) Laguna Salada. View towards east of landward shore of Laguna Salada with highly visible emergent fresh-brackish to brackish marsh vegetation indicators (cattail and bulrush), simultaneous with truck dumping earthen fill (for perimeter road or berm construction) during agricultural land use (cropland shown in background, prior to golf course construction). Undated photo estimated 1920s to early 1930s. The identifiable wetland and aquatic vegetation visible in the foreground includes vigorous, tall cattail with lax broad blades (*Typha* sp, foreground right, green arrow;, alkali-bulrush (*Bolboschoenus maritimus*), a few straight rigid stems of tule (*Schoenoplectus californicus* or *S. acutus*), with either sago pondweed (*Stuckenia pectinata*), wigeongrass (*Ruppia maritima*), or both, on water surface. The background emergent grass-like marsh vegetation is not identifiable to species or genus, but is consistent with short or deeply flooded cattail or tall bulrush marsh, such as *S. pungens* (fresh to brackish marsh plant that was collected at Laguna Salada in 1908, long before Sharp Park golf course (Table A-1). This vegetation is inconsistent with salt marsh hydrology and vegetation (shrubby pickleweed or prostrate saltgrass). None of the plant species shown (except *Ruppia*) are tolerant of prolonged high salinity. The fresh-brackish marsh species inferred were subsequently vouchered by herbarium specimens from Sharp Park/Laguna Salada marshes in 1949, and are still present in modern fresh-brackish Laguna Salada marshes. All species shown are typical of fresh-brackish coastal marshes inhabited by California red-legged frogs in coastal San Mateo County today.

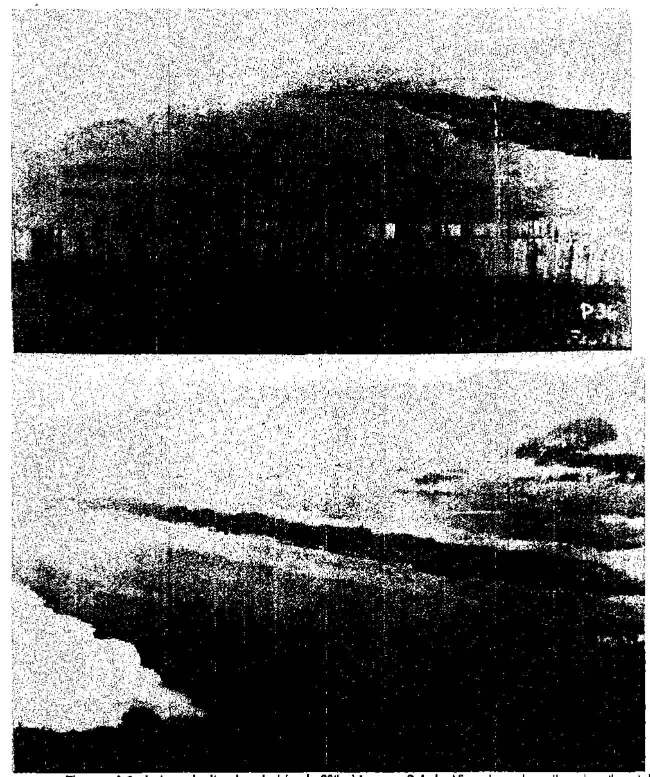


Figure A-2. Late agricultural period (early 20th c) Laguna Salada. Views towards north and northeast. Prominent pre-golf agricultural era features include: a wooden (flume) structure (red arrows) extending into the beach below Mori Point, next to an electrical power line on beach extending to near its seaward end; two outer low artificial wind-fenced foredune ridges with planted beachgrass (*Ammophila arenaria*); and an inner cover Monterey cypress plantation along the barrier beach, nearly continuous (no washover gaps) along its back. A wide flooded lagoon with emergent marsh (compare next Figure A-3), earlier, with sandy gap at south end of beach) and open water lies seaward of cropland. Photo courtesy of private collection.

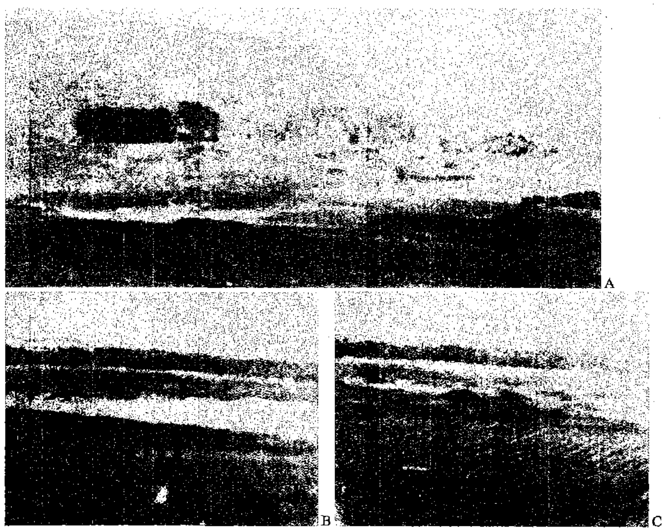


Figure A-3. Late agricultural period (early 20th c) Laguna Salada, enlarged cropped views of Laguna Salada to southwest from hillslopes above. Photograph undated, but taken after establishment of nearly closed-cover cypress plantation on beach; likely circa late 1920s, but prior to installation of electrical utility poles to the end of the flume below Mori Point (shown in Fig. A-2). Emergent (drained) unvegetated lagoon flats and emergent marsh vegetation are evident in the lagoon. Row crops (likely artichoke) occupy the lagoon valley floodplain, indicating land use dependent on drainage or low lagoon levels. An unvegetated emergent flat to gently sloping sandy gap in the cypress on barrier beach occurs at the extreme south end of the lagoon (yellow arrow, A), consistent with location washover sedimentation over a breach (potential lagoon outlet position). Dark vegetation on barrier beach corresponds with Monterey cypress plantation in other early 20th c photos. Vegetation structure and pattern on lagoon flats is consistent with bulrush, cattail, tule (tall emergent grass-like morphogy and clonal growth) and incomplete colonization of lagoon flats. Photo courtesy of private collection.

APPENDIX A. HISTORICAL ECOLOGY AND CONCEPTUAL LAGOON MODELS

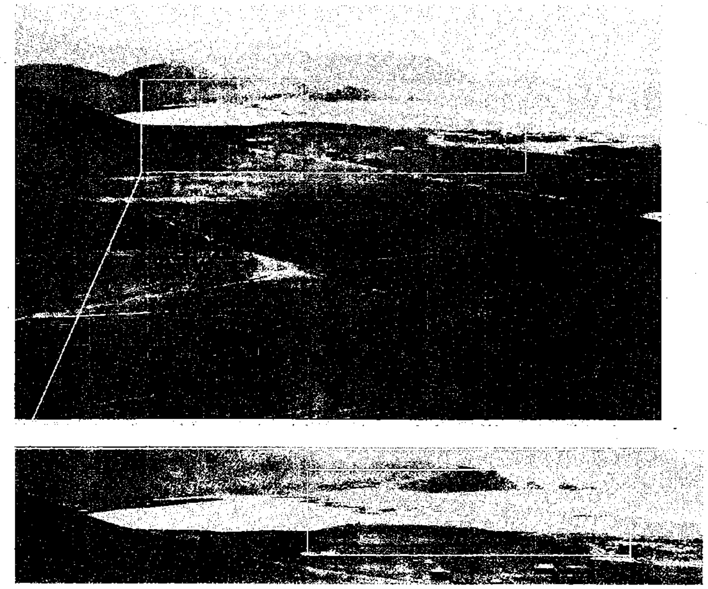


Figure A-4 . Early agricultural period Laguna Salada, undated photograph circa late 19th c – early 20th c prior to cypress plantation on beach, viewed from marine terrace north of Laguna Salada, which lacks natural vegetation patterns and shows uniform cover and plow lines, consistent with cultivation. Dark zone between open water and beach is consistent with fringing marsh. A canal-shaped narrow, linear breach terminating in a dark line (likely wooden structure) is consistent with an excavated canal for a pre-constructed breach to lower the lagoon levels on neap low tides, corresponding with the view shown in the next historical photo of the lagoon prior to cypress plantation establishment (Figure A-5). Lagoon breaching was a common farming practice in floodplains bordering California coastal stream mouths in 20th century (now regulated by federal and state permits).

[illegible]

Figure A-6. Early agricultural period Laguna Salada, undated photograph circa late 19th c – early 20th c prior to cypress plantation on beach; view to southwest towards Mori Pt (left). Lagoon appears substantially similar to the condition shown in preceding Fig A-4. Narrow nearly straight canal (pre-constructed artificial breach; inset, enlarged) extends partially across beach and fringing marsh, parallel with bright linear feature consistent with placement of sandy dredge spoils to north (right), and in the absence of gently sloping natural washover fans or flood inlet shoals over marsh. The canal is consistent with patterns of artificial excavation. No fringing marsh is visible along the landward edge of the northern half of the lagoon, but marsh (dark) is visible at the south end. Source: [illegible] 1908.

APPENDIX A: HISTORICAL ECOLOGY AND CONCEPTUAL LAGOON MODELS

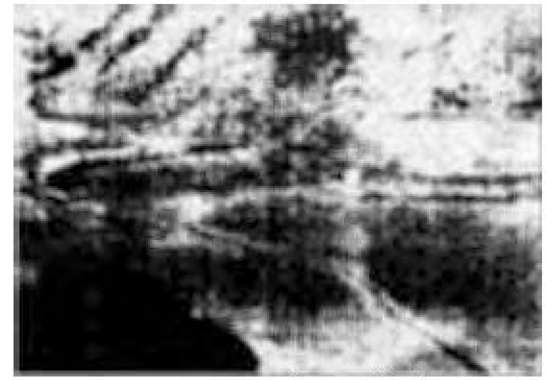


Figure A-8. Impoundment, likely an irrigation reservoir, near the of hillslope above Laguna Salada, with ditch (center) and vegetated channel (right center) downslope. Photography likely late 1920s, early 1930s, annotated "Sharp Park". Courtesy of private archives.

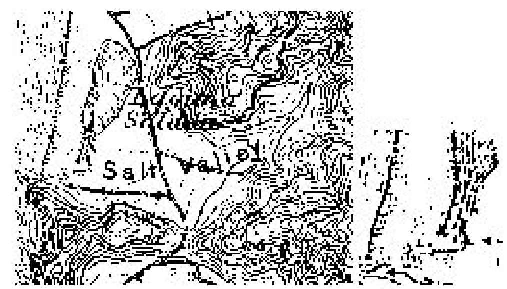


Figure A-7. Topography and shorelines of Laguna Salada, late 19th century, excerpt of 1892 U.S. Geological Survey. No impoundments (artificial ponds) are shown in the watershed above Laguna Salada, and no marsh symbol appears in the former mapped marsh fringe at the southeastern end of the lagoon, where drained row crops are visible in early aerial/ground photography (Figures A-4, A-5). One road is shown ascending from the main N-S coast road near Mori Point, and another road ascends up the "Salt Valley". At the landing from the east end of the southern neck of the lagoon road [illegible] in a straight path to the wave shelter zone of the Mori Point headland. This line does not appear in the 1899 USGS map, but is consistent with a former outlet position in the mid 20th century (Figure A-5).

Figure A-8 . Mori Point outlet draining remnant of Laguna Salada at Sharp Park Golf Course, reported date 1966. The shallow channel bed is incised in the beach above the elevation of the swash, with a swash bar forming below the mouth of the outlet. Not tidal inlet morphology is evident. Photo courtesy of private collection.

Figure A-9. Salada Beach, North, circa 1900. Active deposition of wind-blown fine-medium sand in steep vegetated dune mounds with vegetated caps and windward slopes, and unvegetated wind-shadow deposits, and pioneer native perennial prostrate dune forbs. View towards Mori Point and Pedro Point.

Table A-1. Historical Local Wetland Flora of Laguna Salada. Data source: Consortium of California Herbaria, searched by locality (Laguna Salada, Salada, Sharp Park, marshes at Sharp Park), collector, species. Species collected before 1930s (before Sharp Park) are highlighted in red. Additional species found in Sharp Park today but not reported with explicit Sharp Park/Laguna Salada localities are highlighted in blue. Note that salt marsh dominant or indicator species were not historically recorded at Sharp Park prior to 21st century, and all species recorded from 1930 or earlier are intolerant of marine salinity, but are widespread regionally in fresh to brackish coastal marshes. These fresh to brackish species also occur in the mid-20th century and modern golf period. Salinity range classification corresponds with the modified Venice system classification of brackish waters in Cowardin 1979: (fresh 0-0.05 parts per thousand [ppt]; oligohaline = below 5 ppt; mesohaline, 5-18 ppt ppt; euhaline, polyhaline 18-30 ppt; euhaline 30-40 ppt)

Species	Common name	Herbarium Accession no.	Collector & #	locality & habitat	date	2010 local status	Soil salinity range (coastal CA marsh)
Agrostis alba	bentgrass	[illegible]	Malcolm A. Nobs and S. Galen Smith 1550	marshes Sharp Park	Aug 25 1949	Present (syn. *A. stolonifera*)	Fresh to oligohaline
Agrostis exarata	bentgrass	[illegible]	Malcolm A. Nobs, S. Galen Smith 1562	marshes at Sharp Park	Aug 25 1949	?	Fresh to oligohaline
Agrostis stolonifera	bentgrass	[illegible]	Malcolm A. Nobs, S. Galen Smith 1550	Marshes at Sharp Park	08 25 1949	common	Fresh to oligohaline
Artemisia douglasiana	mugwort	[illegible]	Gordon H. True, Jr. 803	along Salada Beach-Skyline Blvd.	Jul 23 1937	not found	fresh
Argentina egedii (syn. Potentilla anserina)	silverweed	no specimens	------	not reported	----	present	oligohaline to mesohaline
Bolboschoenus fluviatilis	River bulrush	[illegible]	Malcolm A. Nobs, S. Galen Smith 1557	marshes at Sharp Park	Aug 25 1949	not found	fresh
Bolboschoenus maritimus	Alkali-bulrush	[illegible]	Lewis S. Rose 35565	Salada	Aug 13 1935	not found	olighhaline to mesohaline
[Distichlis spicata]	saltgrass	No specimens	---	---	---	present (west shore)	mesohaline to euhaline
Epilobium ciliatum subsp. watsonii	Willow-herb	[illegible]	Malcolm A. Nobs and S. Galen Smith 1548	marshes Sharp Park	Aug 25 1949	present	fresh
Isolepis cernua	Club rush	[illegible]	S. Galen Smith, Malcolm A. Nobs 1565	Marshes at Sharp Park	08 25 1949	not found	Oligohaline to mesohaline
Jaumea carnosa	Fleshy jaumea	[illegible]	L. S. Rose	Salada	Aug 13 1935	present	Oligohaline to euhaline
Persicaria punctata (syn. P. punctatum	Dotted smartweed	[illegible]	Malcolm Nobs and S. Galen Smith 1560	Sharp Park; marshes	Aug 25 1949	present	Fresh to oligohaline
Parapholis incurva	sicklegrass	[illegible]	S. Galen Smith & Malcom Nobs 1566	marshes at Sharp Park	Aug 24 1949	not found	Oligohaline to euhaline
[Sarcocornia pacifica, syn. Salicornia	[pickleweed]	No specimens	-----	Salada Laguna Salada	[2010]	present	Mesohaline, euhaline to hyperhaline

virginica)				Sharp Park			
	Threesquare bulrush	[illegible]	W. R. Dudley				
Schoenoplectus pungens	Threesquare bulrush	[illegible]	S. Galen Smith, Malcolm A. Nobs 1558	Marshes at Sharp Park	08 25 1949	common	Fresh to mesohaline
Scirpus microcarpus	Small-fruited sedge	[illegible]	Malcom A. Nobs, Stanley Galen [S. Galen] Smith 1559	Marshes at Sharp Park.	1949-08-25	not found (present Sanchez Ck)	Fresh to oligohaline
Stuckenia pectinata (syn. *Potamogeton pectinatus)*	Sago pondweed	[illegible]	Malcolm A. Nobs, S. Galen Smith 1552	Sharp Park	Aug 25 1949	not found (present Mori Pt ponds)	Oligohaline to mesohaline
Typha angustifolia	Narrow-leaf cattail	[illegible]	Malcolm A. Nobs and S. Galen Smith 1556	marshes at Sharp Park	Aug 26 1949	common (nonnative)	Fresh to mesohaline
Typha latifolia	Broadleaf cattail	[illegible]	Malcolm A. Nobs and S. Galen Smith 1554	Sharp Park - along ocean coast	Aug 25 1949	common	Fresh to oligohaline

Table A-2. Historical Local Beach and Dune Flora of Salada Beach (Sharp Park Beach). Data source: Consortium of California Herbaria, searched by locality, collector, species.

Species	Common name	Herbarium Accession no.	Collector & #	date	locality & habitat	2010 local status
Abronia latifolia	Yellow sand-verbena	UCD39613	Beecher Crampton 6509	06 11 1962	Pacifica, Sharp Park at Mori's Point	extirpated
Abronia umbellata	Pink sand-verbena	UC577087	Lewis S. Rose 35654	Oct 12 1935	Salada	extirpated
Centromadia parryi subsp. *parryi*	Parry's tarweed	JEPS35137	L. M. Newlon 239	Jan 1 1921	seashore from Salada to Mussel Beach	extirpated
Erysimum franciscanum	Franciscan wallflower	JEPS53557	William S. Cooper 16	May 28 1925	Salada	
Lathyrus littoralis	Silvery beach-pea	POM194715	H. M. Hall 11957	06 17 1924	Salada	extirpated
Lathyrus littoralis	Silvery beach-pea	JEPS22683	Irene Brown 151	May 15 1959	about 50 feet from Ocean, Sharp Park	extirpated
Eriogonum latifolium	Broadleaf coast buckwheat	JEPS56735	William S. Cooper 10	May 28 1925	Salada	extirpated
Fragaria chiloensis	Beach strawberry	UC1536919	Gordon H. True 616	Mar 31 1937	Salada Beach	extirpated
Leymus mollis subsp. *mollis*	Pacific dunegrass	JEPS71209	William S. Cooper 8	May 28 1925	Salada	present
Leymus mollis		UCD61581	Beecher Crampton 6511	06 11 1962	San Mateo County: Sharp Park, Mori's	present
Poa douglasii	Dune bluegrass	UC1537366	Gordon H. True, Jr. 618	Mar 31 1937	Salada Beach	extirpated

Early U.S. historical period prior to Laguna Salada valley/floodplain farming

There are no known botanical data or direct vegetation descriptions currently available to guide interpretation of U.S. Coast Survey maps of the early U.S. historical period, which likely represented the condition of the lagoon in transition from known Ohlone land uses (hunting, trapping, textile vegetation harvest, vegetation management by burning) to ranching (low-intensity agriculture; grazing). New research would be required to provide direct evidence from either pollen/sediment cores (paleoecology) or historical records including explicit, detailed, descriptions or drawings of vegetation and hydrologic features to guide interpretation of the U.S. Coast Survey maps of the mid-19th century covering what is now the Pacific coastline. The USCS topographic maps, and their mapping conventions for drainage and vegetation features, are the only indirect source of information used for the assessment of the early historical wetland landscape of Laguna Salada and its surrounding watersheds.

Distribution of 19th century coastal lagoons and ponds on the San Francisco Peninsula outer coast

The U.S. Coast Survey Map of the San Francisco Peninsula dated 1869 represents the topography of all large perennial pond and lagoon features of the Peninsula, including Laguna Salada, Lake Merced, and the lagoon of San Pedro Creek, as well as the upper hillslope sag ponds ("Skyline sag ponds"; seismic wetland features, natural drainages impounded by earthquake fault blocks) in a single map. Relatively small pond and lagoon features are also shown in San Francisco (Laguna Puerca, Laguna Honda, Mountain Lake, Black Point vicinity lagoons, and two tidal lagoons near Hunters Point; Fort Point lagoon in earlier 1851 USCS T-sheet 314 is shown in Figure A-20).

The 1869 USCS map of the San Francisco Peninsula indicates that large perennial pond habitats were few, sparsely distributed on the peninsula as a whole (only the Skyline sag ponds and Black Point lagoons were closely spaced). Within the known 20th century range of the San Francisco Garter Snake, the only historical (outer/maritime) coastal lagoons north of Montara Mountain and Pedro Point were Pedro Creek lagoon and Laguna Salada. In the absence of any other large coastal ponds, the map suggests that the potential locations of historical core (large, stable) perennial habitats of the pond-breeding California red-legged frog and the San Francisco Garter Snake on what is now the Pacifica coast were limited to these locations in the 19th century, depending on their habitat suitability – particularly their salinity range. Therefore, the analysis of the types of marshes represented in the 19th century U.S. Coast survey maps is of particular relevance to historical wetland ecology.

Figure A-10. Excerpt from the 1869 U.S. Coast Survey map of the San Francisco peninsula, showing distribution of naturally impounded waterbodies (lagoons, ponds shown in blue arrows) along the outer coast and in the lee of the first coastal ridge (Pacific coast watersheds). Shown are fault-controlled ridgetop Skyline sag ponds, backbarrier lagoons at Laguna Salada and San Pedro Creek mouth. Riparian vegetation is shown discontinuously distributed along Calera Creek (Calera Valley); no riparian vegetation is shown in the creek of Salt Lake Valley (Laguna Salada watershed), which terminates before reaching the lower valley.

The only potential major "core" freshwater pond habitats in watersheds surrounding Laguna Salada in 1969 are shown at the mouth of San Pedro Creek (lagoon) and the Skyline sag ponds. If some portion of Laguna Salada wetland complex did antecedent natural local populations of red-legged frogs and San Francisco Garter Snakes in suitable fresh-brackish marsh in 1869 or before, then the 20th century populations of Laguna Salada red-legged frogs and San Francisco Garter Snakes would have to represent new colonization events of both species. Both species

APPENDIX A. HISTORICAL ECOLOGY AND CONCEPTUAL LAGOON MODELS

presumably would have had to disperse jointly, or fog prey species first, to Laguna Salada from the nearest source populations and habitats either during the subsequent farming period or during the 20th century golf development period, when wetlands were apparently greatly reduced by farming and filling of wetlands and floodplains. The long-distance dispersal distances required for new colonization of Laguna Salada from the locations of original, natural 19th century freshwater pond habitats would have been extreme, particularly for San Francisco garter snakes, which are not known to occur today in the San Pedro Creek watershed (inhabited by a distinct subspecies). This biogeographic context is a consideration for interpretation of the Laguna Salada wetland complex illustrated in the 1869 USCS map.

U.S. Coast Survey wetland symbols within Laguna Salada and regional reference coastal lagoons

Laguna Salada is represented in the 1869 U.S. Coast Survey Map with map conventions (symbols) denoting landform and vegetation features (Figure) including beach (stippling over shoreline), marsh (horizontal hatching, parallel lines closely spaced at or near sea level bordering open lagoon flats and flat adjacent terrestrial lowland topography, small marsh channels (lines following drainage patterns or connected to water bodies) and valley lowland flats (widely spread contours and low elevations in valley).

The interior of Laguna Salada, in contrast with Lake Merced and San Pedro Creek lagoon (the only other outer coast lagoons), is uniquely mapped with stippling with lower density than the adjacent beach, in contrast with the darker uniform gray tone denoting open permanent water of all other coastal lagoons and interior ponds and lakes on the same map. In context of the small Laguna Salada watershed (relatively low stream discharge compared with Lake Merced and San Pedro Creek watersheds), termination of the tributary creek channel above the marsh, and closed lagoon outlet at the beach, this feature likely indicates a very shallow lagoon bed with either seasonal or episodic emergence of lagoon flats. Emergent lagoon flats are also evident in an early 20th c photograph (Figure A-3), and are known to occur in modern lagoons during post-breach lagoon drawdowns, and during summer drought periods (WWR 2007).

Coastal landform and vegetation symbols not represented in the 1869 map of Laguna Salada include dunes (concentration of stippling in mound or hillock pattern on or behind beaches), tidal marsh channels (sinuous, dendritic channels connected to open tidal waterbodies), and woodland (tree/shrub canopy symbol), but woodland was mapped within the marsh-floodplain complex of nearby San Pedro Creek mouth and adjacent upper Calera Valley (Figure A-10). This suggests that the terrestrial or seasonal wetland vegetation surrounding Laguna Salada was principally grassland, forbs and low-growing coastal shrubs, or other low-growing vegetation.

Figure A-11. Excerpt of 1869 U.S. Coast Survey Map of San Francisco Peninsula, showing Laguna Salada and "Salt Lake Valley" with lower portion of creek (now Sanchez Creek). A. Beach. B. unvegetated lagoon – seasonal or intermittently emergent bed, unvegetated flats or open seasonal shallow water lagoon (stipple). C. closed remnant tidal position. D. northern sandy fringing marsh. E. southeastern marsh with three channels connected to lagoon. F. Marsh islet opposite inlet channel (likely delta lobe remnant). G. coastal road. H. terminus of Sanchez/Salt Lake Valley Creek.

Figure A-12. Overlay of modern U.S. Geological Survey topographic quad for streets, shorelines and streams of Mori Point and Laguna Salada on U.S. Coast Survey topography (1869) for San Francisco Peninsula, prepared by Golden Gate National Recreation Area. All historic marsh (horizontal hatching) is located in areas of modern fill. (Courtesy of National Park Service).

The habitat and vegetation interpretation of the marsh symbol mapped at the fringes of Laguna Salada, particularly at the southeastern corner below the creek channel in the upper watershed, is uncertain. The range of coastal marsh types represented locally by the general horizontal hatching symbol in coastal lagoons is indicated in part by their most widespread applications in the 1850s-1860s U.S. Coast Survey maps of the San Francisco Bay area, but also by "inter-calibration" (Stripler et al. 2004) of their context with other mapped hydrologic and geomorphic features in specific local wetland settings on the adjacent outer coast.

The most widespread application of the horizontal hatching marsh symbol is in tidal salt marshes of adjacent San Francisco Bay, where they are associated with dendritic tidal creek mouths that were clearly represented as open to the tidal waterbody of San Francisco Bay (Figure A-13). The contemporary horizontal hatching marsh symbol was also applied to other coastal lagoon and marsh geomorphic settings of the Peninsula, San Francisco Bay, and adjacent outer coast where it was not consistent with tidal salt marsh. Two coastal lagoon contexts incompatible with tidal salt marsh interpretation of the hatching symbol are (a) adjacency to closed tidal inlets of barrier beaches, excluding regular tidal flows, and (b) enclosure within contrasting vegetation symbols representing woody vegetation. Woody vegetation (including swamp and riparian vegetation in or adjacent to waterbodies) in California is intolerant of brackish or marine soil salinity levels. Hatched marsh surrounded by riparian woodland, and disconnected from tidal channels, is inconsistent with interpretation as tidal or non-tidal salt marsh. A key example of this non-conforming use of the horizontal hatching marsh symbol is found at San Pedro Creek lagoon. An additional non-conforming example of hatching representing brackish to fresh irregularly tidal or seasonally tidal to nontidal marsh is from Rodeo Lagoon (Stripler et al. 2004). These are examined in detail to check interpretation of marsh mapped at Laguna Salada in the 1869 USCS map.

A B C D

Figure A-13. Comparison among marsh representations in 1869 U.S. Coast Survey map of San Francisco Peninsula: San Bruno tidal salt marsh (A), Laguna Salada landward fringing marsh (B), San Pedro Creek mouth lagoon (C; see also full view, Figure A-11), mouth of San Francisco Presidio Marsh, with possible impoundments (now near modern Crissy Field, D). Tidal salt marshes at San Bruno and Presidio (A, D) are shown with open tidal channel connections to the bay or Golden Gate, and exhibit sinuous, dendritic channel patterns with no inclusions of woodland vegetation symbols within tidal marshes mapped by horizontal hatching – a general feature of San Francisco Bay tidal salt representation of tidal salt marsh. The horizontal hatching marsh symbol is also applied to San Pedro Creek lagoon mouth marsh near the outlet, where it includes island-like "strings" of (salt-tolerant) riparian scrub, and borders extensive riparian scrub within the creek floodplain. The same hatching symbol is also applied to southeastern Laguna Salada marsh (B, and Figure A-11) with nonsinuous channels oriented in a pattern consistent with relict stream mouth delta drainage and a marsh-capped delta shield islet. The use of this symbol in contrasting salinity settings (compare Figure A-4) indicates a wide range of coastal marsh vegetation, hydrologic settings on the region (fresh, brackish, saline) to which it was applied at the time.

The horizontal hatching marsh symbol at the landward end of Laguna Salada 1869 U.S. Coast Survey map is associated with a closed lagoon outlet (beach impoundment of the lagoon) at the south end of the barrier beach. The lagoon outlet is also shown as closed in the and 1892 U.S. Geological Survey Map (Figure A-7). This closed beach and lagoon indicates intermittent, irregular tidal connection, and is consistent with the 19th century U.S. Coast Survey mapping of Rodeo Lagoon's intermittent channel outlet or tidal inlet (Striplen et al. 2004).

The horizontal hatching marsh symbol at Laguna Salada is widest at the southeast corner of the lagoon, below the terminus channel of what is now Sanchez Creek (terminating under the "L" of the printed "Salt Lake Valley"), which did not extend as a single-thread channel through the marsh to the edge of the lagoon. The channel termination is consistent with patterns of canyon creeks that descend in their own alluvial fans or break into diffuse distributary channels with poorly defined, shifting beds and banks. Striplen *et al.* (2004) inferred a similar discontinuous creek, alluvial fan, and delta pattern in the U.S. Coast Survey-mapped mouth of Rodeo Creek discharge into Rodeo Lagoon in the same time period (Figure A-14), prior to diking of the freshwater gradient in the delta marsh.

At the landward edge of the hatching-mapped marsh in the 1869 USCS map representation of Laguna Salada, there is no adjacent representation of woodland (freshwater riparian scrub, willow swamp) , in contrast with the mouth of San Pedro Creek lagoon and Calera Creek (Figure A-10). The lack of riparian vegetation in the lower valley and terrestrial flats bordering the lagoon are possibly due to cattle grazing (consistent with lack of scrub mapped on adjacent hillslopes), cattle grazing following Ohlone grassland burning, or seasonal wetland sedge-rush meadow and grassland. Seasonal wetlands (dry in summer, wet in winter-spring) are expected where stream discharge shifts from channelized flow to diffuse sheetflow and subsurface flow into valley slopes above lagoons (Shaw 2005). The discontinuous channel of Salt Valley (Sanchez) Creek is evident in Figure A-11 at point H.

The 1869 USCS San Francisco Peninsula map represented San Pedro Creek lagoon with the horizontal hatching marsh symbol embedded within irregular areas of woodland/shrub canopy symbol, within the creek's riparian (floodplain) zone (Figure A-15). Woodland species in California are generally intolerant of brackish to saline soil, and in wetlands, they represent freshwater swamp or riparian woodland/scrub. Willow and alder are dominant woody vegetation of coastal stream valleys of the San Mateo coast today, including modern San Pedro Creek. Thus, the multiple patches of horizontal hatched marsh surrounded by the woodland symbol-mapped areas, lacking channel connections to any potential tidal source, must be interpreted as including freshwater marsh or fresh-brackish marsh. The same hatching symbol borders the seaward edge of the woodland symbol, and small isolated "stringers" of woodland symbol (relict channel pattern, not connected to defined channels) occur at the west end of the lagoon marsh. This also indicates that adjacent portions of the marsh are not locally representing saline wetlands at this location.

The geographic context of the horizontal hatching marsh applied to the stream mouth lagoon at San Pedro Creek in the 1869 U.S. Coast Survey Map indicates the freshwater-brackish range of marsh salinity to which this symbol was applied in coastal lagoon settings near Laguna Salada. The horizontal hatching symbol in U.S. Coast Survey maps was where it is most often associated with the characteristic geomorphic "signature" of sinuous, dendritic tidal creek patterns. This symbol was otherwise conventionally used to represent general tidal marsh (mostly saline to brackish) in San Francisco Bay and U.S. Coast Survey maps throughout the U.S. (Shalowitz 1963, Askevold 2005). The use of the symbol at San Pedro Creek lagoon and Rodeo Lagoon indicates that this symbol was not exclusively used to distinguish salt, brackish or fresh-brackish marsh gradients vegetation in coastal marshes.

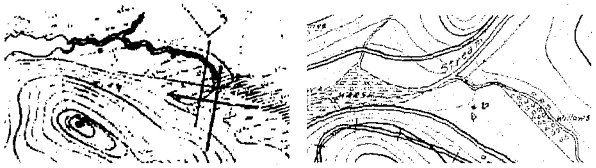
As Striplen *et al.* (2004) noted, historical U.S Coast Survey maps and historical mapping conventions for wetlands did not use modern wetland habitat classifications, but they generally used conventional terminology and symbols that were consistent within their historical context (Striplen *et al.* 2004). The Coast Survey symbols were not always standardized, and individual surveyors for the Coast Survey had wide latitude in the depiction of symbols representing various vegetation types and cultural features on maps (Askevold 2005). The generalized use of hatching to represent marshes with geomorphic signatures that are clearly tidal (dendritic sinuous creeks associated with open bays or open tidal inlets) as well as those with discontinuous straight channel segments or none (Laguna Salada and San Pedro Creek) adjacent to freshwater swamp/riparian woodland, indicates that the 19th c hatching representing coastal marshes did not regularly distinguish tidal salt marsh from, brackish, fresh-brackish marshes, in fully tidal, "semi-tidal" or nontidal coastal wetland settings, at least in the outer coast lagoons.

The Laguna Salada marsh in the 1869 U.S. Coast Survey map is also consistent with the position, morphology, and channel of a broad deltaic marsh discharging into the lagoon, and at least seasonal freshwater discharge or groundwater seepage associated with a fresh-brackish salinity gradient. Within the horizontal marsh hatching at southeastern Laguna Salada, three relatively straight lines perpendicular to the hatching) extend from the edge of the lagoon and converge towards the valley contour line pointing towards the terminus point of the creek. The broad marsh and channel segment patterns are consistent with the geomorphic signature of relict distributary channels of the creek (remnants of erosional high flow events) embedded within its marsh-capped delta. An elongate marsh islet lies immediately seaward of the central distributary channel, consistent with the outline of a former (drowned) marsh-covered delta lobe's outer edge. Marsh is not drawn along the backbarrier edge, in contrast with the photograph in Figure A-4. A small, narrow marsh symbol borders the north end of the lagoon.

The interpretation of a fresh-brackish marsh gradient at the head of Laguna Salada in association with a creek delta is also consistent with the Striplen *et al* (2004) interpretation of the U.S. Coast Survey Map hatching symbol for coastal marsh (contrasting with adjacent wet meadow) at the head of Rodeo Lagoon, and subsequent U.S. Army Corps of Engineers mapping of expanded deltaic marshes at the head of Rodeo Lagoon in the 1920s, prior to construction of a levee/road and weir that isolated a freshwater marsh:

In the 1850s, Coast Survey maps distinctly show the channel of Rodeo Creek stopping just upstream of the Lagoon, fanning out into a wet meadow complex (crosshatching) with no riparian trees ..[series of maps including 1925] ....illustrates the development of a brackish/freshwater marsh at the head of the Lagoon (3 in 14b), most likely in response to grazing-related sediment deposition [Striplen *et al.* Figure 14, p. 25]

...based on similar features (symbols) shown as tidal marsh on USCS maps of other lagoons, we would expect that this feature was semi-tidal and at least seasonally brackish [Striplen *et al.* p. 17]



(a) 1850/53: US Coast Survey (T-321/400) (b) 1925: US Army Corps of Engineers

Figure A-14 . Historical changes at head of Rodeo Lagoon/Rodeo Creek delta showing horizontal hatching in USCS map Rodeo Lagoon at mouth of Rodeo Creek. Excerpt from Striplen et al. (2004) figure 13.(a) hatching marsh symbol marsh within wet meadow (grassland) at the lagoon head, connected with the narrowing open water lagoon; (b) deltaic marsh progradation into the former open-water lagoon, with willows (freshwater swamp/riparian) expanding over former lagoon head wet meadow/marsh. These hatching-represented marshes were interpreted by Striplen *et al.* as brackish to freshwater marsh gradients that were at least intermittently influenced by tides.

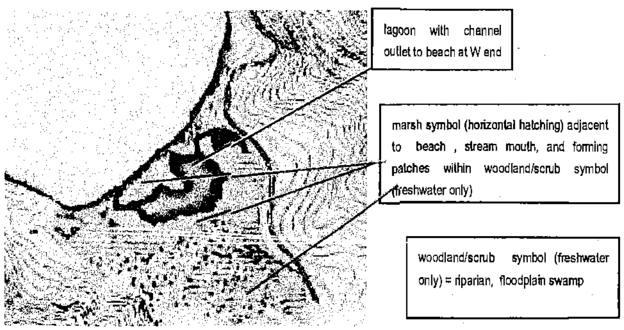


Figure B-15 . San Pedro Creek lagoon (now Linda Mar, Pacifica), U.S. Coast Survey 1869 San Francisco Peninsula map excerpt. Other than Laguna Salada, this is the only other lagoon represented in what is now Pacifica. Here the horizontal hatching symbol surrounding the lagoon, representing marsh, is also shown contiguous and interspersed among irregular areas mapped with a woodland symbol, indicating riparian scrub or swamp, which is exclusively a freshwater (salt-intolerant) vegetation type. Short, irregular linear segments of riparian scrub are represented directly behind the west end of the beach, indicating proximity of freshwater conditions to the backbarrier wetland. The horizontal hatching symbol for marsh extends up to the beach and lagoon outlet. San Pedro Creek lagoon mapping conventions indicate that conventional symbol applied to coastal tidal marshes in San Francisco Bay

was also applied to marshes surrounded by freshwater riparian or swamp vegetation that must have been free from saline tidal influence – i.e, freshwater or fresh-brackish marsh was included in areas represented by the horizontal hatching symbol applied to the San Francisco Peninsula map of 1869. The same horizontal hatching symbol was applied to the southeast corner of the Laguna Salada marsh (Figure).

Additional evidence supporting the interpretation of fresh-brackish marsh gradients at the landward edge of Laguna Salada in the 1869 U.S. Coast Survey map is provided by reference conditions at the heads of modern reference lagoons of the Central Coast from the Golden Gate to north of Monterey Bay. Even where freshwater discharges to lagoons have been altered in the past, there is still a prevalence of salinity gradients with fresh-brackish bulrush and tule marsh at the heads (stream mouth/delta or groundwater seep locations) of most modern coastal lagoons. Representative examples include:

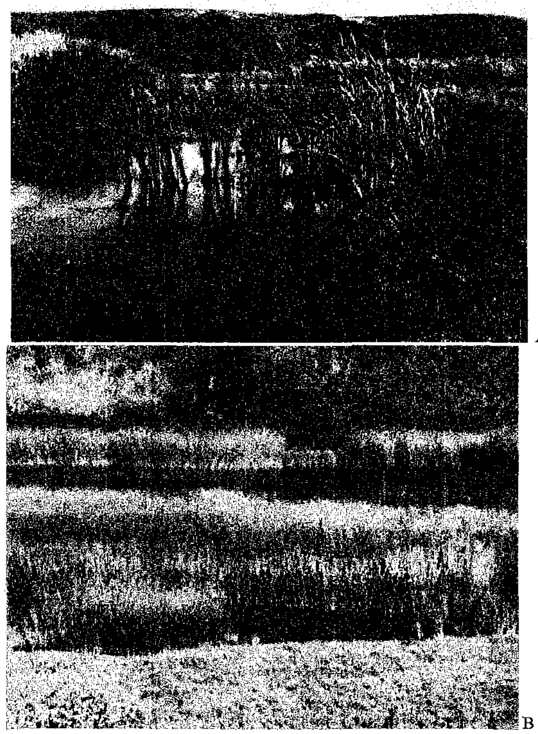
- Laguna Creek Lagoon (Figure A-16): the landward (upstream) ends of these lagoon is generally dominated by fresh-brackish marsh species dominants (bulrush, cattail, tule, spikerush) or riparian scrub, despite seasonal tidal flows at the lagoon mouth. This fresh-brackish landward wetland gradient is associated with red-legged frog habitats (WWR 2007). At Laguna Creek, formerly saline pickleweed marsh is being invaded by fresh-brackish cattail and tule marsh following cessation of crop agriculture in the lagoon floodplain that depended on draining the lagoon (WWR 2007).

- Pillar Point Harbor, San Mateo County (Figure A-17): even at this small beach-choked saline-brackish tidal lagoon with seasonal stream inflows, the landward edge of the brackish marsh grades to fresh-brackish and freshwater marsh maintained by subsurface flows and small stream discharges.

- Rodeo Lagoon, Marin County (Figure A-18): The historic delta of Rodeo Creek and the upper lagoon have been diked by a road that impounds and converts them to freshwater marsh and willow swamp, but the overwash-influenced lagoon below still develops fresh-brackish sedge, cattail, and bulrush vegetation at its truncated head (Striplen et al. 2004).

- The modern San Pedro Creek mouth lagoon in Pacifica (Figure A-19), freshwater to fresh-brackish marsh and pond habitats, extending seaward to the beach, have developed in the absence of a protective high dune, beach ridge, or seawall, despite winter overwash events during major storms. The perennial lagoon's freshwater supply is recharged in summer by low streamflows that are partly impounded by the growth of the cobble and sand berm. Red-legged frogs and terrestrial garter snakes (subspecies similar to the San Francisco Garter Snake) have been confirmed present in and around the lagoon.

There are no modern examples of a seasonally tidal or predominantly nontidal coastal lagoon in this region that lacks a significant fresh-brackish landward wetland gradient. There are no modern or historical examples of nontidal or seasonally (wet season) coastal lagoons in the San Mateo-Santa Cruz region that are predominantly saline or hypersaline, outside of San Francisco Bay tidal marshes.



A

B

Figure A-16. Laguna Creek Lagoon, Santa Cruz County. A. Succession from salt marsh to fresh-brackish marsh following cessation of former drainage for farming in the lagoon floodplain, 2007. Cattail (*Typha latifolia*) and California tule (*Schoenoplectus californicus*) invade pickleweed marsh that was formerly saline due to reduction in freshwater flooding associated with past agricultural drainage. B. Formerly saline pickleweed marsh (foreground) invaded marginally and internally by cattail and tule, grading landward towards open fresh to brackish lagoon and fringing freshwater tule marsh at the landward edge. The lagoon pond at this time was occupied breeding habitat for the California red-legged frog. The lagoon wetland complex is non-tidal in summer, semi-tidal in winter.

A

B

Figure A-17 . Head of Pillar Point Harbor lagoon, San Mateo County, exhibiting salinity-correlated marsh vegetation gradient within a small, sheltered backbarrier lagoon with salt-brackish marsh, pools and flats (pickleweed, alkali-bulrush dominants. (A), bordered by dominant fresh-brackish tule and cattail marsh grading to freshwater marsh (B) at the landward end of the gradient, fed by groundwater seepage and a small seasonal stream. April 2007.

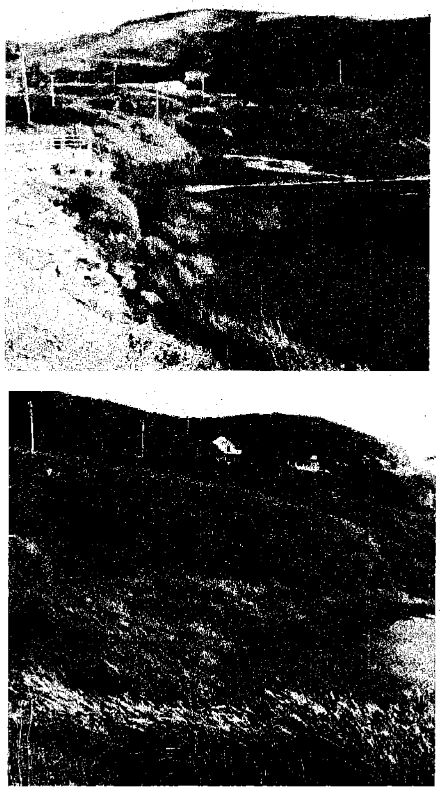


Figure A-18 . Head of Rodeo Lagoon, Marin County, a predominantly non-tidal brackish lagoon grading to fresh-brackish marsh at its landward end, despite partial isolation from its freshwater stream delta. The head of the modem lagoon is here dominated by threesquare bulrush, cattail, spikerush, with slough sedge, typical of fresh-brackish coastal marsh; the adjacent vegetated shallows are dominated by submerged sago pondweed. This marsh is cut off from the freshwater former head of Rodeo Lagoon and the delta of Rodeo Creek, which now form a freshwater marsh above (left of) the road and culvert shown. The seaward end of the lagoon supports more brackish-saline weltands dominated by alkali-bulrush, saltgrass, salt rush, pickleweed, jaumea, and threesquare bulrush, with wigeongrass replacing sago pondweed as the dominant submerged aquatic vegetation.

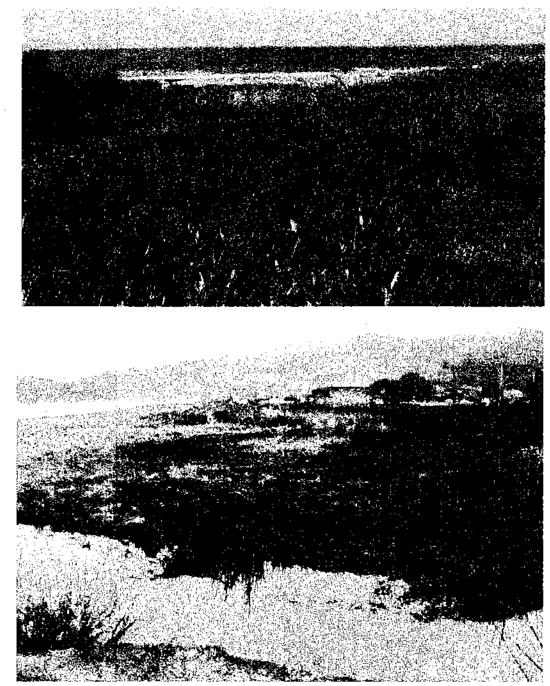


Figure A-19. Modern San Pedro Creek mouth lagoon, Pedro Point, Pacifica in 2008-2009, showing freshwater marsh established directly behind the low barrier beach (A) with an open stream outlet subject to infrequent winter overwash (B). Fresh-brackish and freshwater marsh regenerate annually at the seaward edge of the marsh, and perennial freshwater marsh (bulrush, tule, cattall dominants) is maintained in the low-flow summer season by partial impoundment of the mouth by a low cobble and sand beach berm. The lagoon was excavated as part of the San Pedro Creek flood control and stream restoration project, completed before 2004. California red-legged frog adults and adult terrestrial garter snakes (subspecies similar to the rare San Francisco garter snake) have been confirmed present in the lagoon and its immediate vicinity.

Pre-U.S. historical period (European explorer, Mission, Mexican land grant eras)

The scope of this preliminary historical ecology investigation does not include site-specific analysis of historical geographic descriptions by early explorers of the San Francisco Peninsula, and subsequent settlers of the Spanish mission and Mexican land grant eras. One early explorer account of discovery of a freshwater lagoon in San Francisco (Archibald Menzies' journal, November 1792) is cited here, however, because it provided relevant descriptions of contrasting freshwater and saline to brackish backbarrier lagoons of the northern San Francisco peninsula (Golden Gate and adjacent San Francisco Bay):

> [San Francisco 15th Novr 1792] I met no fresh water stream in all my walk, what they filld our Casks with was from a standing Pond in a Marsh behind the Beach & which provd very good & wholesome.

> [San Francisco] In the morning of the 17th...we found a low track of marshy Land along shore, with some Salt Water Lagoons that were supplied by the overflowing of high Tides & oozing through the Sandy Beach: On these we saw abundance of Ducks & wild Geese. The watering party who/landed before us could meet with no fresh water stream, they were therefore obliged to dig a Well in the Marsh to fill their Casks from, but the Water thus procurd was afterwards found to be a little brackish, which might indeed be expected from the nature of the Soil which was loose & sandy & the little distance it was from the sea on the one side & salt water ponds on the other.

The freshwater "pond in a marsh behind the beach" was likely within the Golden Gate next to Fort Point, corresponding with the location of a cuspate barrier lagoon shown in later U.S. Coast Survey maps of the 1850s (Figure B-20) and a freshwater spring/seep in the cliffs that exists today.

The significance of Menzies' discerning observations of "fresh...good & wholesome", "a little brackish" and "salt" water observations associated with beach and lagoon waters sources in San Francisco is that not all lagoons were either saline or tidal during the early Mission era, and that nontidal freshwater "standing pond" lagoons and "salt water lagoons" with only high tide overtopping were readily observable coastal features.

Menzies' interest in lagoon hydrology and water quality was apparently motivated by searches for shore-accessible potable water to supply his ship. He presented explicit contrasting descriptions of lagoons formed behind sandy barrier beaches in San Francisco, identifying a nontidal freshwater marsh-fringed lagoon, and a "salt" (saline or brackish) water lagoon with seepage and spring tide overtopping connections to the bay:

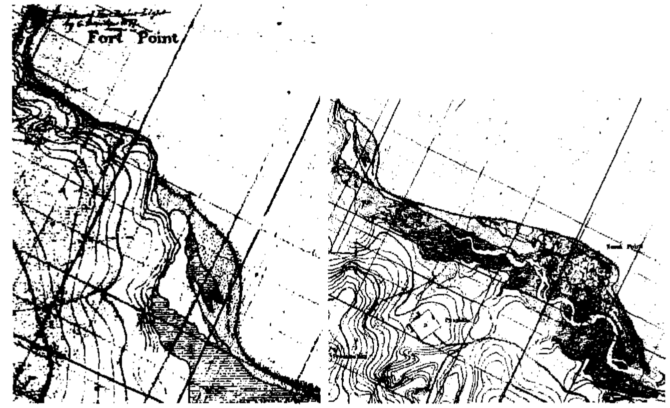


Figure A-20. Fort Point lagoon (nontidal) and adjacent Sand Point/Presidio Marsh tidal lagoon, San Francisco, within the Golden Gate shoreline, represented in U.S. Coast Survey map T-314, 1851. The Fort Point lagoon was located near the position of modern seasonal freshwater springs and seeps in cliffs. These historical lagoons correspond with Menzies' 1792 descriptions of freshwater and saline/brackish lagoons in San Francisco.

No new research in historic geographic descriptive accounts of the San Mateo Coast from the early U.S., Mexican land grant, or Spanish Mission period was conducted for this report. Diseños (Mexican land grant sketches) in general provide some of the earliest detailed maps of some aquatic habitat features in parts of California (often including wetlands and streams; Stein *et al.* 2010). A recent historical ecology investigation of Rodeo Lagoon, Marin County, however, found that the diseño covering its watershed omitted any reference to the lagoon, and revealed little detail about the watersheds associated with Rodeo Lagoon (despite recording Big Lagoon of Redwood Creek, a major freshwater stream with salmon runs), suggesting Rodeo Lagoon's perceived minor importance as a resource at the time of colonization (Striplen *et al.* 2004). Rodeo Lagoon's watershed of 2837 acres is significantly larger than that of Laguna Salada/Sanchez Creek (844 acres). It is uncertain, therefore, whether Mexican land grant historical data would reveal ecologically significant geographical descriptions of Laguna Salada. Additional research beyond the scope of this feasibility report would be required to provide comprehensive historical land use analysis of the Mexican land grant period.

Paleoecological and paleoclimate data from the estuarine wetlands of the San Francisco Bay estuary region indicate that modern (late Holocene) coastal wetlands were associated with slowing sea level rise rates that approached modern sea level in the last 3000-4000 years, and were associated with highly variable climate conditions including extreme droughts and wet periods lasting decades to many centuries (Malamud-Roam and Ingram 2004). The prolonged drought periods, including the periods 1600-1300, 1000-800, and 300-200 years before present, were associated with relatively high salinity conditions in the estuary, including upstream reaches that are brackish to fresh-brackish wetlands today. Prolonged wet periods associated with higher freshwater inflows to coastal wetlands, including the period before 2000, 1300-1200, and ca. 200 years before present, were associated with relatively low salinity in many tidally influenced marshes (Malamud-Roam and Ingram 2004). The 19th century and preceding six centuries were relatively wet and corresponded with low salinity tidally influenced wetlands in the northern San Francisco Bay estuary (Byrne et al. 2001). Comparable wet climate influences at Laguna Salada in the late Holocene (early historical period and Middle to Late archaeological periods) would likely have amplified the freshwater discharges within fresh-brackish gradients of stream deltas or groundwater seeps associated with coastal lagoons.

Conclusions

The summarized chronology of Laguna Salada historical ecology evidence and interpretation is shown in Table B-3. Botanical records and photographic documentation of Laguna Salada vegetation and landforms from the early 20th century indicate that the wetlands of the lagoon supported extensive marsh typical of fresh-brackish wetlands prior to the early Sharp Park Golf era. Despite evidence of artificial breaching when Laguna Salada valley flats were farmed, there are no associated records of salt marsh plants or visible signs of salt marsh dominance in the marsh, and there is strong photographic evidence of tall emergent grass-like marsh vegetation with structure like bulrush or cattail. This evidence is consistent with the hypothesis of relatively little change in fresh-brackish salinity range of wetland types between the agricultural and golf periods of 20th century Laguna Salada.

Typical dominant salt marsh species like pickleweed and saltgrass were not recorded at Laguna Salada in the decades prior to golf conversion. The "saline lagoon" hypothesis – the literal interpretation of Laguna Salada's place-name as a salt pond rather than a seasonally brackish waterbody, is inconsistent with strong floristic (botanical) and photographic evidence. Accordingly, the hypothesis that Laguna Salada was converted from a saline lagoon and marsh system to a predominantly freshwater-influenced wetland by golf development is not supported by historical ecological evidence. The null hypothesis that Laguna Salada supported a fresh-brackish flora and marsh vegetation before and after it was converted from farming to golf is consistent with available historical evidence (not rejected). Evidence of artificial breaching of the lagoon to improve agricultural drainage, however, suggests that agriculture management of the lagoon may have reduced freshwater influence during the growing season and increased growing-season brackish salinity, compared with pre-agricultural conditions. The dynamic fresh-brackish salinity gradient hypothesis is more consistent with the widest range of evidence about Laguna Salada's condition before Sharp Park was constructed.

We conclude that the antecedent condition of Laguna Salada wetlands in the early 20th century during agricultural land uses of the Laguna Salada valley was most likely a dynamic, seasonally variable wetland gradient between fresh-brackish to brackish marsh, lagoon flats, and open

water, with a prevalence of emergent fresh-brackish marsh dominated by bulrush and cattail species. The same wetland vegetation types and marsh species indicated for historical Laguna Salada prior to golf conversion are associated today with coastal lagoon reference sites in the Central Coast region that support red-legged frog habitats, at least at the landward end of the fresh-brackish wetland gradient.

The detailed 1869 U.S. Coast Survey map of the San Francisco Peninsula shows that Laguna Salada was one of very few, widely distributed pond and lagoon habitats along what is now the Pacifica coast: Skyline sag ponds, Laguna Salada, and San Pedro Creek mouth. Laguna Salada was relatively isolated from potential neighboring core freshwater pond habitats and populations sources of California red-legged frogs and San Francisco Garter Snakes in the late 19th century and later. If Laguna Salada did not support antecedent native populations of these species, joint or sequential long-distance colonization by both species (frog/prey first) would be necessary to explain their mid-20th century joint occurrence during the early Sharp Park golf era. The large-scale 19th century distribution of potential core pond habitats of CRLF on the southwestern San Francisco Peninsula, combined with evidence consistent with fresh-brackish marsh at Laguna Salada, suggests that red-legged frogs and garter snakes were pre-existing natural populations at Laguna Salada, rather than the result of s joint colonization events during the 20th century due to long-distance dispersal.

The 1869 U.S. Coast Survey of the San Francisco Peninsula represents Laguna Salada enclosed by Salada Beach, with no open tidal inlet or traces of one. It also shows a wide marsh aligned with a discontinuous creek in the valley above. The marsh is dissected with three channels perpendicular to the marsh/lagoon shoreline, and is fronted by an elongate shore-parallel marsh islet – features consistent with a relict delta and distributary channel system. The marsh type symbol is the same convention used to map coastal marsh at San Pedro Creek mouth embedded within floodplain freshwater woodland, and also identical with the symbol used for Rodeo Lagoon delta marsh at the mouth of Rodeo Creek. The same symbol is more widely used in context of sinuous, dendritic tidal creeks to represent tidal salt marsh in San Francisco Bay. The interpretation of the marsh symbol at mid-19th century Laguna Salada is uncertain, but most consistent with a gradient between seaward brackish and landward fresh-brackish marsh. This interpretation is well-supported by modern reference coastal lagoons in the region.

Table A-3. Synthesis of historic photographic and herbarium data: chronology of Laguna Salada ecology, geomorphology hydrology. Chronology covers historic period, documentary data sources; no paleoecological data specific to this site are currently available.

Date, period	Data sources	Beach and dune	Barrier outlet/drainage	Lagoon & marsh	Lagoon floodplain
1869 pre-cropland (ranching)	USCS topography originally 1850-57, revised 1867 (inland)	Continuous washover; no dune topography shown	**Closed**; no narrow channel; wide beach across neck of relict outlet at Mori Pt; no tidal inlet or flood tidal delta morphology	No backbarrier fringe marsh shown; broad marsh with 3 shore-normal channels and marsh islet at SE lagoon. USCS coastal marsh symbol (hatching) matches symbol at San Pedro Creek lagoon	Not represented; not tule marsh. Likely cattle-grazed lowland grassland, sedge-rush meadow, riparian scrub
1892 likely cropland	USGS topography	open sand, sparse vegetation; no Monterey cypress or beachgrass	**Closed**; linear narrow channel, elongate J-shape, extends from SE end of lagoon to beach; location of 1960s outlet channel and 1930s wide breach	no marsh symbol in USGS 1892 map of Laguna Salada; possible fill or conversion to agriculture	road extends E-W west of coast road
1900s row crops	Historical photos, herbarium record	Low hummock foredunes, native vegetation, active sand accretion, at N end; sparsely vegetated washover on barrier beach, no significant dune topography. No European beachgrass or cypress	**Closed**; Artificial channel cut into barrier, wood weir/retention structure at NW end of lagoon for managed breach. Artificial breaching, lagoon drainage for agriculture in floodplain.	Extensive open water lagoon with fringing marsh. Narrow discontinuous and patchy emergent marsh including threesquare bulrush at lagoon backbarrier shore & partially submerged flats of S and E shore.	Artichoke fields occupy ditched, drained floodplain adjacent to lagoon.
1920s row crops	Historic photos, herbarium label data	Barrier beach stabilized with Monterey cypress grove on landward side of barrier behind double line of sand fence & foredune ridgeplanted with European beachgrass foredune. Native foredune and stable backdune plants present.	**Closed**; likely breach location at south end at Mori bluff (vegetation gap, beach flat). Managed breaching for necessary for draining artichoke fields during spring.	Extensive open water and flats. **Cattail, bulrush marsh** fringing shore; discontinous in fluctuating emergent lagoon flats. Submerged wigeongrass present in lagoon No salt marsh species records.	Artichoke fields occupy ditched, drained floodplain adjacent to lagoon.
1930s Farm-golf transition	Historic photos, herbarium label data	Barrier beach stabilized with continuous 2-row sand fence, outer European beachgrass, inner Monterey cypress grove. Wind-shadow sand deposition behind fences. No overwash.	**Closed.** No breach evident; wooden rectangular structure on beach at S end with electric powerline indicates pump drainage.	Fresh-brackish **cattail, bulrush** marsh widespread in S lagoon flats and shores. submerged sago pondweed present with **cattail** marsh; No salt marsh species records.	Artichoke fields occupy drained floodplain; filling, conversion to golf begins. Salada & Brighton Beach become "Sharp Park"
1940s Early golf	Historic photo, herbarium	Barrier beach retains remnants of beachgrass foredunes and Monterey cypress groves, but washover gaps in vegetation occur at N and S end.	**Closed.** unvegetated or sparsely vegetated gap at Mori Pt (pump location or washover pass? Both?).	Fresh-brackish marsh assemblage (**cattail, bulrush with tule**), comprehensive herbarium collection 1949; No salt marsh species records. CRLF, SFGS confirmed present	Golf links cover floodplain and N backbarrier flats.
1980s-2010 Golf era	Historic photo, site-specific studies (literature cited)	Levee constructed on foredune, crest 3-8 ft above beach, 1980s. Monterey cypress dieback; iceplant prevalent	**Closed.** 1982-3 El Niño overwash fans & throats evident. Pump drainage sets stable low (+7- +8 NGVD) maximum water level.	Fresh-brackish marsh assemblage (**tule-cattail-bulrush**) prevalent, saltgrass-pickleweed local at W lagoon. No submerged aquatic vegetation. CRLF, SFGS confirmed present	Golf links cover floodplain and N backbarrier flats.

A-2 CONCEPTUAL MODEL OF CENTRAL CALIFORNIA COAST LAGOONS

A-2.1 California Central Coast lagoon systems

The Laguna Salada wetland complex is one variation within a spectrum of coastal lagoons in the northern California Central Coast region with similar fish, wildlife, vegetation, and physical processes. Lagoon wetlands form on the landward side of barrier beaches that enclose and shelter them from Pacific Ocean swell. Lagoon wetland physical dynamics and ecology are distinct from inland ponds, even though inland ponds and coastal lagoons support overlapping species. The spectrum of backbarrier lagoon types in the Central Coast region ranges from **tidal lagoons** (also known regionally as **"esteros"**) to **seasonal tidal lagoons,** to **nontidal lagoons.** Tidal lagoons are systems with persistent and relatively stable tidal inlet channels that exchange mostly saline ocean water through an open inlet. Examples include Bolinas Lagoon, Drakes/Limantour Estero, and Bodega Harbor (Table A-4). **Seasonal tidal lagoons** are systems with seasonally or intermittently open inlet connections to estuaries, stream or river mouth channels, and floodplain wetlands. Seasonal tidal lagoons are usually closed in the summer and fall seasons due to high beach berms and low river discharge, and open to variable tidal flows in the late fall to spring due to high runoff. Examples include Salmon Creek, Redwood Creek (Muir Beach), and Laguna Creek (Table A-4). **Nontidal lagoons** are back-barrier lagoons with intermittent and ephemeral outlet channels following episodic storm events that increase lagoon water levels by wave overwash and rainfall runoff. Examples include Abbott's Lagoon and Rodeo Lagoon in Marin County. Laguna Salada is among the few historic nontidal lagoons in this region, and has few analogous counterparts.

> **Lagoons** are water bodies entrapped behind coastal barriers with surface or subsurface connections to the sea. Lagoons form where coastal depressions or embayments are separated from the adjacent sea by a **barrier beach**. There are multiple types of lagoons, ranging from **marine embayments** (sounds), **estuaries** (with significant freshwater inputs), **partly closed lagoons,** and **closed (seepage) lagoons**, including near-freshwater, brackish, and hypersaline lagoons or salt ponds (salinas, sabkhas).
> Sources: Carter 1988 & Cooper 2004

Existing nontidal lagoons in the Central Coast include Abbott's Lagoon and Rodeo Lagoon (Marin County) and Laguna Salada (Table A-4). Of these, only Abbott's Lagoon is relatively unaltered within the lagoon basin, but its barrier beach has been converted from low foredunes to a continuous high foredune ridge dominated by invasive European beachgrass that alters its breach and washover dynamics. Rodeo Lagoon has retained its natural low native foredune vegetation, washover terrace, and breach dynamics. At its end, a road and culvert separates its upstream freshwater gradient from the main fresh-brackish lagoon, and has endured relatively little artificial filling in its floodplain. The outlet of Rodeo Lagoon is unaltered, and closely resembles its condition represented in U.S. Coast Survey maps of the 1850s (Striplen et al. 2004). Laguna Salada, in contrast, is one of the most highly altered of the region's major nontidal lagoons (Appendix A-1, above).

A-2.2 Regional reference ecosystems for empirical conceptual models

Ecological restoration and management of coastal wetlands requires basic understanding the dominant natural processes, variability, and dynamics of unimpaired ecosystems over long periods of time to provide scientifically sound guidance. To provide a sound basis for ecological restoration and management of Laguna Salada, a valid, empirical conceptual model of this type of coastal lagoon system is needed that is calibrated for regional variability and coastal environmental settings. Building a reliable applied conceptual model of specific coastal lagoon types requires integration of multiple assessment approaches (WWR et al. 2008, 2009) including:

a) examination of data or investigations from a regionally representative variable suite of analogous reference ecosystems, or partial, approximate ecological equivalents of the target ecosystem;
b) understanding of long-term ecosystem variability (boundary conditions, rates and patterns of change) through paleoecological or historic ecology investigations, or both;
c) critical review of the relevant scientific literature on physical, biological, and ecological aspects of the target ecosystem and its underlying physical structures and processes; and
d) critical review of restoration and management plans or monitoring reports from analogous lagoon ecosystems.

The PWA team has carefully reviewed the regional applied environmental scientific literature on coastal lagoons, applied its collective professional experience with regional coastal lagoons, and assembled the best available historic data about Laguna Salada (providing additional data and analysis that deepens understanding of its historic development). These are synthesized as a general conceptual model of regional nontidal coastal lagoons (summarized below), and adapted to site-specific data on Laguna Salada and its environmental setting. The scientific literature basis for this conceptual model is shown in Table A-5.

Our working assumption about the use of local, regional, historic, or modern ecological data is that no single reference system state or historic static "snapshot" of a coastal wetland can provide adequate understanding of the underlying mechanisms that maintain it and modify it, particularly complex artificial modifications or impairments occur in its history. We do not develop ecological restoration models or objectives based on specific, arbitrary historic set-points of presumed "equilibrium" or "natural" states, particularly in view of changing baseline conditions, such as sea level rise acceleration, and wave climate change. For this reason, we have assembled an empirically-based conceptual model of nontidal barrier beach lagoon ecosystems of the Central Coast region, and a site-specific reconstruction of natural Laguna Salada conceptual model that integrates its physical and ecological dynamics. These integrated, dynamic physical-ecological conceptual models are used to guide the assessment of existing conditions, future trends, and restoration design options for a sustainable, resilient, diverse rehabilitated Laguna Salada wetland ecosystem supporting special- status fish and wildlife species and naturally high native species diversity.

A-2.3 Dynamics, structure, and composition of seasonally tidal to non-tidal backbarrier lagoons of the Central California Coast north of Monterey Bay

The dynamics of Central California coastal lagoons result from the interaction of coastal processes (wave and wave-induced current transport of sand), watershed hydrology (stream discharge, surface runoff, and groundwater hydrology, including valley, hillslope groundwater), barrier beach seepage outflow, lagoon breaching, and storm overwash. The general conceptual model outlined below is based on a synthesis of background information on coastal processes developed from the scientific literature, reference seasonal estuary/lagoons in their nontidal (low streamflow, dry season) phases, and our knowledge of reference nontidal lagoons – in particular, local investigations of the Rodeo Lagoon (the most similar reference nontidal lagoon) and seasonal backbarrier lagoons in the San Mateo-Santa Cruz coastal region. These sources of the conceptual model, including regional and general studies, are summarized in Table A-5. This conceptual model is integrated with key vegetation and wildlife habitat components of primary biological conservation interest at Laguna Salada.

Central coast lagoons generally include the following highly dynamic geomorphic, vegetation, and wildlife habitat features:

- **Barrier beach with seasonal or intermittent outlet channel or tidal inlet**. The primary hydrologic control of lagoon hydrology is the semi-permeable sand barrier beach that impounds freshwater discharges from the watershed (streamflow, runoff, groundwater discharge) and either chokes or prevents tidal flows into the backbarrier wetland complex. The barrier beach supports its own internal groundwater that mediates subsurface seepage flows between the lagoon and beach face, typically net seaward seepage of impounded freshwater. The barrier beach (including summer and winter berms, washover fans, and dune fields) is the primary structure that dissipates wave energy and creates a sheltered, low wave energy backbarrier environment in which wetlands establish. Barrier beaches adjust to sea level rise dynamically by landward migration, or "rollover", primarily through overwash and low dune deposition. Barrier crest elevations control the upper limit of lagoon impoundment and are approximately controlled by the 1-yr wave runup height (Table A-6). Berm crest elevations of medium-coarse sand beaches of the Central Coast commonly range between +12 to +20 ft NAVD (Table A-6). Shoreline orientation and offshore topography control wave energy gradients alongshore. Wave runup transports sediment onshore and builds a natural berm that dams small, unstable tidal inlets or lagoon and stream outlets with low-energy dry-season outflows. This encloses the backbarrier lagoon and establishes the hydrology of its nontidal phase.

- **Submerged basins or floodplain marshes**. Barrier-impounded streamflow, runoff, and groundwater inundate lowlands landward of the barrier beach. Backbarrier floodplains may lie mostly within still-water tide elevation range or above tidal range. Lagoon levels in non-drought conditions are typically impounded above high tide elevations, causing inundation of floodplain marshes or increased open-water (or submerged aquatic vegetation bed) depths. "Perched" lagoons (drowned stream valley floodplains or basins; water surface elevations above tide, extensive marshes at or above high tide) are typical in the region, and contrast with tidal lagoons with predominantly intertidal substrates. Often the stream or outlet channel itself is the main intertidal habitat estuary within the backbarrier wetland of seasonal estuaries.

- **Salinity gradients between brackish and freshwater wetland habitats**. Even seasonal estuaries with open tidal inlets during winter months of high fluvial outflows support gradients between fluctuating brackish to freshwater salinity ranges near the tidal salinity source (breach; tidal inlet or ephemeral outlet channel, overwash pass) and landward freshwaters discharges (stream channels, seeps, swales). Salinity gradients in nontidal lagoons fluctuate among rainfall years. Relatively stable freshwater wetland habitats generally occur along the landward end of the lagoon gradient, often indicated by local dominance of mature woody riparian or obligate freshwater (salt-sensitive) wetland vegetation.

- **Seasonal salinity inversion relative to permanent estuarine lagoons**. Estuarine salinity in Mediterranean climates fluctuates seasonally, with more dilute brackisb salinity ranges in winter rainfall seasons, and more concentrated polyhaline or euhaline to hyperhaline salinity range in the arid, warm summer. In seasonal estuaries with lagoon closure and perennial freshwater streamflow in summer (or nontidal lagoons), however, backbarrier wetlands that impound freshwater may become stratified and less saline in the upper water column and marsh elevation range than in winter when tidal mixing occurs daily. Oligohaline or freshwater conditions may prevail in seasonal estuaries during their summer non-tidal phases during non-drought conditions. Riparian woodland (willow scrub) and oligohaline to freshwater marsh habitats (cattail, tule, bulrush, spikerush, rush) may occupy summer lagoons even near the backbarrier shoreline.

- **Marsh, wet meadow, submerged aquatic vegetation, and riparian scrub vegetation**. Lagoon wetland complexes in the Central Coast support a recurring set of plant species assemblages and vegetation structures that are distributed in relation to fluctuating salinity gradients, topographic gradients and drainage patterns, and sediment/soil properties. They include the following widespread assemblages, each of which may intergrade with adjacent ones:

  - **Wigeongrass submerged aquatic vegetation (SAV) bed** (*Ruppia maritima*, incl. *R. cirrhosa*): seaward brackish to intermittently saline lagoon bed, permanently submersed or late-summer emergent.
  - **Sago pondweed submerged aquatic vegetation (SAV) bed** (*Stuckenia pectinata*, syn. *Potamogeton pectinatus*): interior or landward oligohaline to intermittently brackish lagoon bed, permanently submersed or late-summer emergent. Occasionally with *P. pusillus, P. nodusus* (freshwater-oligohaline), *Zannichellia palustris* (oligohaline).
  - **Saltgrass-pickleweed-Jaumea salt/brackish marsh** (*Distichlis spicata, Sarcocornia pacifica, Jaumea carnosa*): seaward brackish (mesohaline) to euhaline seasonal marsh, sandy or peaty mud substrates. Infrequent *Polypogon monspeliensis, Cotula coronopifolia* (non-native) in disturbed brackish marsh.
  - **Saltgrass-threesquare bulrush marsh** (*Distichlis spicata, Schoenoplectus pungens* dominant; associated species include alkali bulrush, *Bolboschoenus maritimus*, salt rush, *Juncus lescurii*): seaward brackish sandy backbarrier shorelines, relict washover fan gradient mesic seasonally emergent below OHWL; saltgrass grading into terrestrial washover fan
  - **Threesquare bulrush-alkali bulrush marsh**: seaward brackish marsh, saturated or flooded; mixed or single-species clonal stands; *B. maritimus* more frequent in organic or more saline soils with higher seasonal fluctuation in lagoon level or salinity; S. pungens more frequent in sandy substrates.
  - **Cattail-tule marsh** (*Typha latifolia* (native), *T. angustifolia* (non-native), *Schoenoplectus acutus, S. californicus*: landward oligohaline to freshwater emergent marsh, natural tall monospecific or mixed clonal stands with high shoot density; semi-open stands only in early stages of colonization or recovery; perennial saturation or submergence up to ca. 1 m depth during summer. Ground layer of creeping bentgrass, *Agrostis stolonifera* (nonnative), silverweed (*Argentina egedii*) or club rush, *Isolepis cernua* (native) in seasonal wetland edges.
  - **Salt rush-silverweed meadow** (*Juncus lescurii-Argentina egedii* (syn. *Potentilla anserina* ssp. *pacifica*): landward or seaward oligohaline or brackish seasonally drained marsh plains. Occasional western dock (*Rumex occidentalis*), field sedge (*Carex praegracilis*), threesquare bulrush; Common spikerush (*Eleocharis macrostachya*) Baltic rush (*J. arcticus* ssp. *balticus*) occasionally landward, freshwater-oligohaline.
  - **Saltgrass-creeping wildrye-salt rush meadow** (*Distichlis spicata-Leymus triticoides* (and/or *L.* x *vancouveriensis*)-*J. lescurii*): landward or seaward Oligohaline seasonal wetland (summer mesic to dry) of floodplain/splay or washover.
  - **Marsh baccharis-western goldenrod** (*Baccharis douglasii-Euthamia occidentalis*): landward oligohaline to brackish seasonal wetland, terrestrial ecotone.
  - **Slough sedge-small-fruited sedge marsh** (*Carex obnupta, Scirpus microcarpus*): landward obligate freshwater-oligohaline assemblage, perennial saturation or shallow flooding.
  - **Willow-blackberry riparian scrub** (*Salix laevigata, S. sitchensis, Rubus ursinus*): landward freshwater-oligohaline banks on terrestrial soil or heterogeneous coarse alluvium and silt.

- **Debris deposits.** Major fluvial flood events transport coarse and fine woody debris and floodplain marsh leaf litter into lagoons, where they deposit as wracks, usually along extreme high water lines. Ocean transport of macroalgae and driftwood (sometimes from long-distance sourcs) also introduce abundant organic debris to lagoons after storm events. Litter mats and coarse woody debris can dominate segments of lagoon shorelines, where they provide important habitat structure (cover, unvegetated surfaces, moisture refuges, perches, thermal refuges and basking sites, etc.). Urbanized or agricultural watersheds, culverts, bridges, levees, and seawalls may screen out or eliminate important debris sources, leaving lagoons starved of debris inputs.

- **Backwater sloughs and ponds**. Relict cut-off channel segments and undrained depressions isolated from sediment sources or organic accretion leave shallow open water features in marsh floodplains, either within the summer lagoon (submerged during high lagoon stands), or in portions of the floodplain that lie outside the main lagoon. These isolated sloughs and ponds may become important local habitats (refuges from fish predators, high velocity turbulent flows, salinity or sediment pulses, etc.)

- **Terrestrial ecotones and marginal landforms.** Central Coastal lagoons have variable terrestrial margins, ranging from gentle lowland gradients supporting ecotones (gradual ecological transition zones) to abrupt discontinuous edges, depending on slope, depositional and erosional processes, and antecedent geology. One ubiquitous terrestrial edge landform of lagoons is the *backbarrier shoreline*, consisting of active or *relict washover fans* (mesic upland-wetland ecotones subject to episodic overwash), or *dune slopes*. True *terrestrial uplands* (arid to mesic, well-drained, terrigenous soils) occur in some settings where lagoon valleys form steep erosional *scarps* in uplifted *marine terraces* or resistant *headlands*. Transitional uplands (ecotones) develop on toes of *alluvial fans* of hillslopes (widespread), talus slopes (rare), rock outcrops (rare), or gently *sloping marine terraces*. Transitional uplands form terrestrial ecotones at lagoon *floodplain edges* and within floodplains, where splay and overbank deposits or creekbank levees form. Native vegetation associated with these lagoon terrestrial edges ranges from *coastal bluff scrub, dune scrub, dune forb* and *grassland, lowland (alluvial valley and floodplain) grassland* and *sedge-rush meadows* (rhizomatous dominants), and *riparian scrub*. Coastal bunchgrass/forb vegetation may occur above the actual lagoon edge, not in the ecotone. The most frequent natural vegetation types bordering landward edges of lagoons are alluvial grassland/sedge-rush meadows, riparian scrub, and coastal bluff scrub.

- **Dominant discharge and extreme coastal storm event structures.** Lagoons and barriers are formed by processes with long and short return intervals, including very rare high-energy fluvial flood events and coastal storm (extreme high tides and waves) events occurring over decades. These inevitable extreme events often form essential and major structures of the barrier lagoon complex (washover fans, channels, splays, debris deposits, creekbank levees).

Multispecies dynamic wildlife habitat distribution in coastal lagoons. Smith (2007) concluded from several decades of wildlife investigations of Central Coast lagoons (primarily San Mateo County) that restoration and management efforts should recognize that lagoons provide a variety of habitats for multiple species of concern, and that all habitats do not have to work for all species at all times. He cautioned that focus on single-species hydrologic management may have unnecessary detrimental consequences wildlife communities that seasonally inhabit different sub-habitats within lagoon wetland complexes (Smith 2007). Smith emphasized the importance of isolated or semi-isolated backwater sloughs, ponds, deep scour pools, and channel-disconnected seasonal wetlands within lagoon wetland complexes; these provide breeding habitat for red-legged frog, over-wintering habitat for pond turtles, and rearing and flood and drought refuges for tidewater gobies. Expanded areas of backwater habitat may improve conditions for red-legged frog (Smith 2007). He cautioned that single-species. This perspective is consistent with multiple draft and final recovery plans for federally listed species and associated species of concern (USFWS 2002, USFWS 2005, USFWS 2010).

Wildlife habitat and species distributions within coastal lagoons correspond with vegetation composition, structure, salinity gradients, topography, and flooding/drainage patterns. Special-status species utilizing

APPENDIX A. HISTORICAL ECOLOGY AND CONCEPTUAL LAGOON MODELS

sub-habitats within Central coast lagoons include the following life-history, physiological, and habitat relationships that are basic to lagoon management or restoration.

- **Coast marsh milk-vetch** (*Astragalus pycnostachyus* ssp. *pycnostachyus*): tall perennial forb (Fabaceae) of oligohaline to brackish sandy high tide line vegetation assemblages (often with *Juncus lescurii*) and drift-lines, and terrestrial ecotones of backbarrier shorelines, scarps, creekbank levees and splays, adjacent mesic bluff scrub; San Mateo County and Marin County (disjuct Humboldt County – 1 population). CNPS List 1B; USFWS species of concern.

- **Tidewater goby** (*Eucyclogobius newberryi*) Contrary to its name, the tidewater goby is a short-lived small fish found primarily in shallow seasonal estuarine brackish lagoons and intermittent or nontidal brackish (mostly 12 ppt or less), discontinuously distributed along the California coast.. San Francisco Bay area (southern Sonoma to San Mateo Counties) supports a genetically distinctive series of isolated populations; Rodeo Lagoon is the nearest and largest population. The recovery plan for the species (USFWS 2005) identifies Laguna Salada as one of a few suitable unoccupied potential introduction sites in the San Mateo coast recovery subunit (p. B-7, C-11). Federally listed as endangered. An introduction of tidewater goby to Laguna Salada in existing or restored conditions is not currently proposed by USFWS. It could serve as an isolated redundant population for the nearest neighbor population in the San Mateo Unit at San Gregorio Creek (J. Smith, pers. comm. 2010).

- **California red-legged frog** (*Rana draytonii, syn. R. aurora draytonii*). The California red-legged frog is a pond frog widely distributed and locally abundant in fresh-brackish seasonal estuary lagoons and nontidal lagoons in Marin and San Mateo County, as well as inland freshwater ponds, perennial and seasonal marshes. Wetland habitats occupied by the California red-legged frog generally fluctuate in response to dynamic rainfall, flooding, and drought cycles and the species utilizes a complex mosaic of aquatic, riparian, and upland habitats; populations of this and other pond-breeding frogs are most likely to persist where multiple breeding areas are embedded within a matrix of habitats used for dispersal (USFWS 2002, Hamer and Mahoney 2010). Breeding adults are often associated with dense marsh and riparian vegetation (Hayes and Jennings 1988). Breeding in coastal lagoons occurs in fresh or oligohaline marsh pond edges and in sago pondweed (SAV canopies) within lagoons during winter and spring low salinity phases (salinity < 3-6 ppt for eggs, size-dependent for tadpoles, 5-6.5 ppt upper limit, conservatively estimated lower in some references; Smith 2007, J. Smith pers. comm.. 2010, USFWS 2002) often in the landward end of the salinity gradient within the lagoon wetland complex. Tadpoles develop in freshwater or oligohaline shallow aquatic habitats below a lethal salinity threshold of 7 ppt (USFWS 2002). Foraging by adults occurs in all portions of lagoon wetland complexes except mesohaline to polyhaline marsh (above adult tolerance limit of 9-10 ppt (J. Smith pers. comm. 2010, Smith 2007), usually seaward ends of lagoons). Nitrite, ammonium, and nitrates derived from fertilizer runoff or leachate (risks in coastal lagoons adjacent to either irrigated agricultural or turfgrass dependent on nitrogen fertilizer application) are highly toxic to red-legged frog and other frog species larvae, causing reduced activity, deformity, disorientation, and death (Marco and Quilchano 1999 Schuytema and Nebeker 1999, Nebeker and Schuytema 2000, USFWS 2002). Population size viability are apparently reduced by non-native bullfrogs (Lawler et al. 1999, USFWS 2002), which are usually excluded in coastal lagoons by annual brackish water periods that limit survivorship of salt-sensitive bullfrog tadpoles that require two years to metamorphose.

- **San Francisco Garter Snake** (*Thamnophis sirtalis tetrataenia*). Federally listed as endangered, this garter snake subspecies historically occurred primarily in aquatic habitats and adjacent uplands from Pacifica to Pescadero (Barry 1978, USFWS 1985, Jennings 2000). Its lagoon habitats includes the large seasonal estuary of Pescadero Lagoon (Jennings 2000, Reis 1987, Reis..., Smith 2008) Juveniles spend mucb of their time feeding in riparian zones, marshes, and aquatic habitats (Barry 1994). Subadults and adults may disperse into uplands during summer, feeding on amphibians in mammal burrows (Jennings 2000, Swaim 2008); the extent to wbich summer upland dispersal is driven by prey availability in perennial marsh habitat is not known. Raccoons, herons, egrets, hawks, bullfrogs are predators. Prey base in coastal lagoons is primarily wetland-dependent: Pacific treefrog, earthworms (prey base of juvenile snakes), California red-legged frogs (prey base of adult snakes), stickleback, toads. Juveniles refuse most non-amphibian food items. In contrast with coast garter snakes, adults rarely consume small mammals, but feed on amphibians in rodent burrows. Pbysiological salinity tolerance is unknown; salinity correlations with habitat are likely indirect, related to prey availability (amphibian salinity tolerance and abundance; Larsen 1994). Laguna Salada is identified as a priority for improved habitat management in the 1985 Recovery Plan (USFWS 1985).

- **Western pond turtle** (*Clemmys marmorata*). Western pond turtles are primarily aquatic inhabitants of ponds, marshes, rivers, streams, and Central California coastal lagoons. They inhabit both freshwater to brackisb waters, and tolerate brief exposure to marine salinity (Stebbins 2003). Large populations occur in brackisb estuarine sloughs and nontidal brackisb ponds of Suisun Marsb. In lagoons, they forage in open water, SAV beds, sloughs, ponds, and channels. Pond turtles utilize basking sites provided in estuaries and lagoons by large woody debris, leaf litter mats, or cohesive mud or peaty sand banks. Nesting occurs in spring in well-drained unshaded uplands up to 400 m from riparian zones, but usually close to riparian zones where conditions are suitable; wet substrates are unsuitable for egg survival (Jennings 2000). Western pond turtles of flood-prone inland wetlands often overwinter in terrestrial habitats. Turtle nests are highly vulnerable to predation by raccoons with elevated exurban populations (Jennings 2000). Prey include aquatic insects, fish, amphibians and amphibian eggs, carrion, aquatic vegetation (Stebbins 2003). Western pond turtles are Federal and State species of concern, but have no special legal protective status. A population inhabits the Laguna Salada wetland complex, where it likely breeds.

- **Salt marsh common yellowthroat** (*Geothlypis sinuata sinuata*). The "salt marsh" common yellowthroat, also known as the "San Francisco yellowthroat", is a distinct subspecies of the common yellowthroat. It inhabits salt marsbes only in winter, but breeds in fresb and brackish coastal wetlands, including cattail, tule and riparian scrub (Terrill 2000). Yellowthroats are primarily insectivorous, gleaning prey from the ground, leaf litter, and standing marsb or riparian

vegetation. They frequently use edge habitats (ecotones) between wetland vegetation types. Breeding habitat was reported from Sharp Park (Foster 1977a, b).

A-2.4 Conceptual model of natural Laguna Salada dynamics, structure, and composition

The general Central Coast nontidal lagoon conceptual model is applied to the specific coastal setting of Laguna Salada to generate an approximate model of tbe reconstructed "natural" (pre-agricultural) morpbodynamic conditions (changes in form and process in response to wave and streamflow and groundwater processes) distinctive to Laguna Salada. There are no paleoecological or stratigraphic data currently available for reconstructing the precontact Holocene development of Laguna Salada, but limited bistorical geographic data are available to calibrate the general regional lagoon model (A-2.3) to a specific case for Laguna Salada. This reconstruction is intended as a model for long-term pbysical development of the ecosystem that control species-specific habitat structure, dynamics, and trends. The general model adaptations are based on (a) multiple years of field observations at Laguna Salada, and multiple reconnaissance visits in 2009-2010; (b) direct field observation of seasonal variability of Central Coast reference lagoons by the project team members for more than two decades; (c) site-specific studies of regional reference systems (Shaw 1997, Striplen et al. 2004, Smith 2008, WWR et al. 2008); and local historic ecology data (Section 3.3).

- **LS Barrier beach topography, permeability, and elevation gradient.** The barrier beacb is a relatively coarse-grained, permeable barrier exposed to high incident wave energy of Pacific swell, resulting in a high beacb crest above tidal range; beach crest elevations correspond witb alongshore gradients in wave height, with relatively lower wave height adjacent to beadland sheltering (wave refraction from SW and WSW) of Mori Point. The small backbarrier lowland basin is formed by the southward-dipping marine terrace that dips below sea level at Laguna Salada (Cooper 1967, Sloan 2006) and relict alluvial deposits from Sanchez Creek. Medium-fine sand sources (wind-mobile sand fraction) occur to the north of tbe beach (paleodune and bluff erosion; currently armored); coarser sand sources (wind-immobile fractions) occur at the Mori Point headland. Dune topographic development on the barrier is limited by grain size distribution; low hummock dunes formed by native vegetation (like Rodeo Lagoon) lie at or below the beach crest determined by wave runup. The coarse-grained barrier is highly permeable to groundwater exchange between ocean, beach, and the lagoon, according to local and fluctuating groundwater gradients.

- **LS Barrier beach seepage lagoon and marsh formation.** Laguna Salada is formed by impoundment (damming) of Sanchez Creek outflows and valley groundwater discharge by Salada/Sharp Park Beach (barrier beach). The lagoon wetland complex includes the alluvial floodplain of Sanchez Creek inundated during high lagoon stands Lagoon basin fills with freshwater discharge, raising water surface elevations and hydraulic head above high tide elevations of the adjacent ocean beacb. The lagoon discharges by groundwater seepage through the coarse-grained, permeable barrier beach when the outlet is closed, the normal condition of the lagoon except during periods of winter storm rainfall and stream discharge. Nontidal lagoon water surface elevations and fringing nontidal marshes are naturally "perched" above high tide (cf. Rodeo Lagoon, Laguna Creek Lagoon in nontidal phase; Shaw 1995, WWR et al. 2008), except during extreme droughts. The hydraulic head of high freshwater lagoon stands induces seepage outflow (beach groundwater) discharge through the coarse-grained beach.

The fringing lagoon emergent marsh (cattail, tule, bulrush marsh) develop in the fluctuating submergence zone between ordinary high water and low water elevations, all of which are above the still-water tidal elevation range of the adjacent ocean beach. The lagoon bed (submerged aquatic vegetation substrate) occurs at elevations corresponding to tidal range on the adjacent beach. Lagoon valley (landward) floodplain freshwater wetlands (seasonal wetlands inundated by extreme high lagoon stands (freshwater impoundment) below the breach outlet elevation threshold) and depressional floodplain freshwater ponds, sloughs, and marshes stand at elevations above the tidal frame and beyond ordinary overwash surge limits.

- **LS lagoon level equilibration with beach seepage outflow; net freshwater seepage outflow.** Equilibration between total net freshwater stream and groundwater discharge into the lagoon, and lagoon seepage rates through the barrier, maintain lagoon water surface elevations below the critical spill elevation (lagoon overtopping threshold) of the beach. Hydraulic head of impounded freshwater during high lagoon stands (significantly above MHHW) generally causes net seaward seepage outflow of freshwater, inhibiting saltwater intrusion. In natural non-drought conditions, the lagoon water surface elevation is raised above still-water tide elevation range, and often above elevation of wave runup (swash).
- **LS lagoon spatial salinity gradients and temporal variability.** Lagoon salinity in nontidal (non-breach) seepage conditions varies vertically (density stratification: freshest at the upper water column, most saline at the lagoon bed), horizontally (freshest at the landward and upstream edges of the lagoon where creek outflows and hillslope/valley groundwater discharge occurs), and temporally (predominantly freshwater during average and above-average rainfall years, fresh-brackish to brackish in drought years, with highest salinity pulses associated with El Niño high sea level and storm events. Permanent freshwater wetland gradients are maintained locally near the creek mouth and valley/hillslope seeps except in extreme droughts. Isolated freshwater wetlands may occur in depressions within the landward (upstream) reaches of the floodplain east of the open-water lagoon.
- **LS low lagoon stands, beach groundwater gradient reversal.** During low lagoon stands (late summer/fall, droughts) and periods of high wave runup, emergent lagoon flats with low water levels would interact with higher beach groundwater elevations driven by wave runup and tides. During low lagoon stands/lagoon flat emergence, beach groundwater gradients may reverse, and higher salinity brackish groundwater may discharge into the lagoon during seasonal low lagoon stands, raising lagoon salinity in summer, especially at the seaward (backbarrier) end of the lagoon gradient.

- **LS lagoon level and overwash impoundment.** During storms with elevated sea level and high waves, barrier overwash may directly flood the partially drained (post-breach drawdown; Table A-7) lagoon with seawater. Density stratification of salt water is likely to occur when overwash coincides with high lagoon stands (deep standing freshwater); mixing of saline or brackish waters is likely to occur when overwash coincides with low lagoon stands (drawdown, drought).
- **LS lagoon salinity flushing, stratification, and mixing.** Rapid flushing of turbulent, well-mixed brackish lagoon water occurs only in ephemeral Stages 4-5 (Table A-7) while the lagoon outlet channel is open or partially choked. Gradual flushing of overwash-charged lagoon salinity pulses occurs during prolonged high lagoon stands (above tidal elevations) of impounded freshwater in nontidal lagoon conditions (persistent stages 1,2, 6, driven by seepage outflow of stratified brackish (higher salinity, higher density) bottom water through the beach. Overwash occurring during low lagoon stands (drought conditions) is likely to result in retention of high salinity overwash when beach seepage outflow rates are minimal.
- **LS lagoon breaching and unstable outlet initiation.** Lagoon morphodynamics shift to disequilibrium breach conditions during periods of high stream outflow (storms), driven by stream discharge rather than overwash, primarily during ebbing tides when water elevation gradients between lagoon and ocean are steepest. Lagoon breaching and outlet formation occurs when fluvial discharge rates significantly exceeds barrier seepage outflow rates, causing impounded freshwater in the lagoon to rise above spill elevations of the topographic low zones of the beach, overtopping the lowest zone (Table A-7). Overtopping lagoon waters flow down the beachface, causing incision (downcutting). The low point in the beach crest elevation alongshore gradient establishes the critical spill elevation of the lagoon, usually located at the headland-sheltered south end of the beach adjacent to Mori Point.
- **Lagoon breaching and closure** (lagoon outlet development, choking, and beach dam accretion). The rate of incision is influenced by tidal stage and wave height: maximum breach potential increases with steep water surface gradients due to high lagoon stands during low tides and low wave energy (low wave runup, weak wave deposition of sand). Breaching causes rapid release of impounded freshwater and any co-occurring marine overwash. Rapid emergence of shallow lagoon flats follows breaching. Torrential outflows occurring at low tides rapidly cut a steep, deep outlet throat, with vertical beach scarps and rapid slumping; a short-lived ebb tidal delta forms seaward of the breach. Less energetic breaches on high tides (lagoon and ocean levels more equal) form shallower outlets that may continue to through the subsequent ebb cycle. When the lagoon water surface equilibrates with sea level, waves initiate swash bar (berm) accretion across the outlet, forming a sill. The sill establishes a temporary flood-dominant inlet condition, with overwash impounded in the lagoon in low-energy conditions that favor stratification of salinity and accretion of minor flood shoals in the inlet throat. The transient inlet closes as the beach dam accretes above high tide elevation. The rate of lagoon closure and beach dam accretion varies with the energy of swell (wave runup height on the beachface) and local longshore drift rates.

- **Return to fresh-brackish lagoon impoundment and seepage (seaward groundwater discharge).** After the beach dam crest elevation accretes above wave runup elevation, wave overtopping of the barrier at the outlet/beach dam ceases, and freshwater streamflow impoundment by the barrier resumes. The duration of lagoon flats (bed) emergence varies with rate of stream discharge (freshwater inflows). Dense brackish water remains at the bottom of the lagoon, while freshwater floats in a thickening layer above it; limited wind-mixing declines as the lagoon deepens with freshwater. Brackish mixing due to wind-stress currents occurs during shallow lagoon conditions (drought or post-breach). As lagoon freshwater depth increases, lagoon seepage outflow rates through the lower beachface increase to equal or slightly exceed stream inflow, preventing lagoon overtopping and breaching during the low flow season. The flooded lagoon edges (ordinary high water level and fringing marshes) are submersed with fresh or oligohaline, and gradual drawdown may occur in summer.

A-2.5 Conceptual model of Laguna Salada natural habitat structure

The habitat structure of the natural Laguna Salada was very likely similar to that of most seasonal and nontidal lagoons of the central coast that retain mostly natural streamflow, barrier beach or tidal outlet topography, and are free from (or recovering from) past agricultural conversion. Lagoon habitat and vegetation structure is patterned along seaward-landward gradients of freshwater influence and salinity dilution (stream mouths and groundwater, oceanic overwash and barrier overtopping), sedimentation (coarse fluvial sediment of floodplains, splays, fine fluvial suspended sediment gradients; coarse sediment of beach overwash, dunes) established by the dynamic processes explained in the model. This habitat structure can be summarized for application to restoration and management as follows:

- **Landward upland ecotones**: transition zones between stream floodplain valley and valley wall or terrace uplands, above storm surge elevation. Riparian scrub and lowland (sod-forming) grassland, sedge meadow on soils formed from marine terrace and floodplain sediments. Seasonally wet to mesic soils grading to upland coastal scrub and grassland. Buffered from storm surge by dense marsh and woody vegetation. Continuous vegetation transition to drier coastal scrub and grassland. Small mammal burrows provide winter (hibernation) refuge and summer foraging for San Francisco Garter Snake, Western Pond Turtle (drier upper end of gradient). Potential summer moisture refuges for California red-legged frog, tree frog; storm surge refuge for California red-legged frog. Migration/dispersal corridor between Laguna Salada frog, snake populations and upper watershed; snake dispersal corridor along wide peripheral wetland/upland ecotone of Laguna Salada wetland complex (meadows, riparian scrub cover).

- **Floodplain seasonal wetlands**: landward seasonal marsh with embedded slough and ponds (shallow depressional remnants of former braided stream channels), rush and sedge meadow, spikerush meadow, creeping wildrye-meadow barley meadow; pools may include sago pondweed. Off-channel, peripheral landward freshwater lagoon breeding habitat of California red-legged frog; foraging habitat of San Francisco Garter snake.

- **Lagoon fringing marsh - landward** (tule-cattail-bulrush marsh). Tall emergent freshwater marsh at landward, freshwater end of lagoon gradient, influenced by seasonally high fresh groundwater and high lagoon stands. Foraging habitat of California red-legged frog adults; breeding habitat at edges of lower vegetation ecotone with seasonal wetlands (rush, sedge grassland and meadow).

- **Large woody debris drift-lines** (drift-log wrack lines, piles). Variously patterned at inner landward and outer edges of lagoon fringing wetlands, depending on storm intensity and lagoon water surface height. Basking sites of San Francisco Garter snake, Western Pond Turtle (bordering open water); roosting sites of waterbirds, raptors.

- **Lagoon open water/Submerged Aquatic Vegetation bed.** Sago pondweed dominant in landward, fresher end of salinity gradient; wigeongrass dominant along backbarrier shoreline. Sago pondweed canopy in oligohaline-fresh lagoon waters is potential breeding substrate for California red-legged frog egg masses, floating canopy adjusting to changes in lagoon level without egg stranding; cover for tadpoles. Waterfowl forage in wigeongrass, sago pondweed canopies (dabbling ducks) and beds (diving ducks).

- **Lagoon backbarrier fringing marsh.** Lower fringing wetlands are threesquare bulrush or alkali bulrush; upper zones saltgrass, salt rush. Lower edge at bare sand substrate is tidewater goby habitat; submerged bulrush canopy is escape cover for tidewater goby.

- **Barrier beach and washover.** Wide semi-open flats are potential backshore roosting or stopover habitat for western snowy plovers. Beach is roost site for Caspian terns (predators of lagoon fish, including potential amphibian egg or tadpole predators)

A-2.5 Fish and wildlife responses to extreme morphodynamic and hydrologic events of coastal lagoons

Ecological events correspond with morphodynamics and hydrology events of the lagoon, and are potentially critical to the life-history of special-status species. During high lagoon stands through late spring, the lagoon floodplain seasonal wetlands are shallowly submerged after most rainfall has ceased. The depressions in the floodplain receive a late spring flooding, favoring isolated pool habitats favorable for tree frogs breeding and red-legged frog foraging (aquatic prey base of juvenile and adult San Francisco Garter Snakes). Deep flooding during high lagoon stands inhibits and delays the growth of tules and cattails at the lowest fringing marsh elevations around the lagoon, restricting their rate lateral spread. Lagoon high stands also promote dominance of sago pondweed over the lagoon bed (waterfowl foraging habitat and red-legged frog breeding habitat in Central Coast lagoons), and high groundwater favoring growth of riparian scrub bordering landward portions of the lagoon.

During rare extreme storm storm events, large amounts of coarse woody debris (driftwood) can enter the lagoon (from fluvial and overwash flooding) and deposit along the landward (downwind) edge, forming a concentrated band of flood refuges, basking habitat, summer moisture refuges, and roosts. Extreme storm overwash events naturally may cause mortality of red-legged frogs adults or eggs in winter along the west side edge of the lagoon. Red-legged frog adults survive overwash flooding along the landward freshwater reaches (refugia) of the lagoon, and in the adjacent floodplain and upland ecotone. Full breach events in late winter are also likely to cause mass mortality of red-legged frog tadpoles. Red-legged frog populations rebound from subsequent reproduction of long-lived adults in years of low-intensity storms and low-energy breaching or none. San Francisco Garter Snakes and western pond turtles mostlly hibernate in upland-edge mammal burrows during the winter storm season (stable mammal burrows are infrequent in unconsolidated beach sand of the washover substrates at the backbarrier lagoon edge. Brackish lagoon pulses during storms are likely limiting factors for persistence or population growth of non-native predatory bullfrogs (*Rana catesbiana*) with salt-intolerant tadpoles generally require two years to metamorphose. Breach events are also potential marine dispersal windows for tidewater gobies. Gobies would primarily inhabit the submerged backbarrier lagoon edge.

Table A-4. Major backbarrier lagoons in the northern Central California Coast (Southern Sonoma County to northern Santa Cruz County)

Coastal lagoon	Lagoon type, hydrologic regime	Tidal inlet, outlet type	Salinity regime	Geomorphic signature, vegetation
Salmon Creek, Sonoma County	Seasonal estuary (winter) and nontidal seepage lagoon (low streamflow seasons)	Stream mouth, dry season beach dam; wet season choked tidal inlet	Mesohaline(seaward) Oligohaline-freshwater gradient upstream	Flood tidal delta fresh-brackish marsh
Estero Americano, Sonoma County	Seasonal estuary (winter) and nontidal seepage lagoon (low streamflow seasons)	Stream mouth, dry season beach dam; wet season choked tidal inlet	Polyhaline (seaward) Mesohaline-Oligohaline gradient upstream	Flood tidal delta shoals, brackish marsh
Estero San Antonio, Sonoma County	Seasonal estuary (winter) and nontidal seepage lagoon (low streamflow seasons)	Stream mouth, dry season beach dam; wet season choked tidal inlet	Polyhaline (seaward) Mesohaline-Oligohaline gradient upstream	Flood tidal delta shoals, marsh
Bodega Harbor, Sonoma County	Tidal, marine dominant estuary in drowned fault co-seismic subsidence basin	Flood-dominant tidal inlet, drowned fault subsidence basin (navigational dredging)	Euhaline; localized oligohaline-freshwater gradients, small seasonal stream mouths	Flood tidal delta shoals eelgrass or unvegetated; fringing salt marsh
Abbott's Lagoon, Marin County	Nontidal, barrier-impounded lagoon in lowland marine terrace and dune sheet	Intermittent storm overwash pass (foredune gap); Episodic (decadal) breach, transient outlet	Mesohaline (seaward) Oligohaline (landward) localized oligohaline-freshwater gradients, small seasonal stream mouths	Relict outlet channel landward of breach site outlet/persistent beach dam, no relict flood tidal delta shoal; fringing and deltaic fresh-brackish marsh
Drakes/Limantour Estero, Marin County	Tidal lagoon, marine-dominant estuary, drowned stream valley	Flood-dominant tidal inlet	Euhaline-Polyhaline; localized oligohaline-freshwater gradients, small seasonal stream mouths	Flood tidal delta shoals (massive); eelgrass or unvegetated; salt marsh
Bolinas Lagoon, Marin County	Tidal lagoon, marine dominant estuary in drowned fault co-seismic subsidence basin	Flood-dominant tidal inlet (navigational dredging)	Euhaline-Polyhaline; localized oligohaline-freshwater gradients, Pine Gulch Creek delta and unnamed tributaries	Flood tidal delta shoals marsh-capped, dune-capped, eelgrass, unvegetated, salt marsh

Redwood Creek (Big Lagoon; Muir Beach), Marin County	Fluvial dominant, seasonal choked tidal, dry season nontidal seepage lagoon in drowned stream valley	Seasonal outlet open in wet season, weakly ebb-dominant; choked or closed in dry season, nontidal beach seepage	Oligohaline-fresh to freshwater gradient	Fluvial bedform dominant; minor pondweed; riparian woodland, fresh-brackish marsh
Rodeo Lagoon, Marin County	Nontidal, barrier-impounded lagoon in drowned stream valley	Intermittent storm overwash prevalent, outlet channel Episodic (decadal) breach, transient outlet	Mesohaline (seaward) Oligohaline (landward) to freshwater gradient (Rodeo Creek)	Relict outlet channel landward of breach site outlet, no relict flood tidal delta; persistent beach dam; fresh-brackish marsh
Presidio Marsh (historic Crissy Field), San Francisco County	Tidal lagoon, marshplain dominant with sinuous tidal creek network; choked tidal flows	Flood-dominant choked tidal inlet (throat bed above MLW)	Polyhaline-Mesohaline (floristic proxy data)	Salt marsh, complex sinuous tidal slough network
Lake Merced, San Francisco County	[Historic] Nontidal, barrier-impounded drowned stream valley in marine terrace	[Historic] (?) overwash pass (foredune gap) and outlet channel Episodic (decadal) breach, transient outlet	Oligohaline-freshwater gradient (floristic proxy data)	Isolated lake due to urban fill; fringing tule marsh
Laguna Salada, San Mateo County	[Historic] Nontidal, barrier-impounded lagoon in lowland marine terrace	[Historic] Intermittent storm overwash prevalent; Episodic breach, transient outlet	[Historical] Mesohaline (seaward) Oligohaline (landward); local freshwater-oligohaline gradient at Sanchez Creek mouth inferred (floristic and photographic proxy data)	Relict outlet channel landward of former intermittent outlet; relict washovers, no relict flood tidal delta shoal; fringing and deltaic fresh-brackish marsh
Pillar Point Harbor, San Mateo County	Choked tidal lagoon, marsh channel and upper lagoon pond	Persistent choked upper intertidal inlet and channel	Mesohaline	Brackish marsh, simple tidal channel
Pilarcitos Creek, San Mateo County	Fluvial-dominant supratidal delta and floodplain above tidal frame (non-estuarine) in marine terrace; lagoon restricted to backbeach runnel or aggraded channel	Drift-deflected seasonal outlet, seepage dominant; backbeach lagoon north-offset from mouth (intermittently merged with Frenchman's Creek mouth)	Freshwater marsh and riparian woodland	Berm (swash bar)-dammed backbeach, stream channel; no flood tidal delta; Braided deltaic backbeach fluvial deposition, coarse sediment
San Gregorio Creek, San Mateo	Seasonal estuary in mainstem channel;	Stream mouth, dry season beach dam	Mesohaline (backbeach) Oligohaline to freshwater	Berm (swash bar)-dammed

County	choked tidal/nontidal seepage lagoon in low streamflow seasons; aggraded floodplain	with extensive backbeach lagoon, impounded stream channel; choked tidal inlet in wet season	stream gradient (floodplain, stream channel)	backbeach, stream channel; no flood tidal delta
Pescadero Creek, San Mateo County	Seasonal estuary in shallow tidal basin, drowned stream valley, floodplain marsh, backwater sloughs, ponds; choked tidal/nontidal seepage lagoon in low streamflow seasons	Stabilized (armored Hwy 1 bridge) seasonal tidal inlet position, dry season beach dam (variable)	Polyhaline-Mesohaline-Oligohaline to freshwater stream gradient; extensive marsh impoundments (diked, tidegate choked flows).	Flood tidal delta, sinuous tidal sloughs; brackish-fresh marsh gradient
Waddell Creek, Santa Cruz County	Seasonal estuary in mainstem channel; choked tidal/nontidal seepage lagoon in low streamflow seasons; floodplain marsh	Stream mouth, dry season beach dam with small backbeach lagoon, impounded stream channel; choked tidal inlet in wet season	Mesohaline (seaward) Oligohaline to freshwater stream gradient	Berm (swash bar)-dammed backbeach, stream channel; no flood tidal delta
Scott Creek, Santa Cruz County	Seasonal estuary in mainstem channel; choked tidal/nontidal seepage lagoon in low streamflow seasons; floodplain marsh, backwater sloughs, ponds	Drift-deflected seasonal tidal inlet, stabilized (armored Hwy 1 bridge) mouth; dry season beach dam	Mesohaline (seaward) Oligohaline to freshwater stream gradient	Berm (swash bar)-dammed backbeach, stream channel; no flood tidal delta
Laguna Creek, Santa Cruz County	Seasonal estuary in mainstem channel; choked tidal/nontidal seepage lagoon in low streamflow seasons; floodplain marsh, backwater sloughs, ponds	Stream mouth, dry season beach dam with small backbeach lagoon and impounded stream channel; choked tidal inlet in wet season	Oligohaline to freshwater steam gradient	Berm (swash bar)-dammed backbeach, stream channel; washover fan, no flood tidal delta; post-agricultural reversion to fresh-brackish marsh

Notes: Major coastal backbarrier lagoons in the north-central California Coast (southern Sonoma County to northern Santa Cruz County). Data sources: USGS quadrangle sheets, Google Earth (accessed August 2010), PWA [dates], Shaw 200? [Rodeo], Cooper and ? [Rodeo], [Geol Pt Reyes] WWR et al. 2008, WWR et al. 2009, Baye, unpublished data, Battalio, unpublished data [Geologic map refs] USFWS [goby]

Table A-5. Basis of Central Coast and Laguna Salada conceptual model

Conceptual model component	Literature cited
Lagoon outlet and breach processes, depositional and erosional processes and structures of stream mouth lagoons, Pacific Coast USA	Clifton et al. 1973, Warme 1971, Webb et al. 1991
General backbarrier lagoon outlet and breach processes	Price 1963, 1970
Control of outlet position by wave refraction and beach berm crest elevation gradients alongshore	Bascom 1954, Davies 1980
Coastal seepage lagoon general model, dynamics	Carter 1988, Carter et al. 1984, Jennings et al. 1993
Tidal inlet morphodynamics, instability, choking, closure in relation to stream power and tidal prism	Carter 1988, Davis and FitzGerald 2004, FitzGerald 1996, Ranasinghe et al. 1998, 1998, Webb et al. 1991
El Niño storm effects and regional long-term wave climate change, shoreline change	Allan and Komar 2006, Hapke et al. 2009, LaJoie and Mathiesson 1998, Storlazzi and Griggs 1998, Storlazzi and Griggs 2000
Barrier beach transgression, sand shoreline response to sea level rise	Carter 1988, Davis and FitzGerald 2004, Davidson-Arnott 2005, Woodroffe 2002
Beach slope, height, grain size response to waves	Bascom 1982, Komar 1976
Washover and inlet sediment transport and dynamics	Fisher 1979, Price 1963, 1970, Davis and FitzGerald 2004,
Beach groundwater dynamics in relation to tide, wave runup, lagoon head, seepage	Isla and Bujalesky 2005, Nielsen 1999, Turner et al. 1997
Central Coast regional reference lagoon investigations, models and data	Grossinger et al. 2010 (S. California), PWA et al. 2004 (Big Lagoon), Smith 2008 (Central coast multispecies habitat model), Shaw 1997, Striplen, Grossinger & Collins 2004 (Rodeo Lagoon), WWR et al. 2008 (Laguna Creek Lagoon), WWR et al. 2009 (Pilarcitos Creek Lagoon).

Table A-6. Summary of beach berm and runup elevations for coastal lagoon reference sites

	Typical Beach Berm Elevation[1]			Outlet Channel Elevation			Coastal Flood Elevations		1-yr Runup Elevations[5]	
Lagoon	2002 (ft NAVD)	1998 (ft NAVD)	1997 (ft NAVD)	2002 (ft NAVD)	1998 (ft NAVD)	1997 (ft NAVD)	100-yr TWL (ft NAVD)[2]	FEMA BFE (ft NAVD)[3]	Lowest Maxima (ft NAVD)	2/3 Rule Runup (ft NAVD)
Stone Lagoon, Humboldt	25 (22-26)	N/A	N/A	15	N/A	N/A	27.5	34.5	18.5	21.0
Big Lagoon, Humboldt	26 (25-27)	N/A	N/A	15	N/A	N/A	32.0	34.5	20.0	23.5
Abbott's Lagoon, Marin	28 (20-35)	28 (20-35)	28 (20-35)	4	15	9	28.0	36.5	18.5	21.0
Rodeo Lagoon, Marin	N/A	18 (15-20)	17 (15-20)	N/A	14	12-13	25.5	30.5	17.0	19.5
Laguna Salada, San Mateo[4]	-	-	-	-	-	-	29.0	30.0	17.0	20.5
Laguna Creek, Santa Cruz	N/A	13 (12-15)	12.5 (12-13)	N/A	6	No Outlet	28.0	30.5	16.5	19.5

Notes:

[1] Typical (average) beach berm elevation given for each site and Lidar survey. Range of berm elevations given in parentheses.

[2] PWA estimates of 100-yr TWL in Year 2000 were taken from the nearest available model output location, rounded up to nearest 0.5 ft: Stone Lagoon (27.4 ft NAVD), Big Lagoon (31.6 ft NAVD), Abbott's Lagoon (W Point Reyes = 27.7 ft NAVD), Rodeo Lagoon (Point Bonita = 25.5 ft NAVD), Laguna Salada (Pacifica = 28.1 ft NAVD and Rockaway = 29.9 ft NAVD), Laguna Creek (Davenport Landing = 27.7 ft NAVD). Values are rounded to nearest 0.5 ft.

[3] FEMA Base Flood Elevations (BFE) estimated by PWA (2008), as reported in Pacific Institute (2009). Laguna Salada BFE estimated from preliminary FEMA Flood Insurance Rate Map (FIRM), San Mateo County, Map number 06081C0038E (April 18, 2008).

[4] Laguna Salada seawall crest elevation ranges from 29-35 ft NAVD based on 1997 and 1998 Lidar. Surveys following the January 1983 storms indicated a back beach berm elevation of approximately 18 ft NAVD (Geomatrix 1987).

[5] 1-yr runup elevations were estimated using two methods: (1) lowest annual maxima of 100-yr modeled TWL time series, and (2) the annual maximum TWL exceeded 2/3 of all years of 100-yr modeled TWL time series (PWA 2009).

Table A-7. Modified 6-stage barrier breach and closure lagoon cycle, reconstructed natural model Laguna Salada, adapted from 10-stage seasonal estuary lagoon model of Laguna Creek Lagoon (WWR et al. 2008).

Stage 1: Spring-summer high lagoon stand, nontidal seepage lagoon impoundment phase (outlet closed; low flow (spring-summer) growing season

- Freshwater stream discharge, groundwater inflow impoundment; net beach seepage outflow < stream inflow; rising or equilibrium high lagoon stand
- Lagoon floodplain wetland and fringing marsh inundation with upper water column of lagoon (stratified freshwater)
- High lagoon seepage rate through beach; lagoon maximum hydraulic head
- Gradual summer drawdown during declining spring-summer streamflow, net seepage outflow > stream inflow; supratidal lagoon levels fall
- Ordinary high water lagoon levels and fringing marsh elevation range maintained above tidal frame (except during extreme drought)

Stage 2: Fall/winter increased stream discharge, nontidal seepage lagoon impoundment phase

- Lagoon water level rise to beach crest, >> lagoon ordinary high water level
- Maximum floodplain wetland inundation extent and depth
- Lagoon levels rise rapidly after precipitation events; net beach seepage outflow << stream and runoff inflow
- Cumulative increase in lagoon levels following successive precipitation events

Stage 3: Beach crest overtopping by lagoon, breach initiation (winter, non-drought years)

- Overtopping during high tide, high wave runup: minor outlet incision
- Overtopping during ebb or falling tide (steep water surface elevation gradient): barrier breaching, outlet channel erosion (incision, head cut), localized beach erosion
- Rapid high energy turbulent discharge of impounded freshwater, ebbing tide; transient high-energy ebb dominance
- Rapid lagoon drawdown *below* lagoon ordinary high water and fringing marsh elevations; marsh emergence; *lagoon marsh zones at/above high tide elevation*

Stage 4: Breach phase: unstable outlet (winter, non-drought years)

- High tide tidal inflows or wave bores enter lagoon; marine salinity pulse, turbulent mixing, brackish non-stratified lagoon; ephemeral estuarine conditions (dispersal window for marine organisms; salinity pulse mortality event for terrestrial organisms)
- Lagoon marsh salinity pulse during to wave bore/surges during extreme perigee high tide only, open outlet phase
- Winter wetland vegetation dormancy – minimal sensitivity to salinity outside growing season (no transpiration uptake, no soil porewater infiltration of brackish water)
- Transient impoundment of turbulent brackish water near high tide elevations << lagoon ordinary high water line and marsh elevations, floodplain elevations
- Breach open during storm wave beach erosion phase
- Swash bar accretion (sill) across outlet post-storm constructional swell; outlet instability; shift to low-energy flood dominant outlet, wave overtopping, overwash, at high tide
- impoundment of lagoon during ebb tide as swash bar/sill (tidal choking) increases with bar height

Stage 5: Lagoon outlet closure, beach dam (swash bar) accretion above post-storm wave runup elevation

- Declining, low frequency or cessation of wave overwash, overtopping at beach dam/choked outlet

- Post-breach brackish lagoon water surface elevation near MHHW, << lagoon ordinary high water level and marsh elevation range

Stage 6: Recovery of nontidal lagoon phase, post-closure (winter, non-drought year)

- Freshwater discharge impoundment resumes; lagoon water column salinity stratification initiated
- Stratified fresh-brackish water rises, approaches ordinary high water elevation >> tidal frame, progressively inundates lagoon fringing marsh zones; bottom lagoon water brackish (submerged aquatic vegetation bed).
- Post-breach recovery to Stage 1

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APPENDIX B. COASTAL PROCESSES AND FLOODING

1. COASTAL PROCESSES AND FLOODING

The purpose of this appendix is to address elements of coastal hydrology and flooding that affect Laguna Salada and restoration feasibility.

1.1 COASTAL HYDROLOGY

1.1.1 Local climate and meteorology

The climate of central California is primarily influenced by the Pacific High, a persistent zone of high pressure located over the eastern North Pacific Ocean. The strength and location of the Pacific High varies annually and seasonally. During the summer months, the high pressure zone migrates northward, and diverts most storm tracks to the north (Hapke and others 2006). During the winter months, the North Pacific High migrates southward, allowing intense extratropical storms to follow a more southerly track and affect the central and southern portion of the state (National Marine Consultants 1960). Longer term climate variations are linked to the El Niño-Southern Oscillation (ENSO), which has a cycle of 3-8 years. During El Niño years, Central California's climate is characterized by above average rainfall and increased frequency and intensity of Pacific storms. La Niña years are characterized by lower than average rainfall and less severe storms (Hapke and others 2006). The Pacific Decadal Oscillation (PDO) results in climatic shifts over time frames of 30 to 50 years, and is attributed with changes in beach widths and orientations (Allan and Komar, 2000). Climate change is anticipated to result in warming of the atmosphere and oceans, with an acceleration of sea level rise. The effect of climate change on wave conditions and storms is less certain. Regardless, increased sea level is expected to increase coastal flood and erosion hazards (Heberger et al. 2009; PWA, 2009).

1.1.2 Tidal water levels

The NOAA tidal datums for San Francisco are summarized in Table 1.

Table 1. NOAA Tidal Datums for Presidio, San Francisco, CA (#9414290)

	San Francisco Presidio			
	MLLW (ft)	NAVD 88 (ft)	MLLW (m)	NAVD 88 (m)
MHHW	5.84	5.90	1.78	1.80
MHW	5.23	5.29	1.59	1.61
MTL	3.18	3.24	0.97	0.99
MSL	3.12	3.18	0.95	0.97
MLW	1.13	1.19	0.35	0.36
MLLW	0	0.06	0.0	0.02

Notes: MLLW = Mean Lower Low Water, MLW = Mean Low Water, MSL = Mean Sea Level, MTL = Mean Tide Level, MHW = Mean High Water, MHHW = Mean Higher High Water

The San Francisco coast experiences mixed semidiurnal tides, with two high and two low tides of unequal height each day. The tides exhibit a strong spring-neap variability over a two week cycle; spring tides exhibit a large difference between high and low tides while neap tides show a smaller than average range. The highest monthly tides occur during summer and winter months. The mean tidal range (MLW to MHW) is 4.1 ft and the diurnal range (MLLW to MHHW) is 5.8 ft. Sea level rise over the last few decades at the Presidio tide station has been about 0.2 ft.

1.1.3 Extreme stillwater water levels

The stillwater level refers to the water surface elevation in the absence of waves. It includes the effects of the astronomical tide plus storm surge. We have approximated extreme stillwater levels at Sharp Park using results from a study at San Francisco (PWA 2006). At San Francisco, the 10, 50, and 100-year events were estimated at 8.40 ft, 8.66 ft, and 8.73 ft NAVD, respectively. For comparison, previous estimates have placed the 100-year stillwater level at 8.90 ft NAVD (Knmuti 1995) and 8.69 ft NAVD (USACE 1984). Extreme stillwater levels do not include wave action and wave setup, which can significantly increase water levels temporarily during storms.

1.1.4 Wave climate

The wave climate along the California coast exhibits significant spatial and temporal variability due to seasonal and annual weather patterns, offshore topography, wave-approach direction and coastline orientation. Wave heights generally range from 5-30 ft with periods from 10-25 seconds. North Pacific swell associated with remote extratropical storms dominates the winter months. Longer term variations in wave climate are linked to large scale atmospheric variations, particularly the El Niño-Southern Oscillation (ENSO). During El Niño winter months, storms increase in frequency and intensity, producing waves of exceptional height and period at the shoreline.

Table 2. Return Period and Wave Height for Extreme Wave Events Along Central California Coast

Return Period (yrs)	Significant Wave height Port San Luis (ft)[1,2]		Significant Wave Height San Francisco (ft)[3]	Significant Wave Height Half Moon Bay (ft)[4]
10	23.2	22.2	26.6	29.9
20	25.8	25.8	-	-
25	-	-	29.6	33.2
30	28.0	27.1	-	-
50	29.0	30.0	31.9	35.7
100	31.7	33.1	34.1	38.2

[1,2]Calculated based on Raichlen (1985) dataset at Port San Luis assuming a (1) Gumbel and (2) log normal probability distribution.

[3,4]Calculated by Storlazzi and Wingfield (2005) for NOAA San Francisco (#46026) and Half Moon Bay (#46012) gages.

Table 2 summarizes estimates of extreme deepwater wave heights along the Central California coast (Raichlen 1985; Storlazzi and Wingfield 2005). Estimates of the 100-yr deepwater significant wave height range from 32-38 ft at San Francisco and Half Moon Bay. The shoreline at Sharp Park is very exposed to large waves during coastal storm events. PWA (2009) estimated wave heights corresponding to a 100-yr coastal flood event based on climate model simulations by Cayan et al (2009). Deepwater wave heights for the two closest stations at Pacifica and Rockaway were found to be 36.6 ft and 32.9 ft, respectively, with a peak period of 17 seconds.

1.2 MORPHOLOGY OF BEACH FRONTING LAGUNA SALADA

The beach fronting Laguna Salada is coarse grained and steep, with a slightly arced planform due to the Mori Headland and predominant incident wave direction from the west-northwest. The beach narrows with distance north as its alignment conflicts with the nearly north-south roadway grid and seawalls north of Clarendon Road. The steep foreshore typically projects into a shore-parallel trough, with a shallow nearshore bar farther seaward, consistent with a reflective high energy shore. Alongshore and seasonal variability exist. During large wave conditions, waves can break far offshore, and well beyond the seaward edge of Mori Point. This indicates that sediment bypassing of the Mori Headland headland is possible.

The geology of the Sharp Park area is low and located in a sag/valley just north of Mori Point. Farther north, the seaward expressions of hillsides (ridges) oriented transverse to the shore can be seen, with near vertical bluffs to the north and expressions of bedrock and weaker sedimentary rock (hardpan) underlying the beach sediments. However, borings show the hardpan/bedrock to be relatively deep in front of Laguna Salada (Geomatrix, 1987).

The sediment at Mori Point/Salada beach is dark and coarse, contrasting with the predominant sediment farther north in the Manor District of Pacifica, south of Mussel Rock. Anecdotal evidence indicates that there are several sand sources in the area:

1. The eroding bluffs at Mori and Mussel Rocks, possibly augmented by historical deposits of these coarse sediments derived from generally older sedimentary rocks that are typically lower in elevation except at uplifted and tilted headlands. These are typically coarse (pebble/gravel size to sand size) and dark, and

2. The eroding bluffs or Manor and Daly City comprised of unconsolidated dune sands and weekly lithified sandstone. These are typically fine to medium sands, tan to brown in color, and tend to move over coarser deposits.

A comprehensive study of coastal processes along the Pacifica and Daly City shores has not been accomplished. It appears that the beach immediately north of Mori Point comprises sediment derived from erosion of Mori Point, and possibly accumulated over the last 20,000 years as sea level rose and stabilized. The orientation of the shore indicates that Mori Point is a partial barrier to southward transport, resulting in a rotation of the shore toward the north, and widening of the beach. The coarser sediment can move onshore under high wave action with long periods (relatively low ratio of height to wave length), and northward under westerly and southwesterly swells. The finer, brown sands from the Manor area most likely move southward and offshore at

Mori, unable to remain on the high energy steep beach formed by the predominate coarse sediments. The armoring near and north of the pier inhibits northward movement, creating a littoral divide between the southern subcell (Mori – Laguna Salada-south Sharp Park) and the northern subcell (north Sharp Park Manor to Mussel Rocks). Therefore, except for offshore exchange, the beach in front of Laguna Salada should be relatively stable, neither accreting nor eroding significantly in the long term.

1.2.1 Historical conditions

Historical maps and photographs show that the beach was wide and low, with a washover morphology (rather than dunes) south of the present location of Clarendon Road. The entire area was a sandy deposit, resulting from accretion that occurred as sea level rose and drowned the sag valley north of Mori Ridge. Wave power and sediment supply were sufficient to build a ridge of sand that typically blocked drainage, resulting in the formation of Laguna Salada. Analysis of wave power vs. tidal prism relative to other California lagoons and tidal inlets indicates that the tidal scouring of the lagoon was not nearly strong enough to maintain an open inlet given the strong wave exposure at the site (Figure 1).

Historic shoreline positions indicate shore erosion of approximately 2 feet per year (fpy) over the long term (last 100 years) but rapid erosion of about 5 fpy over the last 50 years, as shown in Figure 2 (Hapke and others, 2006). These studies refer to the shoreline estimated from maps and aerial photographs. The later high rate contrasts to the interpretation of a relatively stable, coarse grained beach described in the previous section. Speculatively, the rapid "short-term" erosion rates are attributed to relaxation of a large accretion event in the mid 1900s, where the shore became wider than that mapped in the early 1900s. There are several processes that could have caused this. Also, there have been anecdotal reports of extensive mining of sands from the beach by the City/County of San Francisco for expansion of the San Francisco Airport runways. While these reports are not substantiated, sand mining of California beaches was prevalent and has been shown to cause massive and lasting erosion. Sand mining can be particularly damaging if coarser sands are selectively mined, which is the typical practice, as the coarse fraction may have accumulated over thousands of years and is not rapidly replaced (PWA, 2008).

A review of historical photographs and documents indicates that the existing levee was constructed in the 1980s. The initial construction was conducted without permitting (personal communication, anonymous source previously employed by City of Pacifica). The remainder of the levee was constructed in 1989-1990, evidently with Coastal Commission approval. However, the approval appears to be partly based on the assumption that a contiguous levee or seawall existed prior to the 1983 event, based on a declaration of categorical exemption from CEQA by the City of Pacifica (see Appendix B, Geomatrix, 1987). The foundational description of a pre-existing levee damaged in 1983 is reinforced by several studies for the City/County of San Francisco (see for example Geomatrix, 1987), without any evidence or description. The ARUP (2009) "seawall" report reiterates that there was a levee/seawall in place in 1983. A review of available photos show an earth embankment at the north and south ends of the shore, with no embankment in the middle third. The embankments do not look to be as substantial as the existing levee and proposed seawall structures. There was not a levee for much of the beach in the 1980s and one could walk directly from the beach to the lagoon (personal observations by Bob Battalio, confirmed with other Pacifica residents). During this period, wave runup occasionally reached the lagoon, and swaths of sand were deposited on the west side of Laguna Salada. Therefore, the assertion that the new levee was a replacement or maintenance of a similar prior structure is dubious, at best.

A response to an inquiry to the California Coastal Commission states that the levee construction in the late 1980s was permitted for a "replacement berm 3500 feet long."

We have not found a review of the potential adverse effects of the berm (or levee, seawall) on the coastal and lagoon habitat. This is astonishing, given its dimensions of over 3,200 linear feet and height approaching +30'NAVD, and its construction more than a decade after the California Coastal Act (1976).

1.2.2 Existing conditions

The existing beach exists in front of an armored coastal structure. The back beach appears to be artificially elevated against the earth levee, which directs wave runup upward. The result is a narrower but locally higher, steeper beach. Another result is a reduction of sand volume, which results in a narrower beach during eroded conditions. This narrow beach incrementally increases wave reflection and increases the size and violence of shore break waves. Several drownings occurred in the vicinity of Clarendon Road and Beach Boulevard in 2009-10, due to being trapped between the large shore break and steep shore. During narrow beach conditions, wave runup reaches the levee. In winter 2010, a large volume of sand (on the order of 30,000 cubic yards) accreted on the beach between Mori Point and the pier, with some moving north to Paloma Street. The wave runup and coarse sand overtopped the seawall at Clarondon and blocked the storm drain outfall, resulting in flooding. The sand and runup nearly overtopped the levee at Laguna Salada. This deposition of sand has incrementally reduced the risk of coastal erosion damage at Laguna Salada.

1.2.3 Future conditions

The future beach conditions will depend on the amount of sand available, climate change and sea level rise, and the back shore condition as affected by man (e.g., whether the levee/seawall is maintained).

A detailed study is required to further diagnose historical conditions and predict future conditions. Pending that, long-term erosion amounting to an average on the order of 1 to 2 feet per year can be expected. However, actual changes will be irregular and likely to deviate from this average.

Relative sea level rise will induce recession of the shore. If the hard edge of the levee/seawall is maintained, the beach will narrow and the levee will be overtopped (or raised to prevent overtopping). If the levee is maintained, the beach will become so narrow that waves will frequently impact the levee/seawall and the beach will be largely lost. This condition has already

occurred north of the pier at Beach Boulevard (Figure 5, main report). In this condition, the wave runup elevation will increase substantially as large waves break directly against the armored slope of the levee.

If the levee is not maintained, it will erode and a wide sand barrier beach will form. The elevation of the berm will be close to the existing beach elevation, with relatively gentle, shallow swash overtopping by wave runup occurring annually. The wave action will transport sand inland and build the berm, conceptually rising and migrating landward with sea level rise. A comparison with unaltered barrier beaches indicates that the berm would equilibrate around +18 to +20 ft NAVD. This condition is approximately represented by Rodeo Lagoon Beach in Marin County (Figure 3). Appendix A (Table A-3) provides the data from reference sites. The expected beach berm elevation is close to the annual runup elevation based on calculations conducted by PWA using 100 years of synthetic water level and wave data (derived from PWA 2009). From this analysis, the 1-year return period water level was between +18 and +20 ft NAVD. We expect that the calculations slightly under predict actual values due to the global climate model used, but this high bias is compensated somewhat by the reduction of runup elevation realized with a greater lateral travel distance over a coarse sand berm versus the beach geometry assumed in the calculations.

Therefore, based on a review of other heaches, the conditions at Laguna Salada and calculations we conclude that the beach herm elevation would equilibrate to about +20' NAVD if the levee (seawall) is removed. The crest of the berm would be farther landward of the levee, and then slope downward into Laguna Salada.

The estimated elevation of +20' NAVD is lower than the existing top of sand elevation at the toe of the levee at the time of this report (about el +22'). The existing elevation is higher because the levee obstructs wave runup and causes the some of the sand that would have moved inland to deposit at the levee face. If the beach narrows, the runup incident to the levee will increase in intensity and scour, rather than deposition, can be expected.

1.3 COASTAL EROSION

1.3.1 Historical erosion rates and shoreline variability

Considerable erosion of the Sharp Park shoreline has occurred since construction of the golf course in 1932. From 1931 to 1992, it is estimated that the shoreline eroded approximately 200-300 ft, or approximately 3.3-4.9 ft/yr (PWA 1992). A large fraction of this erosion likely occurred during the 1983 El Niño storms.

The U.S. Geological Survey (Hapke and others 2006) estimated historical rates of change along sandy shorelines of the California coast over the past 150 years. USGS estimates of long-term shoreline erosion at Sharp Park from 1899-1998 are higher than the regional rates, on the order of 1.6-2.6 ft/yr (0.5-0.8 m/yr; Figure 2a). Short-term erosion rates at Sharp Park from 1946-1998 indicate even more rapid rates of shoreline recession on the order of 2.3-6.2 ft/yr (0.7-1.9 m/yr; Figure 2b).

1.3.2 Future erosion rates and shoreline response to sea level rise

Future erosion rates are of particular importance to coastal management, infrastructure maintenance, restoration design, and sustainability. Predicting long-term geomorphic evolution, especially considering the effects of sea level rise, is a difficult task.

The rate of erosion is related to the frequency, duration, and intensity of wave impact on the toe of the bluff or dune (Ruggiero and others 2001; Sallenger and others 2002; PWA 2009). Based on our understanding of coastal erosion mechanisms, it is expected that future erosion rates will meet or exceed long term, average historical rates. Presumably, higher baseline water levels associated with sea level rise will result in a greater occurrence of waves impacting the dune or bluff toe, thereby increasing the susceptibility to erosion. The coastal loads and erosion rates at Sharp Park are expected to increase and may increase non-linearly (accelerate) in the future. Certainly, historic rates and costs are minimums that will likely be exceeded in the near term.

1.3.3 Profile response to seawalls

Seawall effects are typically considered to be limited to the vicinity of the structure. Seawall effects are subject to ongoing investigation and a range of views and conclusions exist (Plant and Griggs 1992; McDougal and Kraus 1996; Wiegel 2000; USACE 2006). It is also generally accepted that the beach profile in the surf zone is affected by wave energy dissipation and the concept of an equilibrium profile is widely applied (USACE, 2006). On a receding shore, the position of the seawall can become relatively closer to the water over time, essentially truncating or compressing the area of wave dissipation. As a result, associated effects on nearshore hydrodynamics and sediment transport can modify the equilibrium profile. The impacts of shore parallel structures are typically limited to the area in front of the seawall and a downdrift area (relative to predominant sediment transport direction) unless the recession is so great that the structure starts to block alongshore transport.

Most of the controversy associated with seawall effects is associated with the accusation that "seawalls cause erosion." This has resulted in a parsing of the impacts of seawall construction to "passive" and "active" effects. Passive effects are generally agreed to exist, whereas active effects are subject to debate and require further research and consensus building. Passive effects refer to the narrowing of a beach in front of a seawall due to the continuation of erosion processes (Figure 4). The passive moniker is applied because the erosion in front of the seawall would have occurred anyway, and the seawall just prevents the land behind the seawall from becoming beach. It is also generally accepted that the footprint of the structure narrows the shore, reducing beach width (this is called "placement loss" and is not considered an "active" effect; Figure 4). It is also generally accepted that beaches can maintain themselves by eroding upland areas and migrating landward, and can also be nourished by sand released during erosion of back beach areas. Therefore armoring incrementally increases erosion potential by reducing sand supply to beaches and incrementally results in narrower beaches by preventing shore migration. These adverse

effects of seawalls to the shore are not considered "active effects." Active effects are defined as those that increase the rate of erosion by affecting local hydrodynamics. Active effects under debate include increased erosion caused by the interaction of the seawall with the surf zone, in terms of increased wave reflection, increased pore water dynamic pressure and fluidization of fronting sand deposits, acceleration of alongshore currents, modification of setup and rip current formation, among others. Interestingly, local active effects such as toe scour and end effects are generally considered as design criteria for structures and not debated.

In summary, armoring with a seawall (or similarly, a rock revetment or levee) on an eroding shore can be expected to result in a reduction of beach width over time, as the shore continues to try to recede. Active effects, if they exist, would accelerate the rate and extent of beach loss.

It is unfortunate that the coastal engineering and geomorphology community has been unable to develop a consensus and communicate the effects of seawalls to the public. However, recent research by beach ecologists confirms adverse effects of seawalls on the beach ecosystem (Dugan and Hubbard, 2006; Dugan et al., 2008).

In Pacifica, the result of seawall construction can be seen directly. The most extreme case is just north of Laguna Salada along Beach Boulevard north of the pier (Figure 5, main report). The photographs show the reduction of beach width over time. The seawall south of the pier and the levee fronting Laguna Salada have wider beaches in front of them.

1.4 RAINFALL/RUNOFF FLOODING

Assessments of rainfall/runoff flooding in Laguna Salada were completed by PWA (1992) and Kamman Hydrology & Engineering (KHE 2009). Both assessments integrated the rainfall-runoff, flood routing, and pond storage characteristics for Sanchez Creek, Horse Stable Pond, and Laguna Salada. The details of the more recent KHE (2009) modeling are presented here. KHE developed a rainfall runoff model for the Laguna Salada drainage basin using the WinTR-55 computer program. The model was used with published depth-duration-frequency rainfall data for the San Francisco Bay region (Rantz 1971) to determine the discharge into Laguna Salada for a 24-hr rainfall event with recurrence intervals of 2 to 100 years. KHE used the HEC-RAS hydraulic model to simulate lagoon water levels over a 48-hr simulation period. The modeling assumed operational pumps at Horse Stable Pond and an initial lagoon water surface elevation (WSE) of 6.8 ft NAVD. The results are summarized in Table 3.

Table 3. Summary of rainfall/runoff modeling results

Return Period (years)	Peak Flow Rate (cfs)	Storm Runoff Volume (ac-ft)	KHE (2009) WSE Increase (ft)	KHE (2009) Peak WSE (ft NAVD)	PWA (1992) Peak WSE (ft NAVD)
2	136	77	2.2	9.0	-
5	254	127	4.2	11.0	-
10	348	161	5.2	12.0	-
25	468	199	6.7	13.5	-
50	564	238	7.4	14.2	-
100 (w/ baseflow)	646	263	8.2	15.0	-
100 (w/o baseflow)	Not reported	Not reported	6.7	13.5	13.7

Notes: WSE = lagoon water surface elevation. KHE (2009) peak lagoon WSE estimated visually from Figure 11 (KHE 2009). PWA (1992) peak lagoon WSE of 10.9 ft NGVD converted from NGVD to NAVD using a conversion factor of +2.8 ft.

With no pumping the 100-year water level increases to between 15.5 ft (PWA, 1992), and 17 ft NAVD (estimated based on KHE (2009) by adding 1.5' to represent base flow).

1.5 COASTAL FLOODING

The Sharp Park site is very exposed to large waves. The long period swell incident upon the Central California coast results in strong wave setup, which can elevate water levels at the shoreline and allow much larger waves to impact the beach and levee. As waves break and runup on the beach, waves can overtop the crest of the levee, leading to erosion and landward flooding. While the largest waves break well offshore, run-up during winter storms is also greatly increased, causing erosion and overtopping along the Sharp Park shore, especially north of Laguna Salada. The following sections describe previous coastal flood studies for Pacifica, and evaluates the present day coastal flood hazards at Laguna Salada.

1.5.1 Summary of previous coastal flood studies

The effective flood study is the 1987 FEMA Flood Insurance Study (FIS) for the City of Pacifica, CA, San Mateo County (FEMA 1987a). The FEMA study estimated the Base Flood Elevation (BFE), or 100-yr wave runup elevation, in Pacifica at Paloma Avenue, approximately 4000 ft north of Laguna Salada. The BFE was estimated to be 27 ft NGVD (29.8 ft NAVD), based on the Ott Water Engineers' (1984) study. FEMA is currently in the process of updating the Pacifica Flood Insurance Rate Map (FIRM) for Pacifica. The BFE for the revised preliminary map for Pacifica (Map Number 06081C0038E, April 18, 2008) is 30 ft NAVD.

PWA (2009) estimated 100-yr total water levels (TWL = tides + storm surge + wave runup) along the northern California coast based on climate model simulations by Cayan and others (2009).

The average 100-yr total water level for the two closest stations at Pacifica and Rockaway was found to be 29 ft NAVD.

It should be noted that estimates of total water level or maximum wave runup indicate the highest potential runup elevation attained by waves breaking and running up on a surface, such as a beach or levee face (Figure 5). In reality, the wave overtops the levee and the overtopping jet carries water over the crest of the levee, where it collects and ponds on the landward side. The TWL or wave runup elevation is not the same as the flood inundation level on the landward side of the levee. The ponded water level reached on the landward side of the levee due to "pumping" of water over the crest by breaking waves is the landward coastal inundation flood level. This flood level is different than the FEMA BFE and the majority of previous flood studies (FEMA 1987; PWA 1992; KHE 2009; PWA 2009) have not evaluated this flood hazard for Laguna Salada. Geomatrix (1987) estimated the volume of wave overtopping of the 1980s unprotected coastal embankment; however, modifications to the levee crest and level of armoring over the past 20 years have modified the levee such that this assessment is no longer up to date. The sections below describe analysis conducted for this study to update the landward coastal inundation flood level for existing conditions.

1.5.2 Landward coastal inundation by wave overtopping

Coastal flood hazards for the 100-yr coastal storm event were evaluated for three cases at Laguna Salada:

1) **Existing levee** – wave overtopping of existing levee
2) **Degraded levee** – wave overtopping of existing levee with levee crest degraded by 2 ft during coastal storm event
3) **Natural barrier beach** – wave overtopping of natural wave-built barrier for restored lagoon conditions

All cases assume a 100-yr deepwater significant wave height of 36.6 ft and peak period of 17 seconds, based on total water level results from PWA (2009) (see Section 1.1.4), a maximum wave runup elevation of 30 ft NAVD (FEMA 2008), and duration of overtopping of 4 hours. The overtopping duration is selected somewhat arbitrarily pending a more detailed analysis. A four hour duration conceptually allows for overtopping to occur for two hours surrounding the peak high tide. A design water level of 13.7 ft NAVD was selected, assuming a stillwater level of MHHW (5.91 ft NAVD) with 7.8 ft of static wave setup (calculated using methods in the FEMA Pacific Coast Guidelines for Coastal Flood Hazards (FEMA 2005)). Inundation calculations assume that wave overtopping occurs over 800 ft of levee with average crest elevation of 29 ft NAVD (Figure 6). For the degraded levee case, we assume that erosion of the levee during a coastal storm event would lower the crest by approximately 2 ft to an elevation of 27 ft NAVD.

Overtopping rates for the existing and degraded levee cases were estimated using equations 7-11 and 7-12 in the Shore Protection Manual (USACE 1984; Weggel 1976). Overtopping rates were estimated in units of cubic feet per second per linear foot of levee. Total overtopping volume was estimated by multiplying the overtopping rate by the length of overtopped levee (800 ft) and storm duration (4 hrs). Lagoon storage volumes were converted to equivalent water surface level using the stage-storage relationships from Figure 6 in KHE (2009). Results of the wave overtopping analysis are presented in Table 4.

Overtopping rates of the natural barrier beach (restored lagoon) case for a 100-yr coastal flood event were not estimated, although substantial overtopping would occur. However, the presence of an unarmored natural barrier beach would allow both overtopping and free outflow from the lagoon to the ocean during a storm. As a result, the maximum lagoon flood elevation would be controlled by the elevation of the barrier beach berm. As discussed in Section 1.2.3, we estimate a maximum restored natural beach berm elevation of 20 ft NAVD. Natural breaching and drainage of the lagoon would likely occur under this scenario.

Table 4. Laguna Salada landward coastal inundation flood level for 100-yr coastal event

Scenario	Existing Levee	Degraded Levee	1980s condition (Geomatrix 1987)	Natural Barrier Beach (ft NAVD)
Levee Condition	800 ft @ +29 ft NAVD	800 ft @ +27 ft NAVD	800 ft @ +18 ft NAVD	3200 ft @ +20 ft NAVD
Overtopped Volume (ac-ft)	72	569	401	- (Berm is simultaneously overtopped by waves and lagoon drainage)
Lagoon Flood Level (ft NAVD)	9.6	17.2	14.7	20

Notes: Lagoon storage volume and flood level assume initial lagoon water level of 6.8 ft NAVD.

The results presented above for the existing and degraded levee cases are based on simplified methods which appear to overpredict actual overtopping of the coastal levee. These methods are based on flume studies with regular waves, and do not directly apply to the storm wave conditions along the Pacific Coast. This resulted in a high uniform overtopping rate compared to irregular waves. The SPM method was applied here to obtain a rough estimate of the inland flooding potential due to overtopping of the existing levee, based on a readily available maximum runup elevation from prior studies. Erosion of the beach during a storm event would actually change the profile geometry, thereby affecting the maximum wave runup elevation. These effects were not considered in this analysis. The combined influence of simplified overtopping equations and the relatively steep beach and levee profile assumed for the existing and degraded levee cases resulted in very high overtopping rates, and a conservative estimate of the inland inundation level due to overtopping. Comparison with the Geomatrix (1987) overtopping calculations for the levee and beach condition existing at that time confirms this assessment.

We recognize that these simplified calculations likely overpredict the overtopping rate for the existing levee and may overstate the coastal flood risk due to overtopping. Therefore, a more

detailed analysis of coastal flooding is needed to better assess flood risk and evaluated alternative risk mitigation and restoration alternatives.

1.6 COMBINED FLUVIAL AND COASTAL FLOODING

Flood levels within Laguna Salada are due to the combined effects of rainfall runoff, discharge from Sanchez Creek, and wave overtopping of the outboard levee. As previously discussed, the landward coastal inundation flood level has not previously been determined for existing conditions at Laguna Salada. Using the fluvial flood results from Section 1.4 and the coastal flood results from Section 1.5, we estimate the lagoon flood level due to a combined coastal and rainfall/runoff event.

An initial lagoon water level of 6.8 ft NAVD was selected based on assumptions made in KHE (2009) for the rainfall/runoff modeling. The approach taken here is to assume the 100-yr coastal flood event occurs during a 24-hr rainfall event. The results are summarized in Table 5.

Table 5. Laguna Salada landward coastal inundation flood level for combined 24-hr rainfall and 100-yr coastal flood event

	Lagoon Flood Level		
Rainfall Return Period (yrs)	**Existing Levee (ft NAVD)**	**Degraded Levee (ft NAVD)**	**Natural Barrier Beach (ft NAVD)**
2	10.7	17.8	20
5	12.4	18.7	20
10	**13.3**	**19.3**	**20**
25	14.4	20.2	20
50	15.1	20.7	20
100	15.9	21.3	20

Note: Analysis assumes 100-yr coastal storm event coincident with 24-hr rainfall events listed above. For with-levee conditions, initial lagoon water level of 6.8 ft NAVD assumed.

The above analysis indicates that the existing levee results in a lower coastal flood level than the natural condition for coincident rainfall events with a return period less than about 25 years. While the joint probability of coastal flooding and elevated rainfall runoff are not known, a 10-year recurrence rainfall event coincident with a 100-yr coastal event is recommended until more detailed analysis is accomplished (numbers in bold in Table 5). With the degraded levee (some degradation of the levee is likely during a severe overtopping event) the levee provides only a marginal benefit of 0.7 feet, which is within the level of accuracy of the methods used.

The above estimates are approximate. The 1983 coastal flood event was reportedly severe and is sometimes considered to be a proxy for the 100-year coastal flood event. Given that the levee was not present after the event (Geomatrix 1987); it can be assumed it was not continuously in place during the event. Measurements of the actual flood elevations resulting from the 1983 event were not found, but photographs (Geomatrix, 1987) indicate that the elevations were at least several feet below the elevations calculated (calculated elevations are in Table 5). Therefore we conclude that the calculated values probably over-estimate the extent of flooding that would occur. A more detailed analysis of coastal flood potential is recommended.

1.7 GROUNDWATER AND PUMPING

Water levels within Laguna Salada are currently maintained by the operation of a pumping station at the southern end of Horse Stable Pond. The small (1,500 gpm) and large (10,000 gpm) pumps are activated when lagoon water levels exceed 6.9 ft NAVD and 7.5 ft NAVD, respectively. The pumps convey runoff from the ponds to an outfall on the beach and prevent flooding of the golf course by continually pumping down the lagoon to a level below natural levels.

The direct ecological implications of pump operations are discussed in the main report. An indirect effect of artificially lowering the lagoon water level is increased vulnerability to groundwater salinity seepage from the ocean to the lagoon (the typical direction of groundwater seepage is from the lagoon to the ocean). KHE (2009) found no direct evidence of salinity intrusion by beach groundwater in the southern portion of Sharp Park; however, KHE (2009) noted that under certain conditions, the groundwater gradient may reverse and allow higher salinity groundwater to flow into the lagoon. Field observations by the ESA PWA team in February and March 2010 revealed such saline seeps emerging in golf turf patches immediately behind the coastal levee at the north end of Sharp Park (see Appendix F. Salinity intrusion to Laguna Salada backbarrier environments). The saline seeps occurred coincident with high winter tides and storm waves, which act to elevate beach groundwater levels and can cause a reversal in the typical seaward groundwater flow through the beach berm (Isla and Bujalesky 2005; Carter et al. 1984).

Landward salinity intrusion to Laguna Salada by reversal of groundwater gradients at the barrier beach is likely to increase and accelerate as sea level rises, storm wave heights increase in magnitude and frequency in California (Allan and Komar 2000), and as shoreline retreat continues on the San Mateo Coast (Hapke et al. 2006, Hapke et al. 2007).

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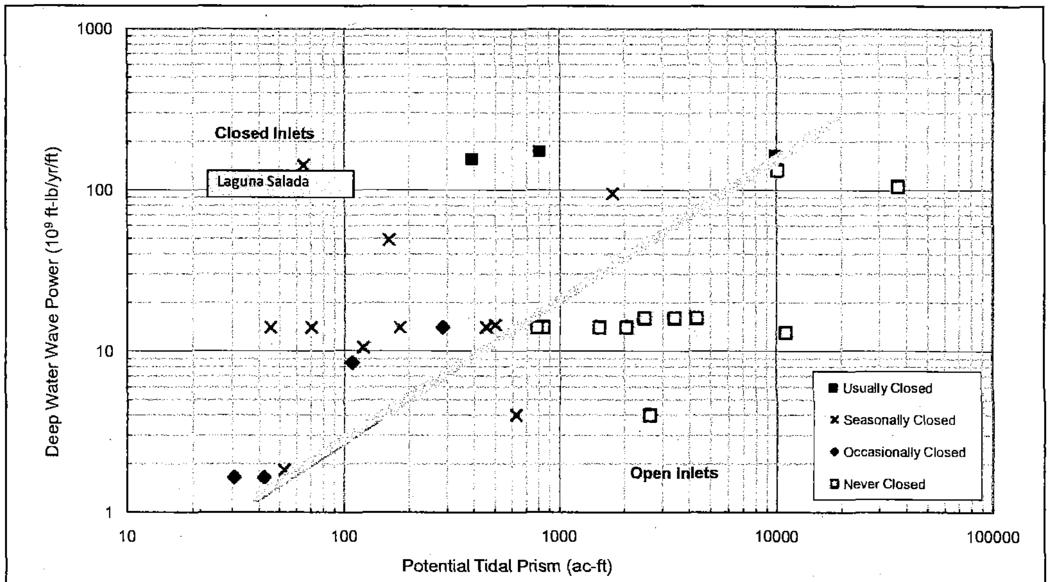
LIST OF FIGURES



Notes: Laguna Salada nearshore wave power = 95-140 x 10^9 ft-lb/yr/ft.
Existing potential tidal prism = 24 ac-ft.
Estimate of maximum historic potential tidal prism = 115 ac-ft (assumes intertidal footprint of 20 acres).

Source: Original methodology developed by Johnson (1973)

figure 1

Laguna Salada Restoration Feasibility Study

Johnson-type Wave Power-Tidal Prism Criterion

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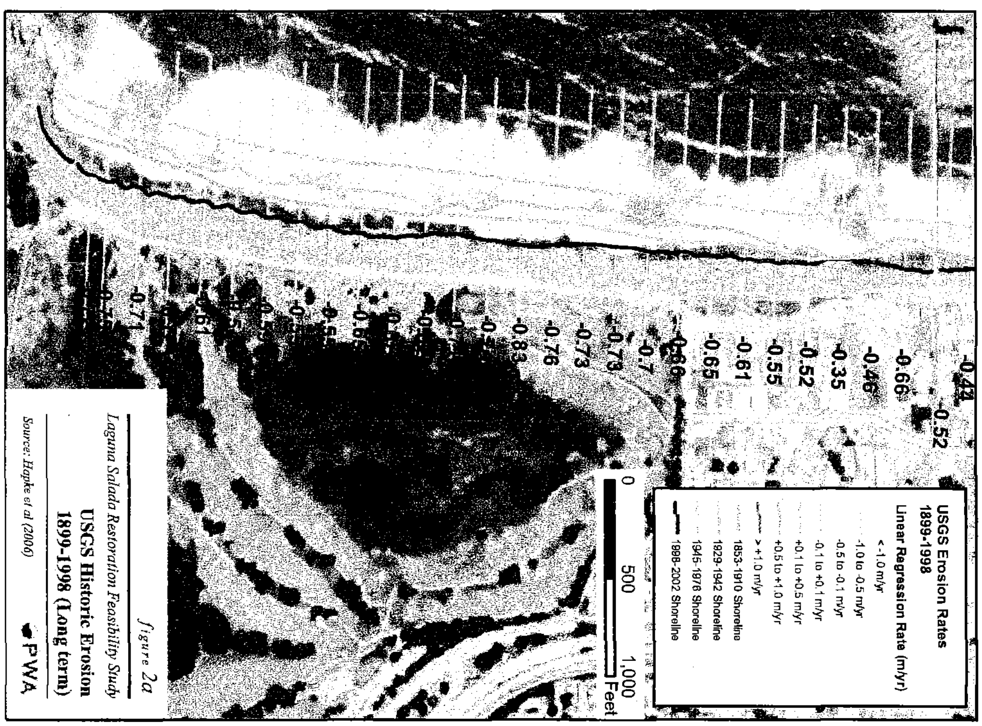

figure 2a

Laguna Salada Restoration Feasibility Study

USGS Historic Erosion 1899-1998 (Long term)

Source: Hapke et al (2006)

PWA

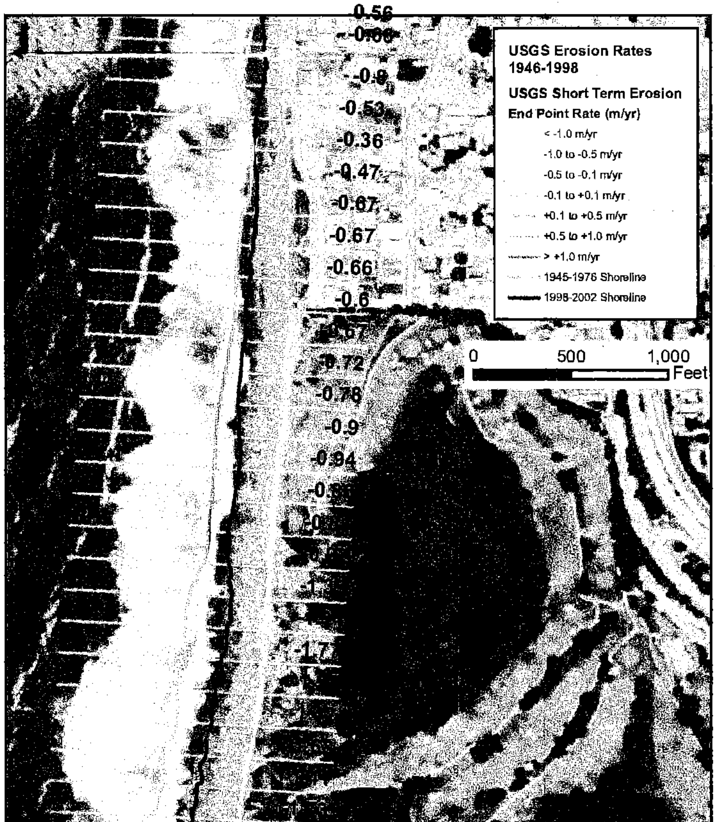

figure 2b

Laguna Salada Restoration Feasibility Study

USGS Historic Erosion 1946-1998 (Short term)

Source: Hapke et al (2006)

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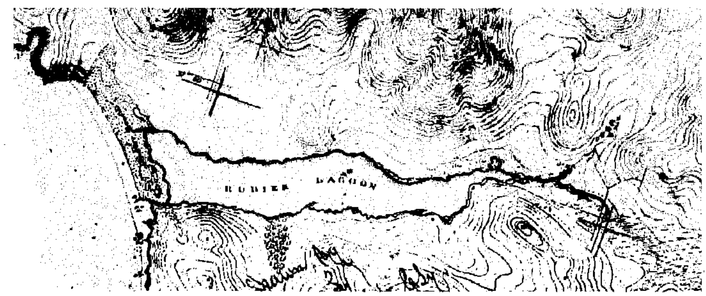

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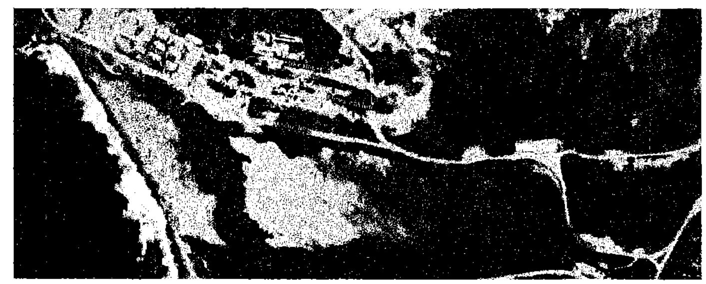

b

Figure 3. (a) Adapted from Striplen *et al.* 2004, Figure 3, USCS mapping of Rodeo Lagoon, Marin Headlands, 1850 and 1853, the first detailed coastal lagoon maps of the region. map shape of the barrier representing a seaward indentation of the backbarrier shoreline at the north end, characteristic of a recurrent outlet channel breach, as in (b) 2007 Rodeo Lagoon outlet morphology. Outlet position in beach planform conforms to headland-shelter wave refraction maximum predicted by Bascom (1954).

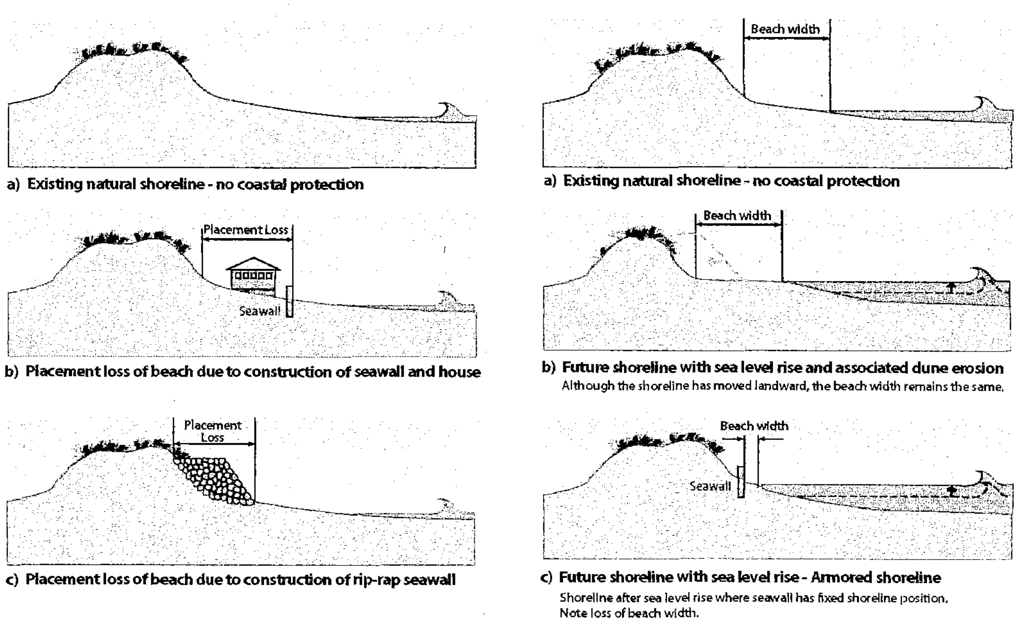

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figure 4

Laguna Salada Restoration Feasibility Study

Seawall Effects - Conceptual Profile Response

PWA

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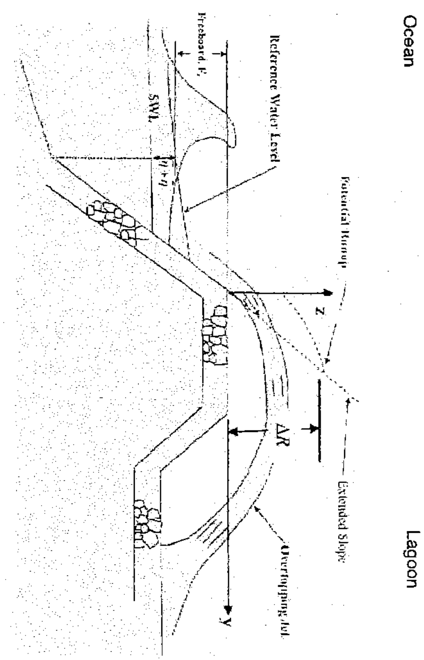


Parameters Available for Mapping BFEs and Flood Hazard Zones

Overtopping Parameters Used in Hazard Zone Mapping

Parameter	Variable	Units
Total potential runup elevation	R	ft
Mean overtopping rate	q	cfs/ft
Landward extent of green water and splash overtopping	$y_{G,Over}$	ft
Depth of overtopping water at a distance y landward of crest	$h(y)$	ft

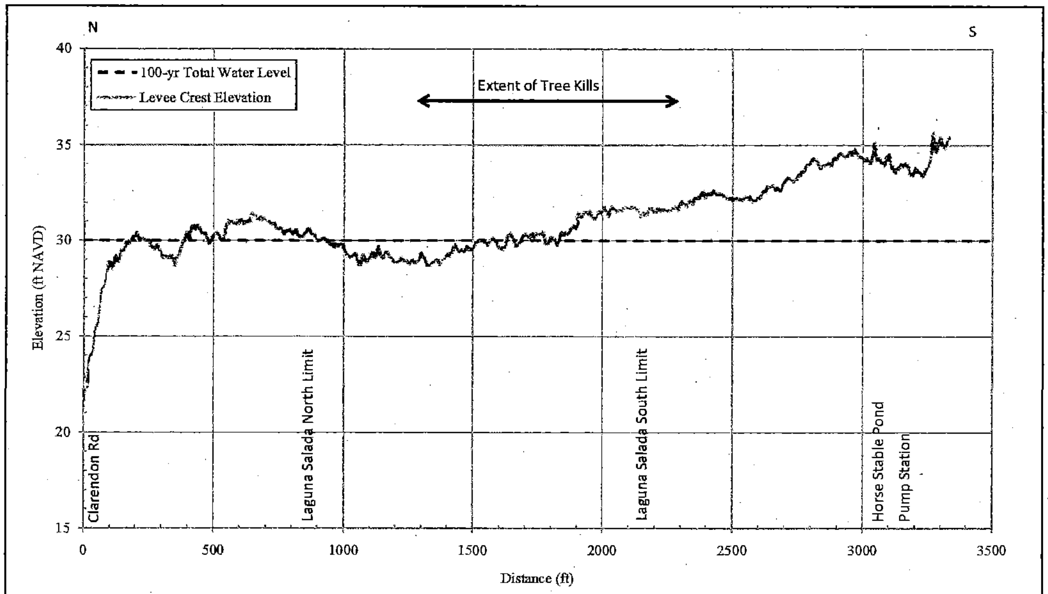
Source: FEMA Guidelines & Specifications for Flood Hazard Mapping Partners (January 2005)

figure 5

Laguna Salada Restoration Feasibility Study

Wave Runup and Overtopping Schematic

PWA



Notes: Laguna Salada North and Laguna Salada South labels indicate approximate northern and southern limits of lagoon, based on 2009 NAIP aerial image. Approximate 100-yr total water level of 29 ft NAVD shown for reference.
Source: NOAA Fall 1997 and Spring 1998 Lidar Topography. Topography shown is average of two surveys, smoothed using 3-point moving average.

figure 6

Laguna Salada Ecosystem Rehabilitation Feasibility Study

Sharp Park Levee Elevation Profile

PWA Ref #: 2028

PWA

Sharp Park Levee Profile.xls / Figure Levee Profile (averaged)

APPENDIX C. LAGUNA SALADA ECOLOGICAL ASSESSMENT

APPENDIX C.

LAGUNA SALADA ECOLOGICAL ASSESSMENT

1.0. BACKGROUND

In this Appendix, we review previous assessments of endangered species San Francisco garter snake (SFGS) (*Thamnophis sirtalis tetrataenia*) and the California red-legged frog (CRLF) (*Rana draytonii*), habitat quality at Sharp Park (Tetra Tech et al. 2009, PWA 1992, McGinnis 1986) in the broader context of the lagoon's physical processes, historic ecology, and the relevant current scientific literature on amphibian and snake ecology. In addition, the PWA team conducted multiple site visits to Laguna Salada in 2009 and 2010 to collect supplemental data and independent observations on habitat, hydrology, water quality, wildlife, and vegetation.

The scope of our assessment of Laguna Salada's ecological status and trends covers both short-term and long-term conservation and management issues, and does not depend on any assumptions of future land uses or land use conflicts within Sharp Park itself. This re-assessment provides the basis for our short-term (interim) and long-term restoration and management recommendations.

1.1. San Francisco Garter Snake

1.1.1. Review of San Francisco Garter Snake Life History Information.

The San Francisco Garter Snake (SFGS) is both fully protected by the State of California and is federally protected under Endangered Species Act implemented by U.S. Fish and Wildlife Service (USFWS). The range of this snake is extremely limited, with approximately only 6 areas identified in the snake's Recovery Plan (USFWS 1980) as worthy for management and restoration; Sharp Park is one of them. The entire range for SFGS occurs from SF airport out to the coast at Sharp Park and down the coastal range of San Mateo County to the northern boarder of Santa Cruz County. This snake primarily eats the tadpoles of native amphibians (tree frogs, California red-legged frogs). Tree frogs are important prey items of juvenile SFGS and are also consumed by adults. The federally protected California Red-legged Frog, however, is one the most important and heavily used prey items of adult SFGS. Therefore, recovery and enhancement of multiple and robust CRLF populations is one of the essential habitat enhancement requirements for the SFGS. The other essential habitat requirement for the SFGS is suitable non-aquatic or upland habitat within nearby locations of aquatic areas. A description of upland and basking habitat is presented below.

Habitat requirements of the SFGS vary throughout the year, and include aquatic foraging habitat, basking habitat (both aquatic and terrestrial), and upland areas close to aquatic sites. "Upland" habitats in the context of SFGS life-history include all well-drained terrestrial vegetation types adjacent to the primary freshwater perennial and seasonal wetland (marsh, riparian) habitats of SFGS. Upland SFGS habitats include seasonally dry coastal grassland and scrub habitats of hillslopes, as well as mesic riparian habitats in valley lowlands that are free from flooding and saturation year-round. Upland areas are used by SFGS as refuge when primary marsh and shaded riparian wetland habitats ares too cold for movement; they are therefore important habitat for the snake especially during the winter and with cold weather in the spring and fall. Upland areas contain small underground mammal burrows and soil crevices with dry warm shelter for the snake: this is typically located in adjacent coastal grassland and shrub community. SFGS also require basking habitat in both aquatic and upland areas. Suitable SFGS basking habitat contain open sunlit areas, with immediate escape cover from predatory birds and mammals. Basking habitat can be in the form of small break in aquatic vegetation (of marshes, lagoons, ponds and creeks), matted rush canopies, debris mats, woody debris, or as dense floating algae mats (USFWS 1985) or pondweed patches (Reis personal observation) that reach the surface but have deeper water for escape cover below, and gaps in terrestrial grassland or coastal scrub vegetation. These snakes use cover of dense vegetation (tules, cattails, grasses) to travel under, and are therefore often hard to find.

SFGS adults forage primarily on native CRLF frogs and tadpoles but will also eat Pacifte treefrog tadpoles (*Pseudacris regilla*), immature California newts (*Taricha torosa*), recently metamorohosed western toads (*Bufo boreas*), threespined stickleback (*Gasterosteus aculeatus*) and non-native mosquito fish (*Gambusia affinis*) (USFWS 1985). Mating occurs either in the spring or fall, but is especially concentrated in the first few warm days of March but has also been observed in late October and early November. Mating aggregations has been observed on open grassy sunny slopes on warm mornings (USFWS 1985).

1.1.2. SFGS distribution and potential habitat at Laguna Salada and vicinity.

SFGS were known to historically occur at Laguna Salada, as documented in 1951 by W.L Fox. The populations were though to have declined by 1978 when only 37 snakes were observed in the aquatic areas adjacent to Horses Stable Pond and 46 were observed at Mori Point (Barry 1978). In 1986, McGinnis did not find any SFGS after 2,000 hours of trapping efforts.SFGS were found by CDFG trapping efforts in 2004 in the wetlands around Laguna Salada (SFRPD 2006).

The existing population of SFGS at Sharp Park is thought to be small and not very robust, which is concerning. SFGS were were detected at Horse Stable Pond as recently as 2008, but have not been detected during the most recent (2009) surveys at this location (Swaim 2009). Detection probability of SFGS in variable widths and densities of cattail/tule marsh vegetation have not been assessed. SFGS are known to occur in the North Pond, on the hill-slope a few hundred feet to the east of the Horse Stable Pond by GGNRA Staff Biologist and at the nearby Mori Point Ponds (Swaim 2008). SFGS are also known to occupy the SFPUC watershed land to he east at the San Andreas Reservoir below Sweeney Ridge (Swaim 2008). The status of SFGS at Arrowhead Lake, Sanchez Creek, or the lagoon or should not be assumed as absent as these areas have not been thoroughly assessed during the last 5 years. The existing potential SFGS habitats at Sharp Park's Arrowhead Lake, Sanchez Creek, the Lagoon and Horses Stable Pond need well timed and focused SFGS surveys that include sex ratios so that the population and potential for future viablity at Sharp Park can be better understood.

Historically SFGS must have existed at Laguna Salada before it was developed as a golf course because there were no other potential significant freshwater or fresh-brackish pond and marsh habitats represented within the Laguna Salada watershed, as shown in the detailed 1869 U.S. Coast Survey map of the San Francisco Peninsula (Appendix A). SFGS were document to occur at Laguna Salada in 1951 by W.L Fox. However, SFGS habitat conditions of the wetland and adjacent uplands are currently far less favorable (and largely displaced) than in the past. The SFGS population at Sharp Park has likely been affected by the following:

a) loss of foraging sources due to extreme salinity pulses in topographically depressed drained Laguna Salada marshes (interaction between artificial marsh drainage on marsh elevations, and overwash) causing brief intensive mortality events of frogs and tadpoles by wave overwash into the depressed remnant lagoon areas and into Horse Stable Pond;
b) possible predation by fish in the lagoon (Swaim 2008);
c) golf course use and maintenance practices (past and ongoing mowing, past and ongoing fertilizer application, past pesticide application, past and ongoing vehicle operation,past and ongoing lagoon pumping,drainage);
d) possible collecting and competition with other garter snake species found present at the site (McGinnis 1976);
e) decline in habitat quality and structure, including water quality, upland cover, mammal burrow refuges, basking habitat, and prey base;
f) Highway and urban developments act as a barrier for snake movement into and out of the park.

Deficient SFGS prey base and deficient suitable upland refuge habitat (where the golf greens now occur) during the winter are likely **limiting factors** in ensuring the persistence of the SFGS at Sharp Park. Laguna Salada, Horse Stable Pond, Arrowhead Lake and other water bodies at Sharp Park need to be net sampled for the presence of predatory fish, including mosquito fish that prey on treefrog tadpoles, so that the suitability of these water bodies for CRLF/SFGS can be better assessed and appropriate actions, such as the eliminating fish can be taken if needed.

With no action, the future of SFGS at Sharp Park is, at best, uncertain. The restoration and or creation of the following mix of SFGS habitat types is needs to occur in balance: the absence of one of these habitat sites at the Park could limit the viability of SFGS at Sharp Park. These different snake habitats include:

a) viable breeding ponds/lagoon for native frogs (food source for SFGS);
b) suitable aquatic and terrestrial basking sites;
c) upland non-flooded refuge habitat for non-active snakes during cold periods in fall, winter and spring;
d) vegetated movement corridors and linkages to Mori Point and into and out of the park.

1.2. California Red-legged Frog

1.2.1. CRLF Life History Information.

CRLF are known to occupy and reproduce in marshy habitats, springs, ponds (both natural and artificial), backwater pools of rivers and streams (Stebbins 1985, Reis 1999a, Reis 1999b, Reis 2001, Reis 2002). CRLF are also known to occur and breed in tidally influenced, seasonally nontidal coastal backbarrier lagoon marshes formed by beach ("sandbar") impoundment of fresh or fresh-brackish (oligohaline) water during the late spring and summer (Smith and Reis 1997, Reis 1999b).

Habitat characterizations are different for each CRLF life history stage (egg, tadpole, juvenile, and adult) (Reis 1999b). CRLF eggs are laid near the surface of the water. Adult CRLF need aquatic areas with emergent vegetation to attach their egg-masses. In a coastal marsh, adult CRLF select warm and shallow water sites for laying eggs, while tadpoles utilize waters of shallow to medium depth (Reis 1999b). CRLF are also known to attaché eggs masses to cattails and tules in deep water (Reis 2001 and 2002). For successful reproduction to occur, surface water must last long enough for tadpoles to complete metamorphosis, at a minimum to late June (Reis 1999b) but depending on the locality, may require surface water through October (Reis 2002).. Tadpoles use both vegetation and mud for escape cover from predators (Jennings and Hayes 1988). It is speculated that CRLF tadpoles are mainly algae grazers (Reis personal observation).

Juvenile and young-of-the-year (y-o-y) CRLF mostly occur in sites with shallow water and limited shoreline or emergent vegetation (Jennings and Hayes 1988). It may also be important for juvenile CRLF and y-o-y to have small (1-meter) openings (gaps) in the vegetation or clearings in the dense riparian cover to warm themselves in the sun and forage, but still have vegetation close for escape from predators (Jennings and Hayes 1988). Population studies of CRLF conducted by Smith (pers. com. 1999) along Waddell Creek and Waddell Creek lagoon, where the reproductive habitat is limited to a small ephemeral marsh and permanent pond near the mouth of the lagoon, have indicated that juvenile frogs remain farther upstream in the creek environment during the reproduction season. Data from other locations where the reproductive habitat is more extensive have shown that juvenile frogs will use both non-reproductive habitat and reproductive habitat throughout the year (Reis 1999a). Juvenile CRLF will eat both aquatic and terrestrial insects.

Radio-tracking studies of CRLF in Waddell Creek indicate that during the reproductive season, adult frogs remain close to reproductive ponds (Smith, pers. com. 1999). During the non-reproductive season, adults are likely to be found in deep (greater than 0.5 m), as opposed to shallow water reproductive areas (Reis 1999b). Deep water areas provide adult CRLF with escape cover from mammalian and avian predators. If the surface water becomes scarce or either air or water temperatures are too warm, the CRLF will seek cool, moist locations in non-aquatic habitats. Adult CRLF die from heat exposure above 95 F (Jennings, Hayes and Holland 1993).

The upland (non-aquatic) and riparian areas adjacent to occupied aquatic areas are essential to juvenile and adult frogs for maintaining prey bases and as foraging area. Adult CRLF will eat mice, aquatic and terrestrial insects, and treefrog tadpoles and adults. Adult CRLF using the upland areas will spend over 22 consecutive days using upland areas to rest and feed in the vegetation, even when surface water is available (G. Rathbun pers. com 2000, USFWS 2001). The maximum amount of time an adult CRLF has been observed inhabiting an upland area without taking refuge in water is 77 days (J. Bulger et al. pers. com 2000).

A radio-tracking study of adult CRLF, conducted in at coastal year round stock ponds in Santa Cruz County, by the National Biological Service (now USGS), found that most adults stay resident and within a few feet of surface water areas during the spring and summer months (Bulger and Seymour 1998, Bulger pers. com. 1997). However, a subset of the CRLF adults was found using upland areas within 60 m (200 ft) of the water. Examples of micro-habitats in upland areas that contain cool and moist climates suitable for adult and juvenile CRLF include small mammal burrows, moist leaf litter, and moist woody debris (USFWS 2000).

During this same radio-tracking study, a few adult CRLF move long distances 3.6 km (2.2 miles) during rainy weather for migrations between ponds (Bulger and Seymour 1998, Bulger pers. com. 1997). During these migrations, CRLF adults moved in straight-lines from non-breeding to breeding habitats and left creek and riparian corridors to crossed upland habitats, including agricultural fields, redwood forest and chaparral (Bulger and Seymour 1998, Bulger pers. com. 1997). Potential barriers to adult movement and dispersal include busy road, roads and highways without culvers or underpasses, heavily urbanized areas, water bodies over 20 ha (50 acres) and saline habitats over 9 ppt. See Table 1 for summary of limiting factors by CRLF life history stage.

Table 1. Potential for California red-legged frogs (*Rana draytonii*) to occur in aquatic areas depending on life-stage.

Life History Stage	Limiting Factor
Eggs	
Water Temp °C	Above freezing and under 24.0° C. *Ideal temperatures are between 14 and 20° C.*
Water Salinity (ppt)	Less than 4.0 ppt (Jennings and Hayes1990) 3.8 ppt (Reis 1999) *when eggs are laid and for 2 to 6 weeks after* until the embryos develops in to free swimming larva/tadpoles. *Ideal water salinities are less than 1 ppt*
Sand Bar (lagoon beach outlet) Closed	Not applicable-sand bar can be open or closed as eggs are laid in backwater or overflow areas when fresh water input is great enough to create a freshwater barrier to tidal action.
Water flow and longevity	Still water with no high water flows which would scour out an egg mass **after** eggs are laid. CRLF eggs in central and northern CA are laid between the end November (USFWS 2002) to mid-May (Reis personal observations).
Water Depth (m)	Shallow water (less than 0.5) is not a liming factor but it is a indicator of potential egg mass presence (Reis 1999). Water depth near eggs should be long enough to complete development of eggs and connected to deeper water that will allow development of tadpoles.
Other	Emergent vegetation (dead or alive) is needed for egg-mass attachment
Tadpoles	
Water Temp °C	Above freezing and below 25.0 °C (between 7.0 and 24.9 Reis 1999) ***until tadpoles have completed development.*** *Ideal growing water temperatures are 14-18.* °C
Water Salinity (ppt)	Less than 5 ppt (McGinnis 1986) Less than 7.5 ppt (Jennings and Hayes1990) or less than 6.5 ppt (Reis 1999) ***until tadpoles have completed development.*** Unless areas are protected from tidal action, the sand bar needs to remain closed until tadpoles have completed development. *Ideal water salinities are less than 2 ppt*
Water longevity	Surface water though July preferablely through late September (development rates vary from site to site) *Ideal water longevity would be year round, but only if predatory fish and bullfrogs are absent*
Water Depth (m)	Not applicable as long as there surface water and structural cover from predators (shallow water under 0.5 meter is a better predictor)
Other	Presence of Cattails and Potagometon sp. are good predictors for CRLF tadpoles.
Resident Adults	
Water Temp °C	Less than 29.0 °C

Life History Stage	Limiting Factor
	Ideal temperatures are between 14 and 20 °C .
Water Salinity (ppt)	Less than 9 ppt (McGinnis 1986 and Jennings and Hayes1990) ***all year.*** *Ideal water salinities would be fresh, less than 2 ppt*
Water Longevity	Not applicable as adults can live up to 77 days away from water if there is moist ground or leaf litter *Ideal water longevity would be year round, but only if predatory fish and bullfrogs are absent*
Water Depth (m)	Residential adults need deep water (0.64 m or more) to use as refuge from mammalian, and avian predators
Other	
Transient Adults	
Water Temp °C	Less than 29.0 °C, Ideal temperatures are between 14 & 20 . °C
Water Salinity (ppt)	Less than 9.0 ppt (Jennings and Hayes1990) ***while moving*** (not needed all year) **Ideal water salinities would be fresh, less than 2 ppt**
Water Longevity and Depth	Water depth does not limit, availability of water is needed for hydration *while* moving

In summary, the discrete age classes (eggs, tadpoles, juveniles and adults) use different microhabitats within the same general area. Further, juveniles and adults may disperse to entirely different habitat types and depend in part on upland areas for prey sources and foraging if the aquatic environment is overcrowded or limited. Dispersal patterns and habitat use of juvenile and adult CRLF varies, and is likely dependent on year-to-year variations in climate and habitat suitability, and on the varying requirements of each life stage.

1.2.2. CRLF distribution and potential habitat within Laguna Salada and vicinity.
Swaim 2008 found CRLF egg masses in Laguna Salada, at Horse Stable Pond, and in the cannel connecting these two remnants of the historic lagoon. CRLF eggs were also found in Lake Arrowhead, east of HWY1 (Swaim 2008). During the PWA Team site vsit in May of 2010, large CRLF tadpoles (TL approximately 7.5 cm, ten adult CRLF and two subadult CRLF were readily observed in a small 4 x 4 meter segment of Sanchez Creek at the base of the walking path to the park on the ocean side of Fairway Drive. CRLF are also know to occur at the nearby Mori Point ponds (Tetra Techet al,. 2009). Laguna Salada was the only potential CRLF breeding habitat in the watershed prior to historic agricultural and urban modification of the landscape, as indicated in detailed U.S. Coast Survey 1869 topographic map of the San Francisco Peninsula (Appendix A). Potentially suitable breeding habitat (cattail, tule, bulrush marsh, pondweed beds, and adjacent open lagoon water) was evident at Laguna Salada during agricultural land use periods prior to golf development, as late as the 1920s (Appendix A).

2.0 PRINCIPAL CONSTRAINTS ON ECOLOGICAL FUNCTIONS AND SUSTAINABILITY OF LAGUNA SALADA WETLAND HABITATS.

The principal constraints on ecological functions at the Laguna Salada wetland complex can be classified in terms of ongoing golf operations and maintenance, hydrologic management of the lagoon and its associated infrastructure (levee, pumps), and legacy impacts of past natural and artificial events (coastal storms, lagoon and floodplain filling, past conversion of natural vegetation to agriculture and later turfgrass). These primary classes of environmental modifications of the lagoon wetland complex are associated with complex secondary (indirect) significant impacts to ecological functions, and long-term sustainability of the ecosystem.

We distinguish current and future environmental constraints associated with current land uses at Laguna Salada from the legacies of past land use impacts that reshaped Laguna Salada's physical structure, vegetation, and wildlife. These legacies pose significant residual, ongoing influence on modern habitats and wildlife populations. Conversion of natural floodplain riparian wetlands and uplands to crop agriculture, floodplain drainage, floodplain and lagoon filling (conversion to uplands) in the late 19th and early 20th century preceded historic filling of the floodplain, artificial drainage regime (pump and levee system), and artificial stabilization of the barrier beach, are pre-golf environmental legacies that have been retained, expanded, or intensified by modern golf land uses. Our analysis of habitat and ecosystem-level constraints within Laguna Salada focuses on two main modern influences: golf course maintenance and operation activities, and the engineered hydrologic management that permanently drains Laguna Salada's floodplain and maintains artificially low and stable year-round lagoon levels.

2.1 Ongoing golf course maintenance and operation.
Ongoing golf course maintenance includes mowing and fertilizing golf greens adjacent to Laguna Salada wetlands, and these maintenance activities also appear to encroach directly into the wetlands themselves. Fertilizer contamination of amphibian habitat waters (particularly nitrogen fertilizers) are known to adversely affect survival and development of frog larvae (tadpoles), including California red-legged frogs (CRLF) and tree frogs, even at concentrations lower than standards for drinking water quality. Laguna Salada has limited water quality sampling for nitrogenous nutrients (nitrate, nitrite, ammonium), but elevated levels within the effects range for frog tadpoles has been detected. Mowing of the golf course extends into the marsh itself, eliminating cover, potential upland habitat transition, potential woody debris, and reducing functional marsh habitat area and edge. These constraints on the abundance, distribution, and quality of wetlands and their terrestrial habitats at Laguna Salada are due to discretionary active, chronic, or recurrent maintenance. They are analyzed below.

No data are available on cumulative pesticide loads in Laguna Salada wetlands from past or recent golf course operations, runoff from adjacent residential areas, or agricultural legacy pesticides. Pesticides (including herbicides, insecticides, fungicides) are related to regional amphibian declines (Davidson *et al.* 2004).

2.2. Nitrogen and phosphorus fertilizers and amphibian ecotoxicity of nitrate, nitrite, and ammonia.

Nitrate discharges from anthropogenic (human-made) sources may result in a serious ecological risk for amphibians, including frogs (Camargo et al. 2005, Hecnar 1995). Nitrogen is generally the limiting nutrient regulating growth in turfgrasses (Goss 1972). Turfgrass (sports turf) maintenance requires regular and relatively heavy applications of commercial nitrogen fertilizers (low rates = 1-2 lbs/1000 square feet; up to 7 lbs/1000 square feet). Nitrates enter wetlands in runoff and groundwater discharges from agriculture and turfgrass fertilizer applications.

CRLF abundance is negatively associated with elevated aqueous concentrations of phosphate , nitrate, and ammonium derived from fertilizers (D'Amore *et al.* 2010). Nitrates, and related nitrites and ammonium (produced by microbial reduction in hypoxic wetland soils), have significant acute and chronic ecotoxic effects on California California red-legged frog tadpoles and treefrog tadpoles, as well as larval stages of many other amphibian species (Marco and Quilchano 1999, Nebeker and Schuytema 2000, Greulich and Pflugmacher 2003). Acute sublethal effects of nitrate and nitrite in frogs include reduced feeding and swimming activity, disequilibrium and paralysis, abnormalities and edemas (California red-legged frogs and treefrogs; Marco et al. 1999) and reduced response to predator cues in other ranid frogs (Burgett et al. 2007). Significant lethal effects of nitrite in California red-legged frog and treefrog tadpoles (high mortality response) were evident even at the recommended limits of nitrite concentration for drinking water (1 mg NO2-/L) established by the U.S. Environmental Protection Agency. Recommended limits of nitrite for warm-water fishes (5 mg NO2-/L) were associated with significant frog mortality (Marco et al. 1999). Current drinking water quality standards for nitrate (10 mg/L) are not protective of some amphibian species (Hecnar 1995).

Swaim (2009) observed California red-legged frog egg masses in both Laguna Salada and Horse Stable pond, but observed tadpoles only in Horse Stable Pond (Swaim 2009, p. 50), and observed fewer egg masses in Laguna Salada despite its greater area (Swaim 2009, p. 18). Swaim (2009) did not account for the anomalous lack of transition between tadpoles and adults at Laguna Salada. Despite the very different potential nitrate source potential of Laguna Salada (bordering fertilized golf greens) and Horse Stable Pond (discharge from Sanchez Creek through dense riparian and freshwater marsh vegetation), recent habitat assessments did not assess whether fertilizer runoff from golf greens may be a limiting factor for California red-legged frog adults, eggs, or tadpoles (Swaim 2009, p. 24). Eliminating nitrogen fertilizer impacts on habitat quality from habitat assessments is not indicated by current federal conservation biology guidance for the California red-legged frog: nitrogen fertilizer contaminants in runoff are recognized by the U.S. Fish and Wildlife Service as potential factors influencing recovery of the California red-legged frog (USFWS 2002, pp. 28-29).

Past water quality monitoring data from Laguna Salada (PWA 1992, Curtis & Thompson Laboratories 2009) indicate that nitrate, nitrite, and ammonia concentrations at some times and locations occur in the reported effects range for sublethal or lethal effects on California red-legged frogs and treefrogs: nitrite concentrations of 2.6-2.7 mg/L and ammonia concentrations between 4.0-5.0 mg/L were detected at some locations in February 2009 (Curtis and Thompson Laboratories 2009). Nitrate concentrations of up to 1.4 mg/L were reported in 1992, and the pattern of nitrate concentration and sampling location in proximity to golf greens or riparian and marsh buffers (1.4 mg/L northwest LS, 0.23 mg/L southeast LS, 0.14 mg/L Horse Stable Pond) consistent with fertilizer contamination of adjacent Laguna Salada. No sampling strategies to quantify seasonal or spatial variability in aquaeous nitrate, nitrite, or ammonia concentrations at Laguna Salada have been implemented.

The extensive eastern border of Laguna Salada marsh and golf greens contains no buffer areas of unmown perennial grassland, sedge meadow, or continuous strips of riparian scrub to act as buffers to nitrogen runoff or nutrient sinks. The mowing of marsh vegetation to the same level as adjacent turfgrass (see 3.4.1.2.) further facilitates surface and shallow subsurface transport of soluble nitrogen fertilizers into Laguna Salada marsh sediments (during spring/summer drawdown) or open waters (winter high water stands).

A potential secondary effect of eutrophication (excessive nutrient loading) due to fertilizer runoff and leachate (percolated groundwater discharge) is facilitation of toxic cyanobacterial blooms. Extensive use of high phosphorus in fertilizers, and phosphorous from various types of manure are know to cause cyanobacteria blooms (Kuffner and Paul 2001, Lehtimaki et al 1997). In fact, fertilizers for golf greens are know to create overloads of phosphorus which can result in both terrestrial and aquatic cyanobacteria blooms (Colbaugh 2002). Although some species of frog tadpoles graze on cyanobacteria, substantial and recurrent blooms of toxic forms of cyanobacteria taxa such as *Microcystis,* which has formed ecotoxic blooms in fresh to brackish lakes, reservoirs, and estuaries with high nutrient loads in California (Miller *et al.* 2010, Moisander *et al.* 2009). Microcystis and other cyanobacterial toxins bioaccumulate are known to cause embryo malformations and significantly alter the development of amphibian embryos (Dvorakova et al. 2002). Visual evidence of cyanobacterial blooms include high turbidity and green, blue-green, or yellow hues during warm weather and shallow water conditions. No monitoring of cyanobacterial species composition or abundance is currently available for Laguna Salada, but environmental conditions favoring blooms (shallow, warm, slightly saline water, nutrient loading sources) and visual appearance of the lagoon in summer indicate the potential for indirect cyanobacterialmediated ecotoxic impacts of eutrophication.

The recovery plan for the San Francisco Garter Snake recommended monitoring of fertilizer use at Sharp Park to ensure no adverse impacts (USFWS 1985 p. 43, recovery task 253). Tetra Tech (2009, pp. 2,) identified "eutrophication" (excessive nutrient loading) as a problem for Laguna Salada only in the context of biomass production of emergent marsh vegetation, and they attributed it only to the secondary source of nutrient release from "decaying vegetation" rather than the primary source of high-nitrogen fertilizers routinely applied to sports turf (golf greens). Neither Tetra Tech et al. (2009) nor Swaim (2009) addressed the potential adverse impact of fertilizers on San Francisco Garter Snakes or need to assess it.

Our review of limited local water quality data at Laguna Salada, and the relevant scientific literature on nitrogen fertilizer contaminant impacts on amphibians in general, and California red-legged frogs in particular, supports a conclusion that chronic or pulsed aqueous nitrate, nitrite, and ammonia loads from fertilizer applications on adjacent golf greens may be limiting factors for California red-legged frog larval survivorship and adult recruitment, at least near golf green nutrient sources. The potential reduction in abundance of adult frogs, eggs, and tadpoles in the lagoon, may be limiting prey availability and trophic support of the San Francisco Garter Snake population.

2.3. Marsh and terrestrial habitat mowing

The mowing of the golf greens extensively encroaches into the core habitats of the California red-legged frog and San Francisco Garter Snake. Routine summer turf mowing in 2010 reached 3 to over 5 meters into fresh-brackish bulrush-dominated marsh along the northern and eastern edges of Laguna Salada, reducing marsh vegetation to stubble and turf with essentially no canopy cover (Figures 7-8 of this appendix). Marsh mowing occurs in summer when pumping artificially lowers the lagoon level enough to allow mowing of the marsh edge (Figures 7-8).

The marsh edge mowing was described ambiguously in the recent habitat assessments of Laguna Salada: "Regular golf course maintenance appears to be controlling the growth of wetland habitat in some areas adjacent to the lagoon, as remnants of some hydrophytic plant communities were observed in lower elevation mowed areas (Tetra Tech et al 2009, p. 25, citing Tetra Tech 2008), and also "lack of secured upland habitat" (Swaim 2009, p. 18), "vegetation structure" as a "primary limiting factor" , "lack of suitable upland habitat", (Tetra Tech et al. 2009). These oblique descriptions applied (at least in part) to turfgrass mowing encroaching up to approximately 5 meters into bulrush marsh during lagoon drawdowns appear to be euphemistic understatements of the severity of the impact on wetland habitat amount, distribution, quality, and upland habitat buffering.

The edges of Laguna Salada wetlands were identified as the most likely travel routes of the San Francisco Garter Snake (Tetra Tech et al. 2009 p. 30) and were sites of California red-legged frog egg mass observations (Swaim 2009). The San Francisco Garter snake depends on the availability of "secure basking sites", "upland cover", and is threatened by "wetland loss", "removal of riparian vegetation" (USFWS 1986), and relies on adequate amounts and distribution of "dense cover" of vegetation within and near its primary aquatic and wetland foraging habitats (Jennings 2000).

The direct reduction of core marsh habitats, and the complete elimination of any potential marsh-upland buffers along the landward edge of Laguna Salada, are likely to be significant limiting factors for viable populations of both the California red-legged frog, and particularly the San Francisco Garter Snake. Converting marsh into golf greens by chronic mowing eliminates essential habitat structure in the high marsh that would develop several habitat types on which the San Francisco Garter Snake depends: primary foraging and escape marsh habitat in preferred "dense cover" of bulrush, cattail and rush marsh (USFWS 1985, Jennings 2000); basking habitat (on matted bulrush and rush leaf litter canopies and algal mats; USFWS 1985), and movement corridors (Tetra Tech et al. 2009, Swaim 2009).

Mowing of the transition zone (partially drained soils) above the marsh also eliminates potential grassland, sedge-rush meadow, and riparian scrub habitats that are required as buffer zones and upland transition zones that are minimally required for viable populations of pond-breeding amphibians (minimum 30 m wide; Harper et al. 2008; Semlitsch & Bodie 2003). Mowing across potential buffer zones and into core habitats and dispersal/travel corridor space exposes San Francisco Garter Snakes and California red-legged frogs to elevated mortality risks due to predation, mechanical injury, loss of core marsh foraging habitat and prey base, loss of seasonal foraging habitat and prey base, loss of flood escape habitat (snake), and facilitation of nitrogen fertilizer contamination of frog winter-spring breeding habitat.

2.4. Stabilization of low lagoon levels and depth fluctuation by pump operation.

The single most influential environmental factor affecting wetland habitat extent, quality, sustainability (stability), structure, and vegetation composition under existing conditions is the artificially stabilized, low-level fluctuation of the lagoon water surface elevation near intertidal (still water) elevation ranges. The lagoon is maintained in a condition of permanent drawdown, eliminating the seasonal high stands of natural coastal lagoons above tidal elevations due to impoundment of freshwater runoff and streamflow. The pumps are set to maintain water surface elevations below 7.5 ft NGVD, and eliminate seasonal hydrologic peaks (high lagoon stands) that would naturally inundate the lagoon floodplain, maintain wide seasonal wetlands and riparian transition zones, submerge upper marsh vegetation zones, and limit encroachment of low marsh vegetation by water depth.

Natural lagoon high stand elevations in seasonal or nontidal lagoons in the region range between approximately +11 to +13 ft NAVD. These lagoon water surface elevations are maintained above tidal elevation ranges, and result in seepage outflows through the barrier beach. The high seasonal fluctuation of natural nontidal/seasonal lagoon levels, in contrast, results in gradual spring-summer drawdown from initial high spring lagoon levels (deep lagoon conditions) and maintains wide, variable, dynamics wetland ecotones and upland edges.

The direct effects of maintaining artificially low permanent lagoon levels with minimal seasonal fluctuation include:

- **Reduced flooded area of open water/potential submerged aquatic vegetation habitat.** Potential sago pondweed tadpole habitat of the California red-legged frog (Reis 1999); foraging habitat of Western Pond Turtle;
- **Reduced flooded area and perimeter (edge) of fringing emergent cattail-tule-bulrush marsh.** Known dense marsh cover of San Francisco Garter Snake habitat (USFWS 1985; Jennings 2000)
- **Reduced seasonally flooded area and perimeter length of seasonal wetlands in the floodplain.** Foraging habitat of California red-legged frog and San Francisco Garter Snake.
- **Reduced seasonally flooded area and perimeter length of seasonal wetland/upland edge habitat.** Transition zone: driftwood, rush litter mat basking sites and mammal burrow foraging habitats of San Francisco Garter Snakes (USFWS 1985)

The indirect effects of maintaining artificially low permanent lagoon levels with minimal seasonal fluctuation include:

- **Depression of freshwater marsh elevations in relation to sea level and high tides.** Upper limits of marsh elevations within Laguna Salada are determined by the maximum persistent high water levels established by pumps set to activate when water levels range between +6.9 and +7.5 ft NAVD. These upper marsh elevation ranges correspond to upper intertidal ranges of the adjacent ocean (still water elevations, in the absence of wave-induced elevations). Perennial freshwater marsh in the lagoon cannot establish at elevations significantly higher than the maximum lagoon high water level. The maximum lagoon and marsh zone elevations of Laguna Salada are significantly *lower* than corresponding marsh zones and maximum sustained water levels of natural seasonal or non-tidal reference lagoons of the Central Coast (such as Rodeo Lagoon and Laguna Creek Lagoon), which are ordinarily *supratidal* (above tidal elevation ranges), exceeding +10 ft NAVD (+11-+13 ft NAVD) due to impoundment of freshwater discharge at elevations above tidal range. Natural lagoon levels are ordinarily sustained *above* tidal elevation due to freshwater impoundment in dynamic equilibrium with beach seepage discharge (seaward) rates, stream inflows, and beach crest elevations (also above tidal elevations). Natural lagoon fringing marshes, unlike tidal marshes in which marsh zones are adapted to daily mean tidal elevation ranges, thus generally lie mostly *above* the tidal range, and are thus very infrequently flooded by extreme tides, storm surges, and overwash. When lagoons are tidally breached, they drain, stranding most of the marsh zone above the high tide line except during extreme high tides or storms that flood them very briefly.

  In contrast, the artificially low maximum lagoon elevations of Laguna Salada maintain their fringing marshes (and endangered species habitat) at a vulnerable low elevations in relation to tides and storm surges. As sea level rises, the lagoon maximum water level and marsh elevation ranges must fall farther below mean and extreme high tidal elevations, and extreme storm wave runup and overwash elevations. When inevitable storm overwash occurs with or without seawall breaching or overtopping (*i.e.*, direct overwash flooding from the seawall gap at Clarendon Avenue) the entire Laguna Salada marsh elevation range is susceptible to flooding by marine salinity with for prolonged periods of the tide and storm cycle. This risk increases as sea level rise accelerates. Natural lagoon marsh zones at higher, supratidal elevations in equilibrium with higher maximum lagoon water elevations are susceptible to relatively brief peak extreme tide or storm overwash. Natural lagoon levels and beach crest elevations rise in adjustment to rising sea level. Artificially stabilized Laguna Salada marsh zones, like subsided diked baylands of San Francisco Bay or levee-bound Delta islands, falls relatively farther below high tides and extreme high tides as sea level rises. This indicates increasing vulnerability to marine overwash over time. This is potentially one of the greatest inherent threats to long-term sustainability of Laguna Salada.

- **Increased vulnerability to saltwater seepage (beach groundwater salinity intrusion).**
  As sea level rises, high tide wave runup elevations on the beach increase relative to the maximum water surface elevations of Laguna Salada, set by pumps at +7.5 ft NAVD. This appears to result in landward salt seepage through the barrier beach during perigean high tides and high swell even in existing conditions, and is likely to result in landward gradients in brackish to saline beach groundwater as sea level rises (Appendix). Pumping the lagoon down to permanent low water elevations in relation to wave runup is likely to promote significant salinity intrusion from the beach to the lagoon over decades of sea level rise. Natural seasonal or nontidal lagoons, in contrast, maintain fresh-brackish impoundments behind barrier beach at elevations that rise in dynamic equilibrium with sea level.

- **Increased vulnerability to storm overwash impacts; increased capacity for storage of undiluted seawater**. The permanently low freshwater storage and water surface elevation of the managed modern lagoon increases the long-term potential landward penetration of storm overwash surges, and increases the capacity of the lagoon to store undiluted seawater. Marine overwash occurring during high lagoon stands (water surface elevations above tidal frame, near wave runup elevations) is subject to turbulent mixing, dilution, and rapid drainage through high volume surface discharge through breach outlets in natural backbarrier lagoons (see Appendix A). Marine overwash occurring in existing conditions, with low lagoon stands and no breach outlet (armored barrier), has low potential for dilution and high capacity for seawater storage, with discharge rates limited by electrical pump capacity and unimpaired pump operation. The current lagoon structure and hydrologic management is prone to artificially increased spatial extent and intensity of salinity pulses during extreme storm events, compared with natural hydrologic and geomorphic conditions. The relative increase in vulnerability of the artificially stabilized lagoon to extreme storm event salinity impacts will increase as sea level rises (see Appendix B).

- **Increased encroachment of the lagoon bed by cattail and tule marsh vegetation due to pumping.** Shallow water less than 1 m deep during the growing season facilitates clonal expansion rates of tall emergent fresh-brackish marsh vegetation (tules, cattails, bulrushes). Early rapid spring and summer drawdown of the lagoon levels expose more lagoon bed to the submergence depth range over which tules, cattails and bulrushes may spread over an extended low-water growing season. This shallow water facilitation of tule-cattailbulrush spread process is independent of sedimentation, but may be exacerbated by nutrient loading (eutrophication), autochthonous sedimentation (local organic sediment production, or allochthonous sedimentation (runoff transport of watershed-derived sediment). Permanent drawdown of the lagoon maximizes the proportion of lagoon area with shallow gradients subject to cattail and tule colonization. Shallow water depths were identified as a significant contributing cause of cattail/tule spread in 1992 (PWA et al. 1992), and rapid expansion of cattail-tule marsh in shallows of Laguna Salada is consistent with that assessment even in the absence of sedimentation.

- **Increased exposure of anoxic and hypoxic organic sulfidic sediments and oxidized acid sulfates.** Acid sulfates can cause extremely low pH (high acidity) of wetland soils, and are a worldwide environmental problem in artificially diked or drained coastal wetland soils. High sulfide production is naturally associated with strongly hypoxic or anoxic organic sediments in brackish or intermittently seawater-influenced coastal wetlands. High concentrations of sulfides are typically not associated with higher fringing marsh elevations that are subject to only relatively brief seasonal flooding, but occur primarily in bottom organic sediments. (refs) Bottom sediments are usually exposed to shallow water edges or air only during extreme low water levels associated with droughts in natural lagoon conditions. Conspicuous exposures of black, sulfuric organic muck sediments are evident in shallow edges of Laguna Salada during summer drawdowns (Fig. 10), and rust-colored surface films of iron oxide, indicative of acid sulfate production due to oxidation of sulfides, is widespread in surface muds of the northeastern lagoon in summer drawdowns. Sulfide and sulfate concentrations were not measured in water quality past studies, and no quantitative sediment sampling of sulfate or sulfide has been performed at Laguna Salada. Sulfides and acid sulfates are potentially toxic to amphibian larvae and eggs.. In summary, the unhealthy presence of high sulfides and acid sulfate are likely to be in unavoidable impact due to the artificial on-going drawdown of the lagoon.

- **Reduced capacity to restrict salinity intrusion from beach groundwater.** The higher lagoon levels stand above sea level, the more the hydraulic head of the lagoon is able to "push back" salt seepage in beach groundwater. Salinity seepage occurs briefly in the short term when high wave runup during high tides occurs on the beach. However, sea level rise poses an increasing long-term risk of salinity intrusion to a lagoon that is maintained at levels below the elevation of beach groundwater that rises with sea level.

- **Concentration of high-nitrogen fertilizer runoff.** Maintaining permanently shallow water levels in the lagoon reduces the capacity of the lagoon to dilute and dissipate fertilizer runoff (through wind-stress current circulation of open water associated with naturally high lagoon stands).

2.5. Elimination of protective dynamic barrier beach functions, sea level rise adaptation, and associated ecological functions.

The barrier beach formerly supported a high beach ridge and low foredunes with dynamic, disturbance-adapted native vegetation until the late agricultural period, when artificial dunebuilding and stabilization plantings with non-native vegetation were developed (see historic ecology, Appendix A). Currently, coarsening beach sand has eliminated onshore wind-transport of dune sand grain size classes (Appendix A), and restricted native pioneer dune vegetation to the toe of the extensive erosional scarp in the earthen "seawall" berm and boulder armor (Figures 13-14). Native foredune vegetation is capable of regenerating both landforms (foredune topography and elevations) and habitats (low, prostrate forb vegetation and gaps; federally listed western snowy plover habitat) following erosion events, and also allows net landward transport of sand across the barrier beach (barrier rollover), which is the essential, primary mechanism of barrier beach profile adjustment to rising sea level (Appendix A).

The artificial fill and boulder armor of the "seawall" (earthen berm or levee) permanently displaces the native foredune community, and prevents constructive washover deposition during storm events. By preventing all washover deposition of sand, the levee arrests the dynamic adjustment response of the barrier beach profile to sea level rise and storm events, and eliminates sand storage in the backbarrier profile where it can buffer the barrier response to sea level rise. The "seawall" reduces the potential beach response to sea level rise to net erosion and profile steepening, and restricts landward sand transport (currently none) to the high threshold of complete levee failure (overwash during erosion of entire levee profile), which would likely result in catastrophic intensity of overwash processes across the sediment-starved backbarrier washover profile. The backbarrier profile retains little or no native disturbance-adapted native vegetation capable of regenerating after natural constructive washover deposition. The artificial levee thus diminishes the resilience of barrier beach system to coastal processes, forces extreme storm events to be exclusively erosional (until the extreme threshold of "seawall" failure), and increases its vulnerability to catastrophic failure and progressive net erosion.

2.6 External constraints on habitats and population viability.

The long-term recovery of special-status amphibian and reptile species at Laguna Salada (western pond turtle, San Francisco Garter Snake, California red-legged frogs) depends not only on population robustness and population viability and habitat quality within the site itself, but also metapopulation structure and community dynamics – including the genetic and demographic interactions among populations in the local watershed and surrounding watersheds, potential non-native species invasions and species interactions (Semlitsch 2002). For example, the proposed CRLF and SFGS mitigations will include the construction of additional ponded areas along the eastern edge of the lagoon and alogn the Sanchez Creek Cooridor so that there are multiple areas that can provide potential reproductive habitat for CRLF. If a catastrophic event happened to one reproductive local there would be other localities to aid in the resiliency of potential reproductive success during that year. Increased population connectivity is also a conservation need for core recovery areas of the California red-legged frog in south San Francisco Bay area (USFWS 2002)

Isolated, small inbreeding populations of San Francisco Garter Snakes are at risk of impaired population viability due to inbreeding depression, and possibly allee effects (inability to find mates at very low population densities) over the long-term, regardless of habitat quality (Semlitsch 2002). Low-level genetic exchange through immigration (infrequent dispersal from relatively isolated but neighboring populations) is needed in the long-term to avoid potential inbreeding depression associated with genetic bottlenecks following declines to very low population sizes.

Bullfrogs (*Rana catesbiana*), are larger non-native competitor and predators of the California red-legged frog, and are widespread in ponds and reservoirs in California and within the Bay Area. Their co-occurrence with smaller frog species, including the California red-legged frog, is often associated with reduced local population viability or population size (Fischer and Schaffer 1996, Kieseker and Blaustein 1998, Lawler et al 1999, USFWS 2002,). Bullfrogs have not been reported from Laguna Salada, but the species can invade even isolated stock ponds in cool coastal core habitats of the California red-legged frog, such as Tomales Bay. Deliberate introduction of bullfrogs in urban ponds from aquaculture or pet sources is a potential pathway of invasion. Perennial water depths at Laguna Salada are suitable for bullfrogs to thrive, but it is not known whether summer peak aquaeous salinity currently exceeds bullfrog tadpole tolerances. . Bullfrogs are limited by seasonal extremes (such as drought/seasonal wetland drawdown) or salinity levels that exceed the tolerance of their tadpoles that require, in cool coastal locations, two years of continuous suitable aquatic habitat to metamorphose into adults. Although bullfrogs are not known to occur at Sharp Park, long term monitoring of amphibian species should include bullfrogs. Optimal survey timing for CRLF and bullfrogs are different.

Non-native predatory fish are also associated with reduced population size or viability of California red-legged frog populations (USFWS 2002, Kieseker and Blaustein 1998, Lawler et al.1999). Non-native mosquitofish are present in Laguna Salada, and larger non-native predators have not been surveyed (Tetra Tech et al. 2009) but are likely to be present, based on the observed frequency of Caspian tern foraging and prey size from open waters of Laguna Salada. All water bodies at Sharp Park, including Arrowhead lake and Horse Stable Pond should be net surveyed for the presence of fish and actions taken if necessary.

2.7. Other habitat degradation factors

Several habitat constraints were identified by Tetra Tech et al. (2009) and Swaim (2009) as outstanding habitat and population threats for conservation of San Francisco Garter Snakes and California red-legged frogs specifically at Laguna Salada. We have reviewed the evidence, analysis, and relevant scientific literature support for these conclusions, but have found insufficient or incompatible evidence for their conclusions regarding the roles of unsuitable "vegetation structure" (excessive cattail/tule shoot density), salinity and oceanic overwash flooding, and upland habitat within marsh as limiting factors. These are explained below.

- **Marsh vegetation shoot density and structure.**
  Tetra Tech et al. (2009) and Swaim (2009) refer to excessively dense marsh vegetation structure as a primary limiting factor for California red-legged frogs:

  > The primary limiting factor for the CRLF in the wetlands complex is a vegetation structure that is inappropriate and not optimal for successful breeding and/or recruitment of larval stages into the adult population. The dense emergent vegetation combined with little remaining open water offers poor habitat for the survival of egg masses or tadpoles. (Tetra Tech *et al.* 2009 p. 29; p. 4)

  No data on shoot density, or shoot density/frog reproductive success relationships, or other analysis of "vegetation structure" were provided to support the conclusion that vegetation structure was a limiting factor, or a "primary" limiting factor, for California red-legged frog habitat. No arguments were presented to suggest that this factor was relatively important compared with other potential limiting factors. The recovery plan for the California red-legged frog (USFWS 2002) does not identify shoot density of marsh vegetation as a limiting factor for habitat quality. The recovery plan for the San Francisco Garter Snake (USFWS 1985) states that dense marsh vegetation cover of tules, cattails, and bulrushes is the preferred core habitat of that species, in agreement with later species accounts (Jennings 2000).

There is extensive open water/marsh edge in Laguna Salada, but low abundance and diversity of seasonally flooded marsh vegetation at the upper, landward perimeter of the fringing wetlands, which is mowed and drained and artificially graded to prevent isolated shallow seasonal ponds from forming. We conclude that artificially homogenized and stabilized topography at the upper edge of the lagoon, combined with excessive artificial drainage and mowing (destruction) of the upper marsh edge vegetation, are the primary vegetation structural and compositional deficiencies affecting the California red-legged frog. The density or extent of cattail and tule vegetation is not likely to be a primary limiting factor for frog habitat.

- **Salinity pulses and chronic salinity.**
  Storm overwash may cause infrequent, intensive, short-term mortality of California red-legged frogs in the seaward reaches of coastal lagoon wetland complexes, such as El Niño events. All coastal lagoons in Central California that are inhabited by California red-legged frogs are subject to long-term infrequent overwash flooding of their seaward wetland reaches during extreme coastal storms. There is no evidence that intermittent, infrequent storm overwash is a primary threat to long-term persistence of California red-legged frog populations in coastal lagoon wetlands, except where connectivity with upland and freshwater refuges in landward marshes and floodplains has been eliminated or impaired by berms and levees. California red-legged frog adults tolerate fresh-brackish salinity regimes of coastal lagoons if not too saline most years (Smith 2007; see Table 1 and Appendix A). Western pond turtles tolerate brief exposure to marine salinity, and can live in mesohaline estuarine salinity regimes, such as Suisun Marsh, where they are locally abundant in the absence of perennial freshwater sources. Salinity pulses in coastal lagoons have low potential to be catastrophic events for California red-legged frogs, San Francisco Garter Snakes, and Western pond turtles populations unless (a) populations are reduced to artificially low and unstable sizes, and (b) populations are occupying marginal habitat without nearby freshwater refuges. Salinity pulses and chronic fresh-brackish salinity *per se* are not threats to persistent populations of these special status wildlife species in coastal lagoon wetland.

- **Upland grassland habitats.** The recovery plan for the San Francisco Garter Snake states that SFGS are most often observed in dense, tall, emergent marsh vegetation including cattails, tules, spike-rush or rush, while upland grasslands are used mostly for basking, seasonal refuge, and movement (USFWS 1985 p. 9). SGFS are not active in cold weather in the winter, nor during cold fall or spring days, and need refuge (dry areas) such as mammal burrows during these times. Jennings (2000) stressed the habitat importance of dense marsh vegetation cover and adequate prey base, with proximate basking sites, along with adjacent upland habitats with small mammal burrows used for foraging on treefrogs. Similarly, the recovery plan for the California red-legged frog identifies upland habitats as movement/dispersal corridors and seasonal foraging areas, as well as refuges (USFWS 2002).

3.0 CONCLUSIONS

The primary limiting factors for habitat quality, sustainability, and population persistence of special-status wildlife species are likely to be consequences of two primary influences: ongoing golf course maintenance and operations and stabilization of artificially low lagoon levels. Golf maintenance impacts result from mowing of marsh and upland edges, exclusion of dense native vegetation cover by wetland and riparian vegetation and large woody debris, and chronic nitrogen loading of the lagoon due to fertilizer application to turfgrass. Stabilization of artificially low lagoon levels with minimal seasonal fluctuation has multiple significant short-term and long-term impacts to the habitat quality and sustainability of the lagoon wetland complex. These impacts include elimination of the lagoon floodplain hydrology and habitat connectivity; increase in the proportion of the lagoon area within depth ranges suitable for rapid spread of cattail and tule vegetation. Artificial stabilization of lagoon wetland elevations within tidal elevation ranges makes them increasingly susceptible to increased marine flooding risks as sea level rises. In addition, pumping the lagoon to fixed, low levels relative to wave runup as sea level rises over decades is likely to induce increasing frequency and rates of salinity intrusion due to reversal of beach groundwater gradients. Salinity intrusion over decades is a more significant threat than intermittent, infrequent overwash in a lagoon that is not artificially drained of its impounded freshwater.

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APPENDIX C

LIST OF FIGURES

APPENDIX C.

EXISTING CONDITIONS - FIGURES

Figure 1. **Artificially low maximum water levels of Laguna Salada.** Central western shore of Laguna Salada at remnant washover fan following winter rains (February 17, 2009), showing transient lagoon surface elevations re-occupying artificially drained floodplains above emergent tule marsh prior to drainage by pumps. Rapid drawdown due to pumping prevents seasonal wetland habitats from establishing in upper flooded areas.

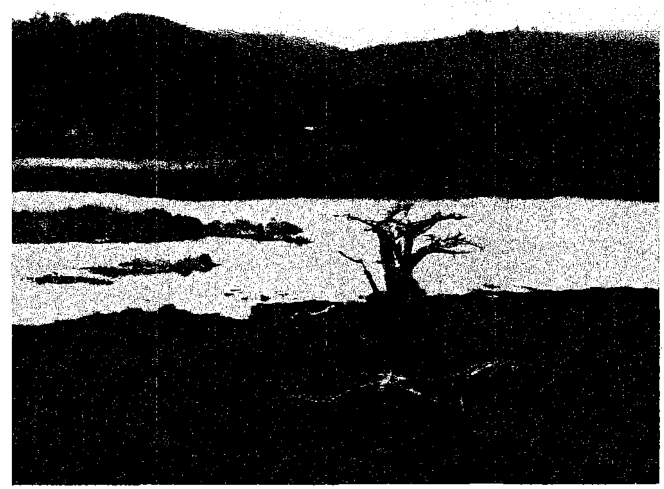


Figure 2. **Artificially low maximum water levels of Laguna Salada.** Central western shore of Laguna Salada at remnant washover fan following winter rains (February 17, 2009), showing temporary lagoon surface elevations partially re-occupying artificially drained floodplains prior to drainage by pumps. Rapid drawdown due to pumping prevents seasonal wetland habitats from establishing in upper flooded areas.

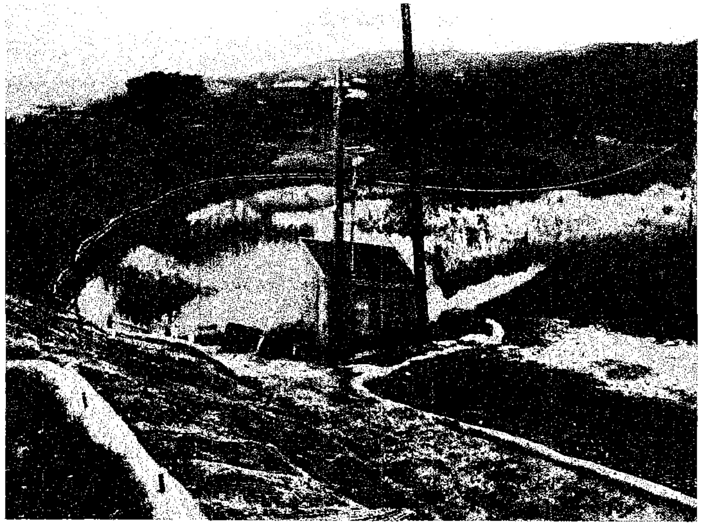


Figure 3. **Artificially low maximum water levels of Laguna Salada.** Horse Stable Pond at pump station, showing transient high lagoon surface elevations partially re-occupying artificially drained floodplains, February 17, 2009. Note partial flooding of fairways in background. Rapid drawdown due to pumping prevents seasonal wetland habitats from establishing in floodplain above tule marsh.

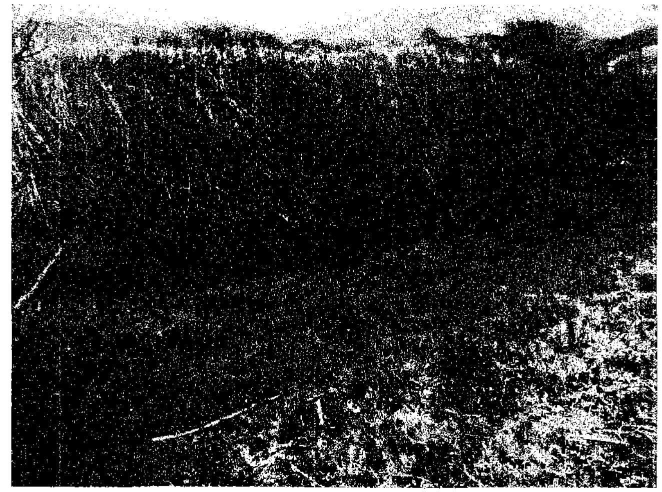


Figure 4. **Artificially low water levels of Laguna Salada and marsh zonation.** Fresh-brackish tule marsh (*Schoenoplectus californicus*) of central west shore Laguna Salada is drained in late spring of dry year (June 15, 2009) nearly to base of tule culms; tule marsh elevations colonized by perennial stands of less flood-tolerant threesquare bulrush (*Schoenoplectus pungens*). Corresponding marsh zones in natural seasonal or nontidal lagoons of the Central Coast are submerged in spring.

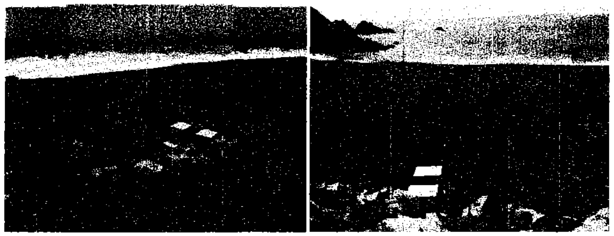


Figure 5. **Drainage and discharge of Laguna Salada waters on Salada Beach during the dry season.** The natural filling of Laguna Salada by Sanchez Creek low flows and groundwater discharges in summer is arrested by active pumping even in dry months, maintaining artificial drawdown of the lagoon to low levels all year. Discharge point below the outfall results in scour pools, internal drift-lines delineating high water levels in the pool, and an erosional discharge channel. Photo at left June 11, 2010. Right, August 17, 2010.

Figure 6. **Relict washover flats: drained lagoon floodplain and upland ecotone vegetation invaded by non-native species.** Remnant washover flats landward of "seawall", dominated by non-native terrestrial vegetation. Iceplant (*Carpobrotus edulis* x *chilensis*) occupies the (artificially drained) potential ecotone between seasonal wetland zones of the lagoon (saltgrass-salt rush -bulrush-silverweed) and native dune vegetation. Traces of native dune vegetation are present but scarce.

Figure 7. **Marsh mowing: golf maintenance impacts.** The golf turf mowing encroaching the northeast end of Laguna Salada, extending directly into the marsh and riparian woodland zones. The apparent golf turf is composed of the same fresh-brackish marsh species shown at the left, *Schoenoplectus pungens, Argentina egedii, Agrostis stolonifera,* and *Cotula coronopifolia.* The seasonally flooded outer marsh and its terrestrial ecotone are replaced by turf even with pumped drawdown of the lagoon. The natural floodplain (unimpaired maximum lagoon elevations) would include a much wider floodplain area. All wildlife cover is eliminated, exposing travel corridors of SF Garter snakes and eliminating suitable mammal burrow foraging habitats. All potential buffers for fertilizer impacts are eliminated by encroachment of golf turf into the marsh. Above: June 10, 2010. Below: August 3, 2010.

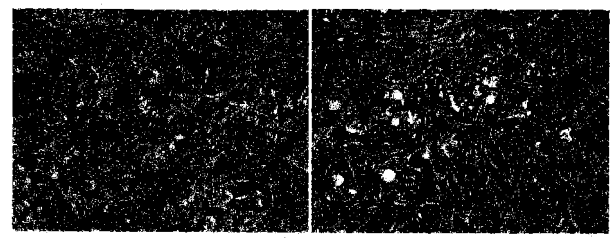


Figure 8. **Marsh mowing: golf maintenance impacts.** Detail of mown marsh turf composition by fresh-brackish marsh (FACW and OBL wetland indicator species): left, *Argentina egedii* (syn. *Potentilla anserina*) and *Agrostis stolonifera.* right, *Cotula coronopifolia* (succulent leaves, yellow flowerheads) and *Agrostis stolonifera.*

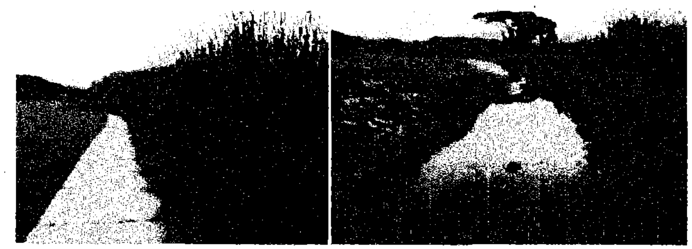


Figure 9. **Marsh mowing: golf maintenance impacts.** Paved path encroachment of fresh-brackish marsh and riparian woodland. Paved paths were constructed in marsh (mown into turf on landward side), and are partially flooded even in the dry season. Earthen fill (golf turf sod wastes) are dumped directly in jurisdictional wetlands (apparently without federal or state authorization) on the landward side of the flooded path at the northeast end of Laguna Salada. August 3, 2010.

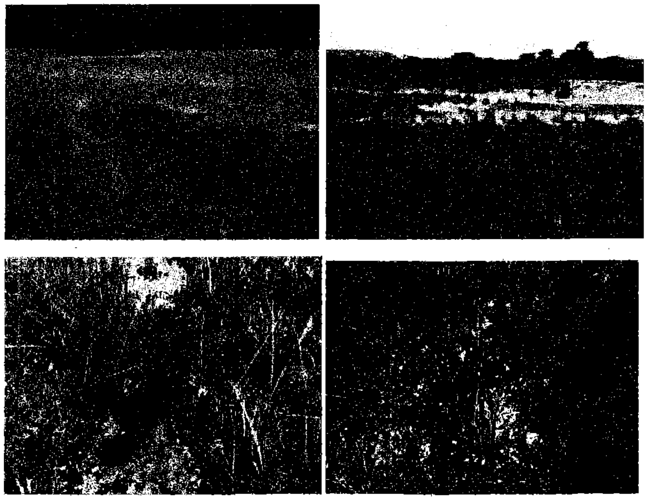


Figure 10. **Iron oxide surface films and iron sulfide accumulation of muds exposed by artificial lagoon drawdown.** Iron oxide (orange-brown mineral films indicative of oxidation of iron sulfide and acid sulfates in brackish coastal sediments subject to alternating strong hypoxia and oxidation) are apparent in drawdown-emergent muds at the northeast end of Laguna Salada. Organic-rich sediment immediately below the iron oxide-stained surface sediment film is deep black (lower left), indicative of toxic iron sulfide, formed under strong hypoxic bottom conditions, exposed at the marsh surface by artificial drawdown of the lagoon.

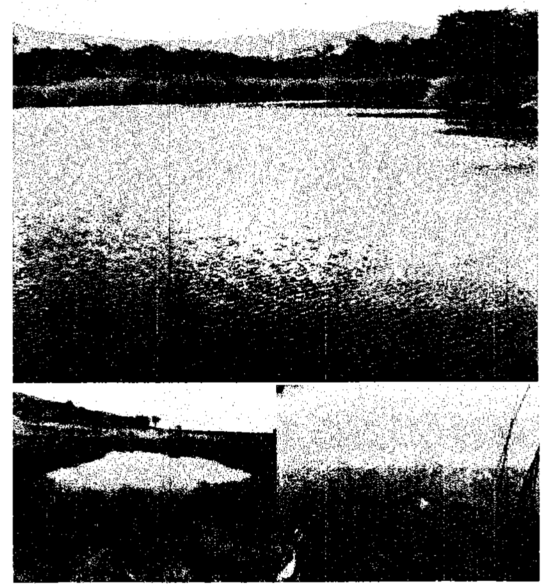


Figure 11. **Absence of submerged aquatic vegetation in modern Laguna Salada contrasting with rapid colonization of adjacent Mori Point perennial ponds**. The wind-rippled surface of the entire Laguna Salada lagoon (above) indicates a lack of submerged aquatic vegetation. The lagoon supported two species of submerged aquatic vegetation (sago pondweed, *Potamogeton pectinata*, syn. *Stuckenia pectinatus*; and wigeongrass, *Ruppia maritima*) in the 20th century and likely before. In contrast, 2 year old ponds constructed by GGNRA adjacent to the lagoon (below) were rapidly colonized by vigorous *Stuckenia pectinatus* in the absence of planting (D. Fong, GGNRA pers. comm. 2010). Sago pondweed is important potential habitat (breeding, foraging) for red-legged frogs, and foraging habitat for waterfowl.

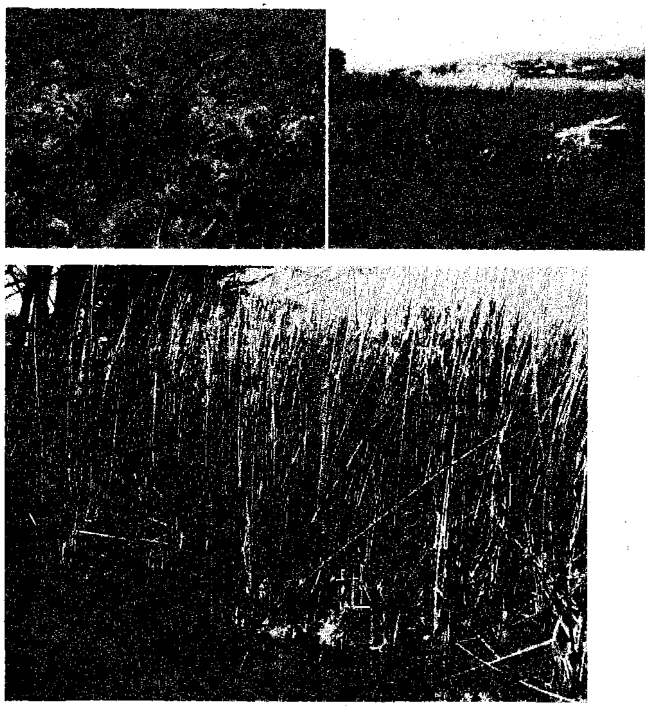
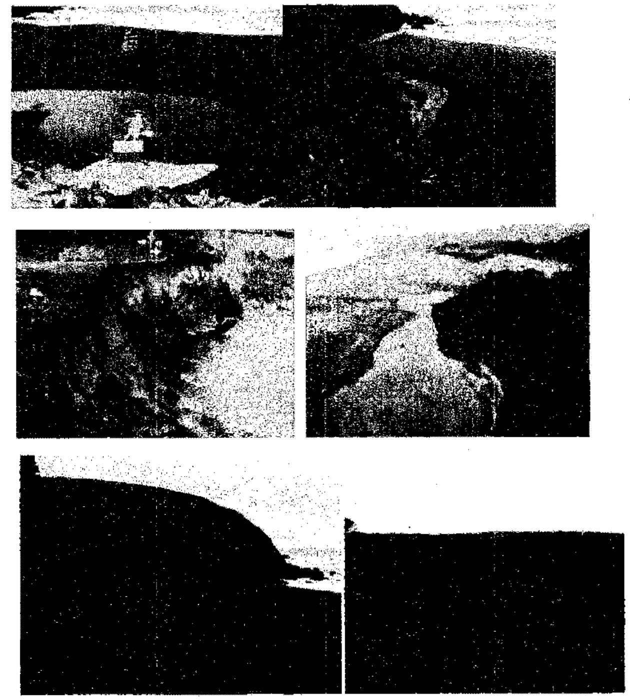


Figure 12 . **Brackish marsh along western shore of Laguna Salada on relict washover fan.** In the absence of overwash in more than 2 decades, brackish and salt marsh plants (pickleweed, saltgrass, jaumea, silverweed; upper left) dominate wetland flats bordering the west shore of the lagoon (upper right), near areas where groundwater salinity has been measured at 15 ppt (nearly half seawater concentration; Kamman 2009). Below, brackish marsh vegetation (saltgrass, jaumea) spreads into ground layer of emergent lagoon bed in summer where hardstem tule dieback has allowed enough sunlight to penetrate.

Figure 13. **Armored and earthen "seawall" profiles.** Erosional scarp in earthen berm "seawall" at south end of boulder armoring. No eolian (wind-deposited) dune sand occurs within or in lee of boulders, or on landward slope of berm. Adjacent beach is coarse sand. Small patches of native dune vegetation (beach-bur, *Ambrosia chamissonis*) occur at the toe of the scarp or boulders.

Figure 14. **Beach armoring (boulder revetment).** The historic location of the lagoon outlet, near the modern pump outfall, is completely armored by an engineered boulder revetment approximately 3 m above the adjacent beach. The seawall and revetment preclude natural lagoon outlet from forming and draining impounded floodwaters in Laguna Salada by gravity following natural breaches.



Figurer 15. **Bluff erosion facilitated by lagoon outfall discharge** (bluff toe erosion and saturation). The high volume discharge of the pump outfall on the beach is deflected along the base of the adjacent Mori Point bluffs, where it forms a channel with an erosional scarp, and extensive areas of persistent saturation. The adjacent bluffs are actively slumping on to the beach despite a lack of direct wave attack behind the wide coarse beach berm. February 17, 2009, except lower right (July 25, 2010). Above: pump outfall pool and berm-deflected outlet channel with erosional scarps. Middle: saturated sheetflow across braided deltaic channel at back of beach, bluff toe. Bottom: large to small rotational slumps occur along the bluff despite a wide beach profile.

APPENDIX D. SUMMARY OF LAGUNA SALADA MIDSUMMER SHORELINE AQUEOUS SALINITY

APPENDIX D – SUMMARY OF LAGUNA SALADA MIDSUMMER SHORELINE AQUEOUS SALINITY

Summary of Laguna Salada midsummer shoreline aqueous salinity (shallow lagoon edge),

Peter Baye

Prepared for Philip Williams and Associates, Laguna Salada Conceptual Restoration Study

Refractometer measurements, 1-2 cm water depth, near maximum seasonal drawdown (emergent lagoon bed). Precision: 1 ppt

Sample date: August 3, 2010

Sample locations:

APPENDIX D – SUMMARY OF LAGUNA SALADA MIDSUMMER SHORELINE AQUEOUS SALINITY

Location	shoreline vegetation above waterline dominants/subdominants	shoreline vegetation below waterline dominants/subdominants	Iron sulfide/sulfate indicators	Aqueous salinity measurement 1 cm depth
Pump basin 5 m NW of intake, Horseshoe Pond	Jaumea, threesquare bulrush/silverweed	Broadleaf cattail	Sulfidic black mud at shoreline surface	1.0 1.0
Pump basin 5 m NE of intake, Horseshoe Pond	threesquare bulrush, silverweed	Broadleaf cattail	(steep; not visible)	1.0 1.0
Ditch between S end lagoon and S fairway	Threesquare bulrush, silverweed/Jaumea	Broadleaf cattail California tule	Sulfidic black mud at shoreline surface	2.0 2.0
5 m N of washover fan	Saltgrass, threesquare bulrush	California tule	Sand & muck; sulfidic black below 1 mm	2.0 2.0
Washover fan, NE	Saltgrass, salt rush, pickleweed, silverweed	Hardstem tule	Sand & sulfidic black below 1 mm	2.0 2.0
Washover fan, central E	Saltgrass, threesquare bulrush	Broadleaf cattail (distal leaf necrosis >25%)	Black sulfidic muck/leaf litter	3.0 3.0
Washover fan, central	None (bare sand; trampled)	None (bare sand/filamentous algal detritus)	Black sulfidic sand & muck below 1 mm	2.0 2.0
Washover fan, S	Saltgrass, threesquare bulrush	None (bare sand/filamentous algal detritus)	Black sulfidic sand & muck below 1 mm	2.0 3.0 (depression) 2.0 3.0 (depression)
N end, flooded fairway path	Bare path (asphalt)	Willow, broadleaf cattail, creeping bentgrass	N/A (no sediment)	2.0 2.0
NE end, golf ball impact pit	Bare mud	Broadleaf cattail, silverweed, creeping bentgrass	Rusty brown surface film; black mud below 2 mm	5.0 ppt
MARINE REFERENCE: ocean, Salada Beach	n/a	n/a	n/a	35.0 ppt
FRESHWATER REFERENCE: Fairway Drive ditch (CA red-legged frog occupied)	Small-fruited sedge, watercress, horsetail	Small-fruited sedge, watercress, horsetail	none	0.0 ppt 0.0

APPENDIX D – SUMMARY OF LAGUNA SALADA MIDSUMMER SHORELINE AQUEOUS SALINITY

Summary of findings:

- Salinity range 1-3 ppt in shallow water at vegetated edge of lagoon and ditches; within range of adult CRLF tolerance; fresh-brackish range, not "freshwater"
- Reduced salinity below Sanchez Ck/Horseshoe Pond (1.0) relative to main LS and ditch (2.0-3.0 ppt); freshwater (0.0 ppt) in Sanchez Ck and Fairway Drive ditch.
- Highest aquaeous salinity (3.0 ppt) at edge of relict washover fan (transmissive coarse sediment closest to beach and potential beach groundwater seepage) associated with local salt marsh vegetation and leaf tip necrosis of cattail (despite 25+ yr seawall barrier to overwash and pumping; potential indicator of salt seepage due to pumping)
- Highest salinities measured were in shallow depressions in marsh or mud: brackish marsh depressions (concentration due to evapotranspiration, S end washover fan) and golf ball impact pit in emergent saturated mud at NE (landward) edge of lagoon – 5 ppt (evaporative concentration; soil porewater seepage from residual soil salt)
- Iron sulfide (black mud) widespread present at or below organic (muck) surface of lagoon bed at lagoon shoreline; iron sulfate (oxidized iron sulfide product) widespread in emergent mud at NE end of lagoon
- Caspian terns foraging in Laguna Salada; fish larger than Caspian bill length taken; species not known (fish predators of CRLF?)
- No CRLF observed (no splashes heard, no frogs or tadpoles seen) in LS; CLRF observed abundant at adjacent reference sites at Fairway Drive roadside ditch , Mori Point (constructed) marsh ponds, Sanchez Creek culvert.
- Anomalous lack of both brackish and freshwater submerged aquatic vegetation (pondweed, wigeongrass) in LS

Observed Plant species salinity indicator status (ranked by salinity tolerance):

- **pickleweed (*Sarcocornia pacifica*)**: salt marsh, brackish marsh, fresh-brackish marsh (marsh (0 ppt to > 60 ppt, extreme hypersaline tolerant)
- **saltgrass (*Distichlis spicata*)**: salt marsh, brackish marsh, fresh-brackish marsh (0 ppt to > 40 ppt, low hypersaline tolerant)
- **Jaumea (*Jaumea carnosa*)**: salt marsh, brackish marsh, fresh-brackish marsh (0 ppt to > 40 ppt, low hypersaline tolerant)
- **Salt rush (*Juncus lescurii*, syn. *J. lesueurii*)**: brackish marsh, fresh-brackish marsh (0 ppt to <30 ppt, brackish tolerant)
- **Silverweed (*Argentina egedii*, syn. *Potentilla anserina* ssp. *egedii*)**: brackish marsh, fresh-brackish marsh (0 ppt to <30 ppt, brackish tolerant)
- **Threesquare bulrush (*Schoenoplectus pungens*, syn. *Scirpus pungens*)**: brackish marsh, fresh-brackish marsh (0 ppt to <30 ppt, brackish tolerant)
- **Hardstem tule (*Schoenoplectus acutus*, syn. *Scirpus acutus*)**: brackish marsh, fresh-brackish marsh (0 ppt to <20 ppt, brackish tolerant)

APPENDIX D – SUMMARY OF LAGUNA SALADA MIDSUMMER SHORELINE AQUEOUS SALINITY

- **California tule (*Schoenoplectus californicus*, syn. *Scirpus californicus*)**: fresh-brackish marsh (0 ppt to <30 ppt, brackish tolerant)
- **Broadleaf cattail (*Typha latifolia*)**: fresh-brackish marsh (0 ppt to <20 ppt, marginal brackish tolerance)
- **Small-fruited sedge (*Scirpus microcarpus*)** (0 ppt to < 5 ppt, freshwater-oligohaline obligate; salt –intolerant)
- **Creeping bentgrass (*Agrostis stolonifera*)** (0 ppt to < 5 ppt, freshwater-oligohaline obligate; salt –intolerant)
- **watercress (*Nasturium officinale*, syn. *Rorripa nasturtium-aquatica*)** (0 ppt to < 5 ppt, freshwater-oligohaline obligate; salt –intolerant)

APPENDIX E. SUMMARY OF OBSERVED SALINITY INTRUSION AT LAGUNA SALADA

1. Salinity intrusion: seasonal saline seeps. Kamman (2009) found no direct evidence of salinity intrusion by landward subsurface flow of beach groundwater in four transects sampled between April 2007 and April 2008. His groundwater analysis revealed shallow groundwater salinity of 15 ppt at a distance of less than 300 feet from the shore of Laguna Salada, which had a salinity of 2 ppt, and a persistent hydraulic gradient of the shallow groundwater outflow from the pond westerly towards the beach, resulting in freshwater hydraulic head pushing back saltwater from the ocean. He noted, however, that under certain conditions, such as rapid drawdown due to pumping or extreme low water during late summer, the hydraulic gradient may reverse and subsurface water of relatively higher salinity may flow into the ponds. (Kamman 2009). Kamman's groundwater sampling stations were clustered at the southern end of Laguna Salada, where most of the backbarrier profile is generally wide and gently sloping (on relict washover fans), with no piezometers located along the steep backbarrier profile at the N end of the beach.

In February and March 2010, the ESA PWA team did detect extensive conspicuous saline seeps emerging in golf turf patches immediately behind the steep levee backslope at the north end of Sharp Park, following extreme winter tides and storm wave runup events (El Nino storm events coinciding with spring tides). The saline seeps were detected as large, irregular patches of rapid golf turf dieback on landward-sloping, sandy loams with positive drainage, unconnected to localized surface saltwater flooding from wave overtopping in the low gap bordering Clarendon Avenue (Figure 1). During rainless weeks of high evapotranspiration in March 2010, the saline seeps developed white efflorescent salt crusts on moist sandy loam and capillary surfaces of leaf litter from salt-killed grass turf and salt-intolerant weed species (Figures 2-4). The sandy loam immediately below the salt-crust/efflorescent film surface remained moist during periods of efflorescence (Figure 3). The salt-crusted barrens were colonized by two salt-tolerant weeds, succulent spurrey species (*Spergularia* sp., vegetative plants only; likely *S. rubra* and *S. bocconii*) and staghorn plantain (*Plantago coronopus*) producing green foliage in the white-crusted barrens. (Figure 4). Subsequent rainfall in April, and summer overhead irrigation dissolved and leached the soil surface salt evaporites, but left barren turf dieback areas and residual salt-tolerant weed patches (Figure 5).

The beach adjacent to the saline seeps also developed winter storm berm crests that matched or exceeded the height of adjacent seawalls near Clarendon Avenue. The correspondence between extreme coarse storm berm crest elevations and saline seep locations is consistent with current empirical models of super-elevated saline beach groundwater in coarse-grained barrier beaches (Carter *et al.* 1984, Nielsen 1990, 1999, Horn and Li 2006, Isla and Bujalesky 2005, Turner et al. 1997).

The abrupt emergence of saline seeps following high spring tides and storm wave runup is consistent with current validated models and field evidence of significant net landward beach groundwater infiltration above mean sea level due to super-elevation of beach groundwater in coarse-grained barrier beaches due to (a) tidal asymmetry of beach groundwater flow and elevation, and (b) "pumping" of saline groundwater by high wave runup events (Nielsen 1990, 1999, Turner et al. 1997). These effects are particularly efficient on permeable coarse-grained barrier beaches less than 1 km wide, like Salada/Sharp Park Beach (Horn and Li 2006, Isla and Bujalensky 2005). The experimental conceptual model of saline backbarrier seepage in coarse-

grained barrier beach seepage lagoons (figure 5 of Isla and Bujalensky 2005; Carter *et al.* 1984), which predicts perched salt groundwater and landward subsurface saline flow during high tides and runup events, appears to be applicable to Laguna Salada at least seasonally under existing conditions.

As Kamman (2009) predicted, sea level rise and climate change (increased swell height and storm intensity, frequency; Allan and Komar 2006) may also alter seasonal and long-term ocean levels and wave energy, potentially reversing shallow groundwater gradients between the lagoon and ocean and allowing more salts to migrate into Laguna Salada. We concur, and conclude that landward salinity seepage is currently occurring seasonally during periods of high tides and wave runup. Landward salinity intrusion to Laguna Salada by reversal of groundwater gradients between the permeable, coarse-grained barrier beach is likely to increase and accelerate as sea level rises, and storm wave heights increase in magnitude and frequency in California (Allan and Komar 2006), and as shoreline retreat continues on the San Mateo Coast (Hapke et al. 2009, Hapke et al. 2006). This prediction is significant for assessment of long-term sustainability of fresh-brackish salinity in Laguna Salada at current managed (pumped) water surface elevations that will be increasingly exceeded by rising sea levels and rising saline beach groundwater elevations over time.

2. Salinity intrusion: wave overtopping and flooding at the Clarendon Avenue gap.
We observed localized seawater flooding of depressional uplands and wetlands at the extreme NW corner of Sharp Park, following wave overtopping of the low pedestrian access gap in the seawall between the north end of the Sharp Park levee, and the lower concrete seawall along Clarendon Avenue. Beach sand with current ripples was observed along the roadside below the gap, and the evidence of prolonged saltwater flooding (salt evaporite crusts in dried puddles, salt-film patterned dieback of iceplant, rapid spread of saltgrass) were evident (Figures 6-8). This gap in the shoreline is currently a location of oceanic flooding (overtopping or overwash), and is beyond the boundaries of Sharp Park. It is likely to become increasingly important as a storm flooding pathway (salinity pulses) for Laguna Salada as sea level rises and extreme El Nino storm events recur.

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Figures

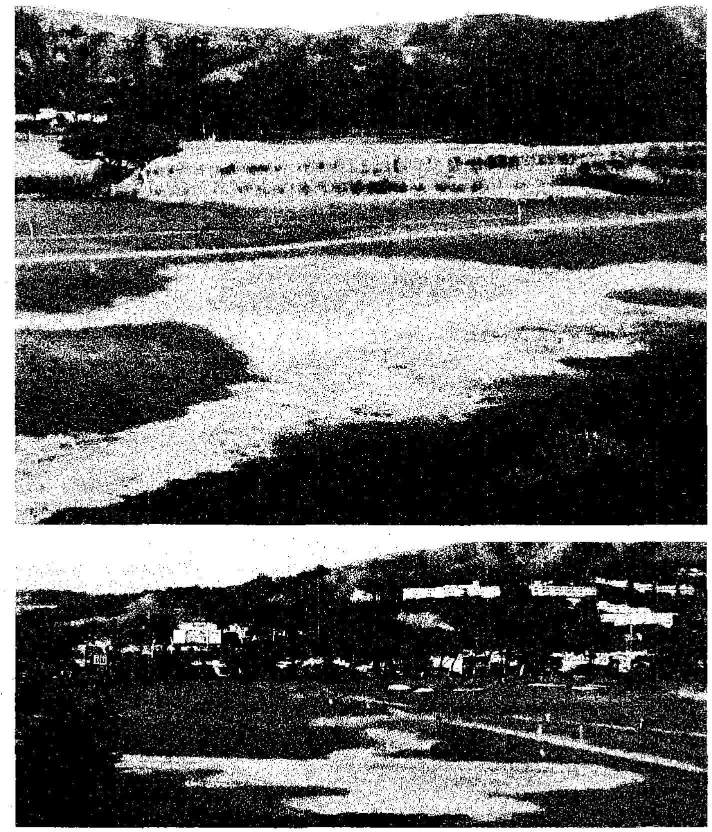

Figure F-1. Overview of saline seep patch in golf turf immediately behind levee at NW end of Sharp Park golf links appeared in February 2010 following high spring tides and high swell runup on adjacent beach, but no levee overtopping [illegible] No salt spray injury is evident in adjacent turfgrass. [illegible] formed white efflorescent salt crust evaporite films during rainless dry weeks through March. [Photo: March 27, 2010]

Figure F-2. Conspicuous white salt evaporite film, composed of efflorescent salt crystals deposited by evaporation of capillary soil moisture at soil surface within [illegible] saline seep patches in golf [illegible] immediately behind levee at NW end of Sharp Park golf links. Dead turfgrass [illegible] is covered with efflorescent salt crystal film. Green vegetation within salt-[illegible] dieback patches is composed of [illegible] salt-tolerant weeds *Spergularia* sp. (spurrey) and *Plantago coronopus* (cutleaf plantain). No salt spray injury is evident in adjacent green turfgrass; contaminated salt is localized. [Photo: March 27, 2010]

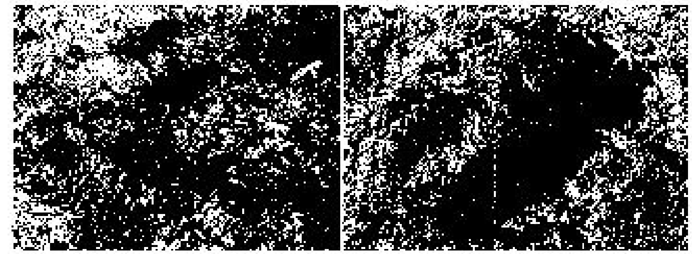

Figure F-3. Surface soil and leaf litter with conspicuous [illegible] efflorescent salt evaporite film. Salt crystals deposited by evaporation of capillary soil moisture at soil surface within localized saline seep patches in golf turf immediately behind levee at NW end of Sharp Park golf links. Dead turfgrass and salt-scorched grass litter is covered with efflorescent salt crystal film. Shallow scrape (right) exposes moist sandy loam (capillary moisture) below white salt crust at surface. [Photo: March 27, 2010]

Figure F-4. Detail of succulent, salt-tolerant *Spergularia* sp. (vegetative phase, without flowers) growing in dead golf turfgrass covered with efflorescent salt film deposited by evaporation of capillary soil moisture at temporary saline seep behind levee, NW Sharp Park. [Photo: March 27, 2010]

Figure E-[illegible]. Sharp Park golf turf dieback patches persist at locations of Feb-Mar 2010 saline seep/capillary evaporation contact (NW golf lines), [illegible] overhead irrigation (which [illegible] facilitates leaching of soil salts). (Photo: August 3, 2010)

Figure E-[illegible]. Low [illegible] marsh flooding at NW corner of Sharp Park golf course from [illegible] overtopping and flooding of [illegible] seepage. Salt [illegible] (white film [illegible] salt crust), [illegible], and dieback patches of [illegible] marsh flooding pattern. (Photo: March [illegible], 2010)

Figure F-7. Local marine flooding of NW corner of Sharp Park golf course from wave overtopping through Clarendon shoreline gap. Detail of evaporated saline puddle with white salt crystal evaporite film and saltgrass; no salt-intolerant species surviving. [Photo: March 27, 2010]

Figure F-8. Local marine flooding of NW corner of Sharp Park golf course from wave overtopping and flooding through Clarendon shoreline gap. Salt evaporite film in dried puddle, polygonal mud cracks, shown in detail. [Photo: March 27, 2010]

APPENDIX F. LAGUNA SALADA PLACE NAME ANALYSIS

APPENDIX F – LAGUNA SALADA PLACE NAME ANALYSIS

The folk place-name "Laguna Salada" (salty lake, lagoon, pond; "Laguna" = Spanish geographical name for small lakes and marshy lakes; diminutive = "lagunita"; Gudde 1969)) has been interpreted at face value to mean that the original historic condition of Laguna Salada was a salt pond (near marine salinity, saline or hypersaline). Yet the historic vegetation evidence from early 20th century agricultural land use era, during which farmers artificially breached the lagoon to drain the farmed floodplain for artichokes, indicates that even with forced openings in the barrier beach and contact with the ocean, the lagoon supported brackish to freshwater vegetation (dilute salinity relative to seawater) and lacked a persistent tidal inlet. This discrepancy indicates a need for critical analysis of the geographic place-name "Laguna Salada" in full historic and geographic context. The term "laguna" contrasts with the term "estero", which was the historic term applied to "all little lagoons communicating with the sea" (Trowbridge 1854, cited in Engstrom 2006; Gudde 1969).

There is unequivocal historic evidence that true salt ponds (at or above marine salinity) did exist in the Bay Area in early historic times. The largest of these, "Crystal Salt Pond", from which native Ohlone harvested salt crystals, occurred in the borders of San Francisco Bay near San Lorenzo, now Hayward Shoreline (Ver Planck 1951, 1958). Many smaller true shallow nontidal or intermittently tidal "salt lakes", also called "salinas" (salt pond or marsh), were mapped in south San Francisco Bay by U.S. Coast Survey topographers in (Goals Project 1999). This raises the question of whether "salada" was a description of relatively salty seasonal lagoon water quality compared with pure freshwater lakes, or a synonym of "salina" indicating a brine-filled waterbody. What folk distinctions were made about salinity in early California history, compared with modern scientific distinctions of salinity gradients?

Hypersaline coastal lagoons are documented from the historic and modern arid southern California coast (Engstrom 2006, Warme 1971), but even there, beach-dammed stream mouths in the early Mission era to the 1870s formed literally "freshwater" backbarrier lagoons (lakes), such as Las Flores Creek lagoon and San Mateo Creek lagoon, distinguished as "tule lagunas" (Engstrom 2006). These were considered "freshwater" (prior to analytic measurements of salinity) in contrast with "saline" lagoons based on their practical potential for agricultural use as crop irrigation or stock watering, such as corn cultivation (Englehart 1921, cited in Engstrom 2006). Any water salinity greater than 1- 2 ppt during the growing season (oligohaline in modern scientific salinity classifications; Cowardin 1979) was too strong for use in agricultural irrigation (due to evaporative concentration) or stock watering in the rainless California summer. Humans also taste brackish water at 1 part per thousand salinity (one tenth of one percent strength, or one thirty-fifth of sea water strength). This human salt taste detection threshold corresponds with the irrigation salinity threshold in dry climates, and also modern regulatory salinity standards for the Sacramento Delta, which set the 2 parts per thousand (two tenths of a percent) salinity standard at the western edge of the Delta bordering Suisun Marsh. Thus, the threshold for "salty" water for drinking or farming corresponded with what ecologists term "oligohaline" (slightly brackish), below 2 ppt.

The term "Salada" was applied to surface waters that had a "strong" saline content, as perceived by settlers and surveyors during the Mission and 19th century agricultural era (Gudde 1969). The threshold for "saline" epithets in folk names for waterbodies in the pre-scientific Mission era did not recognize 20th century distinctions among of multiple salinity classes between freshwater ("sweet water") and marine salinity (euhaline); "brackish" (dilute seawater) salinity distinction was not even used as a descriptive term applied to marshes by early California naturalists and botanists, who cited localities as "salt marshes" supporting species intolerant of marine salinity (Jepson 1911, Baye et al. 2000). California settlers, ranchers, and surveyors in the early-mid 19th were not naming waterbodies and wetlands according to (later) scientific wetland and aquatic habitat classifications that made fine distinctions among biological salinity tolerance classes.

The aspect of seasonality of salinity is also an important context for lagoons in summer-arid climates, as it is for creeks. Just as the historic epithet "Seco" and "Dry" applied to place-names (Arroyo Seco, Laguna Seco, usually applied to the dry-season condition) indicates important contrast with permanent lakes and streams, and indicated an historic condition of a seasonally or permanently dry creek or lake (Gudde 1969), "salada" does not indicate that a waterbody too "salty" for the contemporary consumptive water uses all year. The epithet "Salada" indicates at least seasonally "strong" salinity relative to land uses and needs, in contrast with a permanently freshwater lake suitable for irrigation, stock watering, or drinking. The term "salada" in the 19th century context would thus apply to all seasonally brackish or fresh-brackish coastal lagoons that were frequently too saline for use.

The perception of "freshwater" and "saltwater" in 19th century coastal place names was relative and influenced by perception contrasts and contemporary practical needs: navigators of mostly oceanic salinity (non-potable) waters named what is now Suisun Bay "Puerto Dulce" ("Sweet Bay" or "Freshwater Bay") as late as 1842 (Gudde 1969). Suisun Bay is fully tidal and estuarine, fresh-brackish in historic times, with near-zero salinity (potable, < 1 ppt) in sloughs during ebbing tides of the rainy winter-spring runoff period. Stratigraphic data, however, confirm that Suisun Bay has fluctuating oligohaline to mesohaline (fresh-brackish) seasonal salinity variation with brackish marsh and water column biota dominating sediments over two thousand years old (Goman and Wells 2000).

The name "Laguna Salada" is consistent with the early historic condition of a fresh-brackish coastal lagoon with intermittent overwash, as depicted in the earliest scientific map (1869) by the U.S. Coast Survey based on field surveys from the mid-19th century.

APPENDIX F – LAGUNA SALADA PLACE NAME ANALYSIS

References

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EXHIBIT M

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

STATE OF CALIFORNIA – NATURAL RESOURCES AGENCY EDMUND G. BROWN, JR., GOVERNOR

CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE (415) 904-5200
FAX (415) 904-5400
TDD (415) 597-5885

SENT BY CERTIFIED AND REGULAR MAIL
Certification No. 7006 2760 0005 5883 7396

March 11, 2013

Steve Castile
San Francisco Recreation & Parks
McClaren Lodge
Golden Gate Park
501 Stanyan Street
San Francisco, CA 94117

RE: Alleged **Coastal Act Violation No. V-2-13-002** (Sharp Park Golf Course), consisting of unpermitted repairs to the existing seawall

Dear Mr. Castile:

Thank you for meeting with Stephanie Rexing and me on March 4, 2013 at the Sharp Park Golf Course seawall in Pacifica. As noted in the letter Ms. Rexing sent you dated March 5, 2013, Commission staff has determined that the repair work that has taken place on the seawall constitutes development under the definition in the Coastal Act and is therefore not exempt from Coastal Act requirements.

1. **Alleged Coastal Act Violation.**

As you know, the California Coastal Act (Coastal Act) was enacted by the California Legislature in 1976 to provide protection of California's 1,100-mile coastline. The Coastal Act protects this coastline through implementation of a comprehensive planning and regulatory program designed to manage conservation and development of coastal resources. The California Coastal Commission (Commission) is the State agency created by and charged with administering the Coastal Act of 1976. The Commission carries out Coastal Act mandates by seeking to protect sensitive habitats, natural landforms, and scenic landscapes. Our goals include providing maximum public access to and along the coast, and to neither create nor contribute significantly to erosion, geological instability, or destruction of natural land forms along bluffs and cliffs.

The Coastal Act broadly defines development in Section 30106, in part as follows:

> *"Development" means, on land, in or under water,* ***the placement or erection of any solid material or structure;*** *discharge or disposal of any dredged material or of any gaseous, liquid, solid, or thermal waste;* ***grading, removing, dredging, mining, or extraction of any materials;*** *change in the density or intensity of use of land, including, but not limited to, subdivision pursuant to the Subdivision Map Act...change in the intensity of use of water, or of access thereto;* ***construction, reconstruction, demolition, or alteration of the size of any structure,*** *including any facility of any private, public, or municipal utility; and the removal or harvesting of major vegetation other than for agricultural purposes, kelp harvesting, and timber operations which are in accordance with a timber harvesting plan submitted pursuant to the provisions of the Z'berg-Nejedly Forest Practice Act of 1973... (Emphasis added)*

As such, the repair work at the subject property, which includes the placement of unpermitted rock riprap on the site ("placement or erection of any solid material or structure," "reconstruction...of any structure") and the grading of the material on top of the seawall ("grading, removing...or extraction of any materials") constitutes development under the Coastal Act. Section 30600(a) of the Act requires that any person wishing to perform or undertake development in the coastal zone must first obtain a coastal development permit (CDP), in addition to any other permit required by law, before carrying out any development. Any development activity conducted in the State's defined coastal zone without a valid coastal development constitutes a violation of the Coastal Act. Thus, the repair work, which includes the placement of rock riprap, is considered to be unpermitted development, constituting a Coastal Act violation.

2. Enforcement Remedies.

The Commission enforcement staff prefers to work cooperatively with alleged violators to resolve Coastal Act violations administratively. We are confident that we can resolve this matter without resorting to formal action. However, it is my obligation to inform you that, should this alleged violation remain unresolved, the Coastal Act contains a number of enforcement remedies for violations, including, but not limited to, issuance of Cease and Desist Orders, issuance of Restoration Orders, and the ability to initiate court action to collect civil liability in an amount not less than $500 and not more than $30,000 for each instance of development, pursuant to Coastal Act Sections 30809, 30810, 30811, and 30820 (a). Additionally, section 30820 (b) provides that additional civil liability may be imposed for violations which were undertaken knowingly and intentionally in an amount not less than $1,000 and not more than $15,000 for each day in which the violation persists. Any development that occurs after being notified by Commission staff of the need for a CDP for such development may be considered to be undertaken with knowledge of CDP requirements and intentionally undertaken in spite of that knowledge. Finally, pursuant to Section 30812, the Executive Director, after giving notice and allowing for a public hearing if requested, may record a Notice of Violation on the property where an unresolved violation exists.

3. Resolution of Alleged Coastal Act Violation.

To resolve the outstanding alleged Coastal Act violation on the subject site, please submit to Ms. Rexing of our North Central District planning staff a complete CDP application seeking after-the-fact authorization for the seawall repair work that has already taken place at the subject property. As you know, Ms. Rexing set a deadline of March 11, 2013 for this submittal. The CDP application should also include a request for any additional repair work you wish to do at the subject site. If you have any questions about completion of your CDP application, please contact Ms. Rexing at 415-597-5894. If you have any questions regarding enforcement, please contact me at 415-904-5269.

Thank you for your cooperation.

Sincerely,

JO GINSBERG
Enforcement Analyst

cc: Nancy Cave, CCC, Northern California Enforcement Supervisor
Madeline Cavalieri, CCC, North Central District Manager
Stephanie Rexing, CCC, North Central District Planner
Lisa Wayne, SFRPD

EXHIBIT N

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
08ESMF00-2012-F-0082

NOV 06 2013

Ms. Jane M. Hicks
Chief, Regulatory Division
U.S. Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, California 94103-1398

Subject: Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project in San Mateo, California (Service File # 08ESMF00-2012-F-0082)

Dear Ms. Hicks:

We are writing to inquire as to the status of the U.S. Army Corps of Engineers' (Corps) permit decision on the San Francisco Recreation and Parks Department's (Applicant) for a proposed Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project. As you know, the U.S. Fish and Wildlife Service (Service) on October 2, 2012, issued a Biological Opinion to the Corps on the effects of the proposed action on the endangered San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) and the threatened California red-legged frog (*Rana draytonii*).

In the view of the Service, the Biological Opinion is effective only upon issuance by the Corps of the authorizing action for which consultation was requested pursuant to section 7 of the Endangered Species Act (Act). The incidental take statement included in the Biological Opinion thus exempts the Corps and the Applicant from the take prohibitions of section 9 of the Act only when the action is authorized by permit issued by the action agency. The measures set forth in the Biological Opinion's incidental take statement must become binding conditions of any grant or permit issued to the Applicant by the Corps, in order for the exemption in section 7(o)(2) of the Act to apply. Consequently, Corps action on the application is essential.

If you have any questions please contact Ryan Olah at (916) 414-6623. Thank you for your attention.

Sincerely,

Cay C. Goude

Cay C. Goude
Assistant Field Supervisor

EXHIBIT O

To Board of Supervisors Appeal of the Sharp Park Pumphouse Project
Final Mitigated Negative Declaration and Project Approval

September 6, 2011

San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
Mayor Edwin Lee
City Hall, Room 200
San Francisco, CA 94102-4689

Re: Restoration of Sharp Park

Dear Board of Supervisors:

We are a group of scientists with collective expertise and experience regarding coastal wetlands and endangered species habitats. We are writing regarding the future of Sharp Park in the City of Pacifica. Given the recently proposed legislation for the City of San Francisco to co-manage Sharp Park in partnership with the National Park Service, you have a historic opportunity to restore regionally significant wetlands and endangered species habitat within and around the unique coastal lagoon ecosystem at Sharp Park.

We, the undersigned scientists with backgrounds in biology, herpetology, ecology, coastal engineering and hydrology, contend that the peer-reviewed scientific report and proposed restoration plan prepared by ESA-PWA with Dr. Peter Baye and Dawn Reis Ecological Studies in February 2011, *Conceptual Ecosystem Restoration Plan and Feasibility Assessment for Laguna Salada*, contains the best available science on the ecology of the Laguna Salada and surrounding natural features at Sharp Park, as well as the impacts of the management of the Sharp Park Golf Course on endangered species and their habitats at the site.

The restoration of Sharp Park wetlands and uplands habitats and connectivity with protected adjacent open space, as proposed in the ESA-PWA report, is the best option to ensure the long term survival of the San Francisco garter snake and the California red-legged frog in the area.

Conversely, the San Francisco Park Department recommendation for Sharp Park released in 2009 was to maintain 18 holes of the golf course while making small changes in the course layout to address environmental concerns, construct a multi-million dollar seawall along the coast, and invest millions of dollars into course improvements. This would have negative consequences for endangered species and their habitats, increase the potential for flooding, result in the loss of the Sharp Park beach and incur significant costs to the City's budget, all in order to maximize golf opportunities.

It is our conclusion that the minimal habitat enhancement proposed by the Park Department in their preferred 18-hole alternative is inadequate to allow the recovery of the San Francisco garter snake and red-legged frog at the site, and is set up to fail with climate change and sea-level rise.

Sharp Park contains unique coastal wetlands habitat features and is important habitat for two interdependent federally listed species. The extremely endangered San Francisco garter snake, confined to six areas on the upper San Francisco Peninsula, is federally and state listed as endangered. The California red-legged frog, found in wetlands in lowlands in central California, is federally listed as threatened. We concur with the ESA-PWA report that "Laguna Salada represents one of the best opportunities in the Central Coast region to improve and restore impaired lagoon wetland habitats for endangered species."

Sincerely,

Carlos Davidson, Ph.D. - Conservation Biologist and Ecologist
Director and Associate Professor
Environmental Studies Program
San Francisco State University
Relevant Experience: Expertise in conservation ecology and California amphibians

Dr. Kerry Kriger, Ph.D. - Ecologist
Founder, Executive Director of Save The Frogs
Relevant Experience: Expertise on amphibian disease; research into amphibian declines; articles in peer-reviewed international scientific journals

Peter H. Raven, Ph.D. – Botanist
President, Missouri Botanical Garden
St. Louis, Missouri
Relevant Experience: Expertise and many years of study on the plants of Central California

Glenn R. Stewart, Ph.D. - Zoologist and Ecologist
Professor Emeritus of Biological Sciences
California State Polytechnic University, Pomona
Relevant Experience: Expertise in the ecology and systematics of reptiles, amphibians and mammals

Samuel S. Sweet, Ph.D. - Zoologist
Department of Ecology, Evolution and Marine Biology
University of California, Santa Barbara
Relevant Experience: Expertise in vertebrate systematics and evolutionary morphology; herpetology

Michael Vasey - Botanist
Assistant Professor of Biology
San Francisco State University
President of the California Botanical Society
Relevant Experience: Trained botanist and conservation biologist; involvement in wetland conservation issues for nearly 15 years, extensive field work in wetlands

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From: David Holland [dholland@co.sanmateo.ca.us]
Sent: Friday, February 11, 2011 3:37 PM
To: Bo Links
Cc: richard@erskinetulley.com
Subject: Re: Sharp Park Working Group Findings and Conclusions, Please Approve Final Draft

Importance: Low

Bo - I agree after reviewing ...none of the comments from Steve Rhodes and I got in..so they redrafting.

Save Paper.
Think before you print.>>> "Bo Links" <bo@slotelaw.com> 2/11/2011 3:02 PM >>> Dave - thanks again for taking the time this morning. I read over the draft report and, quite frankly, was dismayed, but then again, perhaps I misunderstood the charge for the task force. I thought the central mission was to see if everyone could come up with a general plan for the property.
The report says NOTHING about keeping a golf course there. I'm worried that our opponents will wave this draft around like the American flag, declaring that the task force fully supports the frog/snake, and NOT the golf course.
They should support BOTH, in my view. I mean, people do count....at least as much as frogs/snakes.

Is there any way (sort of like inserting the reference to "City of Pacifica"!) to insert something along the following line: "None of the foregoing is incompatible with preservation of the historic 18 hole golf course that exits on the property. Even though the course may have to be reconfigured in the southwest corner, it is still possible to retain the key architectural features while at the same time providing for much needed habitat restoration."

Just a though; Rich agrees, and is cc'd on this message.

Thanks, Dave.

On Fri, Feb 11, 2011 at 12:01 PM, David Holland <dholland@co.sanmateo.ca.us>wrote:

> Bo and Richard,
> Thanks for the time and support this morning. Attached is the final
> draft for the release from SF Parks....
>
>
> David G. Holland
> Director
> San Mateo County Department of Parks
> 455 County Center, 4th Floor
> Redwood City, CA 94063
>
> Phone: (650) 599-1393
> Fax: (650) 599-1721

>
>
>
> Save Paper.
> Think before you print.
>
>
> ---------- Forwarded message ----------
> From: Janet.Young@sfgov.org
> To: "Amy Meyer" <a7w2m@earthlink.net>, "David Holland" <
> dholland@co.sanmateo.ca.us>, frank_dean@nps.gov,
> Howard_Levitt@nps.gov, rhodess@ci.pacifica.ca.us
> **Date: Fri, 11 Feb 2011 11:13:26 -0800**
> Subject: Sharp Park Working Group Findings and Conclusions, Please
> Approve Final Draft Hello all,
>
> **We've heard back from everybody and the only change is the addition of**
> **the City of Pacifica (sorry for the oversight). Here is the final**
> **draft for**
> **approval- please let me know. RPD is working on a press release today**
> **which I will forward along when complete. Please let me know your**
> **plans for the statement so we can continue to work together.**
>
>
>
> Finally, here is a link to WEI's press release, on their website: *
> http://wildequity.org/entries/3146*
> <http://wildequity.org/entries/3146>
>
> Very best,
> Janet Young
>
> Administrative Analyst
> Planning and Capital Division
> City of San Francisco
> Recreation and Parks
> 415-581-2546
> *Janet.Young@sfgov.org* <Janet.Young@sfgov.org>
>
>
>
> From: Janet Young/RPD/SFGOV
> To: Phil Ginsburg/RPD/SFGOV@SFGOV, Sarah Ballard/RPD/SFGOV@SFGOV,
> Dawn Kamalanathan/RPD/SFGOV@SFGOV, Amy Meyer <a7w2m@earthlink.net>,
> David Holland <dholland@co.sanmateo.ca.us>, rhodess@ci.pacifica.ca.us,
> frank_dean@nps.gov, Howard_Levitt@nps.gov, nancy_hornor@nps.gov, Lisa
> Wayne/RPD/SFGOV@SFGOV
> **Date: 02/10/2011 03:20 PM**
> Subject: Sharp Park Working Group Findings and Conclusions, Final
> Draft
> ------------------------------
>
>
> Hi all,
>
> We are on the last steps for completing the working group findings!
> **Attached is a marked up draft and a clean version for your review.**

> **Please have comments for me by tomorrow morning because as you may**
> **have heard, Wild Equity Institute released their 200+ page report**
> **today. I've linked it**
> **here:***
> http://www.biologicaldiversity.org/campaigns/restoring_sharp_park_cali
> fornia/pdfs/Laguna_Salada_Report_2-9-11.pdf
>
*<http://www.biologicaldiversity.org/campaigns/restoring_sharp_park_california/pdfs/Laguna_Sa
lada_Report_2-9-11.pdf>.
> A more manageable 4 page summary is linked here: *
> http://www.biologicaldiversity.org/campaigns/restoring_sharp_park_cali
> fornia/pdfs/Laguna_Salada_Restoration_Report_information_sheet.pdf
> *<http://www.biologicaldiversity.org/campaigns/restoring_sharp_park_ca
> lifornia/pdfs/Laguna_Salada_Restoration_Report_information_sheet.pdf>
> .
>
> Very best,
> Janet Young
>
> [attachment "2.10.11WorkingGroupConclusions.doc" deleted by Janet
> Young/RPD/SFGOV] [attachment "2.10.11WorkingGroupConclusions(tracked
> changes).doc" deleted by Janet Young/RPD/SFGOV]
>
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> 415-581-2546
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>
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SHARP PARK WORKING GROUP STATEMENT AND LIST OF FINDINGS

Sharp Park is a 417-acre multiple use facility owned and maintained by the San Francisco Recreation and Parks Department, located in the City of Pacifica, San Mateo County within the boundary of Golden Gate National Recreation Area. In the 1920's, a golf course was built on the western side of Sharp Park around the wetland complex, Laguna Salada. As late as the 1970's, the San Francisco Garter Snake and the California Red-legged Frog were abundant on the property. However, for the last 30 years, the population has been endangered and threatened, respectively. Multiple reports from the United States Fish and Wildlife Service and San Francisco Recreation and Park Department have pointed to the short-term need to restore Laguna Salada.

After the conclusion of 2010's summer public process, the San Francisco Recreation and Park Department convened a working group of land managers with interest in the property:, Dave Holland (San Mateo County), Steve Rhodes (City of Pacifica), Dawn Kamalanathan (San Francisco Recreation and Park Department), and Amy Meyer (Facilitator). Senior Staff of the Golden Gate National Recreation Area also participated in the working group.

The working group engaged in research, site visits, and guest speakers to determine the following:

According to the US Geological Survey, beach erosion dominates the coast in northern San Mateo County from Daly City to Pt. San Pedro, with over 98% of the shoreline eroding over the last several decades: the rate (0.6 m/yr) has increased by 50% over the long-term average (Dallas and Barnard, 2011). This erosion is linked, in part, to a sharp reduction in the sediment supply from San Francisco Bay over the last century. Looking ahead, by 2100 we can expect global sea level to rise by 0.6m to 2.0 m (Rahmstorf, 2007; Pfeffer et al., 2008; Jevrejeva et al., 2010). In addition, there is an observed increase in the size of the storm waves striking this region (Allan and Komar, 2006). Further sediment supply reductions, accelerated sea level rise and more powerful storm waves combined will put increasing stress on beaches and adjacent ecosystems, likely accelerating coastal erosion rates over the coming decades.

All working group members agree that the recovery of the San Francisco Garter Snake is a top priority. Thus, the working group agrees the next short term step is the restoration of Laguna Salada. Restoration of Laguna Salada will provide three times the current habitat by removing built up sedimentation, creating critical but missing upland habitat, and forming a connecting channel to Mori Point by moving Hole 12. A positive identification of SFGS would mean success of the short term goal and a United States Fish and Wildlife Service goal over two decades in the making.

As a long term goal, the working group finds a naturally managed system is the most sustainable approach to manage the property's coastal acreage. To this end, the seawall should not be further armored or heightened. A technical study by the various land owners and regulators, taking into account sea level rise, is recommended to continue to explore feasible transitions into a naturally managed "barrier lagoon" without undue risk to the protected species, adjacent property, and human life. This longer term goal will minimize management costs while creating a more naturally sustainable system for the protected species.

These habitat enhancements and golf could be compatible.

Findings:

a) The most valuable habitat and breeding opportunities of San Francisco Garter Snake and California Red-legged Frog are concentrated around Laguna Salada and Horse Stable Pond. Habitat for the California Red-legged Frog continues to rapidly degrade at Laguna Salada and Horse Stable Pond where cattails and tules are replacing the open water habitat the frog depends upon for breeding.

b) The San Francisco Garter Snake is endangered. The California Red-legged frog is threatened.

c) San Francisco Garter Snakes have been subject to human, hawk, dog, cat and other predation.

d) Annual flooding of fresh water from the hills is captured in the golf course. Historically, the water was discharged into the ocean.

e) Sharp Park is a managed environmental system which includes seasonal pumping of Laguna Salada to control peak winter flooding. The pumping system is located at Horse Stable Pond.

f) In 2005, United States Fish and Wildlife Service sent a letter to Recreation and Park Department recording stranded California Red-legged Frog egg masses at Horse Stable Pond. The Department instituted a new pumping protocol and has not received further notice of violation from United States Fish and Wildlife Service.

g) Maintaining the existence of the seawall will continue to accelerate beachfront erosion, changing the natural beach profile.

h) With consideration of the needs for sustainable species habitat and the more natural function of a barrier beach and lagoon system, the golf course could be redesigned to coexist with viable populations of sensitive species in the long term.

i) Winter flooding regularly occurs now in the residential area north of the golf course from a combination of water from the hills captured by the golf course and sea water. If the golf course is redesigned to support a more naturally functioning barrier beach and lagoon system, it must provide a solution to periodic flooding of the residential area.

j) If the decision is made to support a more naturally functioning barrier beach and lagoon system and golf remains a use on the property, design costs and future maintenance need to be addressed within a sustainable management plan.

k) The short term and long term management plans must be integrated and funded for a design that progressively moves from solving short-term problems to a long-term sustainable management program.

USGS quote courtesy of Patrick Barnard (USGS in Santa Cruz). Mr. Barnard's area of expertise is coastal resources.

Literature Cited:

Allan, J.C. and Komar, P.D., 2006. Climate controls on US West Coast erosion processes. Journal of Coastal Research, v. 22, no. 3, p. 511-529

Dallas, K.L., Barnard, P.L., Anthropogenic influences on shoreline and nearshore evolution in the San Francisco Bay coastal system, Estuarine, Coastal and Shelf Science (2011), doi:10.1016/j.ecss.2010.12.031

Jevrejeva, S., J. C. Moore, and A. Grinsted (2010), How will sea level respond to changes in natural and anthropogenic forcings by 2100?, *Geophys. Res. Lett.*, 37, L07703, doi:10.1029/2010GL042947.
Pfeffer, W.T., Harper, J.T. and O'Neel, S., 2008. Kinematic constraints on glacier contributions to 21st-century sea-level rise. Science, 331, p. 1340-1243
Rahmstorf, S., 2007. A semi-empirical approach to projecting future sea-level rise. Science. Volume 315, p. 368-370

BIOLOGICAL ASSESSMENT

SHARP PARK SAFETY, INFRASTRUCTURE IMPROVEMENT AND HABITAT ENHANCEMENT PROJECT

Prepared by:

Recreation and Park Department

City and County of San Francisco

May 2, 2012

also threaten adjacent residential areas. Flooding of the golf course affects the playability of the course as well as golf course maintenance activities. In past years, flooding on the course has rendered entire holes or portions of holes unplayable including holes 9, 12 and 14. Flood waters back up onto the course such that players cannot not access greens and tees and holes are shortened to avoid flooded areas. Operationally, the course cannot be mowed or otherwise maintained under flooded conditions. Operation of the flood control pumps can limit the extent of such flooding.

The Project Description includes two parts: (1) the construction action, which is the subject of the section 404 permit and (2) golf course maintenance and operations. Pursuant to the Final Rule regarding Interagency Cooperation (50 CFR pt. 402), this BA evaluates the potential effects of the action, which include the direct and indirect effects of the Federal action (that is, authorization to fill waters of the United States) as well as the effects of other activities that are interrelated or interdependent with that action (see Section 2.3) See 50 CFR 402.02 (definition of "effects of the action"), 402.12(a), (f).

2.2.1 Construction Action

The construction action is intended to 1) ensure the ongoing operation of the flood control pumps and worker safety when operating and maintaining the pumps 2) to replace minor infrastructure (pathways) and 3) to enhance existing habitat for CRLF and SFGS.

Currently, two factors adversely affect the operation of the pumps. First, pump operation is adversely affected by sediment buildup and vegetation growth around the pump intake structure and along the connecting channel between LS and HSP. Second, pump operation is adversely affected by the buildup of vegetation on the pump intake screens. In order for the pumps to function properly, the existing screens at the intake must be kept clear of vegetation buildup. The maintenance of the screens, including the removal of debris buildup, can be necessary as frequently as daily during the rainy season. Such maintenance often occurs while the pumps are being operated during or immediately after storm events when poor visibility, slippery conditions, and high water levels present

DRAFT

Significant Natural Resource Areas Management Plan

PLANNING DEPARTMENT
CASE NO. 2005.1912E

STATE CLEARINGHOUSE NO. 2009042102

Volume 1 – Draft EIR

AUGUST 2011

SAN FRANCISCO PLANNING DEPARTMENT

Draft EIR Publication Date:	AUGUST 31, 2011
Draft EIR Public Hearing Date:	OCTOBER 6, 2011
Draft EIR Public Comment Period:	AUGUST 31, 2011 to OCTOBER 17, 2011

Written comments should be sent to:
Environmental Review Officer | 1650 Mission Street, Suite 400 | San Francisco, CA 94103

Table 2
Summary of Environmental Impacts and Mitigation Measures

Impact	Impact Significance	Mitigation Measures	Impact Significance With Mitigation
Impact RE-4 Implementation of programmatic projects under the SNRAMP would not have a substantial adverse effect on the physical characteristics of existing recreation facilities	LTS	Not applicable	LTS
Impact RE-5 Implementation of routine maintenance projects under the SNRAMP would not have a substantial adverse effect on the physical characteristics of existing recreation facilities	LTS	Not applicable	LTS
Impact RE-6 **Implementation of the Sharp Park restoration activities under the SNRAMP would have a substantial adverse effect on the physical characteristics of existing recreation facilities**	LTS/M	**M-RE-6:** *Restoration of the Sharp Park Golf Course to 18 Playable Holes* **The SFRPD would coordinate with a golf course consultant and would restore the playability of the Sharp Park Golf Course, which would involve replacing Hole 12 either on the west (Option 1) or east (Option 2) side of Highway 1. Replacing the hole on the west side of Highway 1 may also require moving an additional hole west of the highway to retain playability and flow of the course, thereby increasing the number of holes west of the highway to 15 and decreasing to three the number of holes to the east. Creating a new hole east of Highway 1 would decrease the number of holes west of the highway to 13 and increase to five the number of holes to the east. The determination of where the replacement hole is constructed and whether additional holes need to be moved would require additional environmental review.**	LTS

brush blades or chainsaws. Ground disturbance from this activity is typically within the top inch or so of ground around the root zone.

- Installing plants using hand tools and plants in one-gallon containers or smaller. In addition to planting, volunteers also may assist Natural Areas Program staff with installation of erosion control materials, including coir rolls, straw bales, wattles, jute netting, and straw matting. These materials are installed with pins or two- to three-foot-long wooden stakes. This activity typically disturbs up to 12 inches of surface soil.
- Removing invasive trees (mostly eucalyptus), as well as overhanging tree limbs. This activity typically occurs in places where trees are expanding into or threatening a native habitat or presenting a safety concern. Following removal, stumps are left in place, resulting in little, if any, ground disturbance. Typically, no more than 20 trees (or half an acre) are treated at one time. This removal covers saplings and any tree over 15 feet high. Trees over six inches dbh are typically removed by tree crews at a rate of one to a few trees at a time. Trees will be removed manually and limb-by-limb, as described above.
- Maintaining trails, which includes clearing deposited soil from steps, replacing or installing steps or trail edging, and rerouting and benching trails. Ground disturbance for this activity is usually six inches or less.
- Maintaining catchment basins and sediment dams through hand removal of accumulated materials.

Sharp Park Restoration

As part of the Sharp Park restoration activities, the following measures from the SNRAMP would be implemented. The full set of Sharp Park SNRAMP measures are presented in Section III.I.23 and include additional measures that may fall under either programmatic projects or routine maintenance.

- SP-4a—Implement improvements to protect and enhance the habitat for the California red-legged frog and San Francisco garter snake at Laguna Salada, including the following:
    - o Create upland mounds for foraging, resting, and escape cover for the California red-legged frog and the San Francisco garter snake;
    - o Dredge excess sediments and accumulated organic matter, including stands of encroaching tules, to maintain open water and fringe habitat in the wetlands complex

and use appropriate dredged material on site to create or enhance upland habitat or to increase the elevation of certain golf course fairways;

- o Continue monitoring for California red-legged frogs and San Francisco garter snakes; and
- o Install and maintain signs and barriers to prevent disturbance of sensitive habitat in Horse Stable Pond and Laguna Salada by dogs or other possible nuisances.

- SP-4b—Construct upland mounds in the area directly south and southeast of Laguna Salada and plant with native grasses and herbs to provide snake and frog basking sites, and to provide nesting habitat for riparian birds; and
- SP-9b—Establish a vegetation management plan for the canal connecting Laguna Salada and Horse Stable Pond that would allow channel maintenance without affecting the forktail damselfly, California red-legged frog, or San Francisco garter snake.

The improvements to protect and enhance the California red-legged frog and San Francisco garter snake at Laguna Salada under measure SP-4a are focused on restoring the marsh complex and associated uplands. These restoration activities are intended to establish conditions that more resemble previous conditions and allow for thriving populations of these listed species. Figure 2 shows the restoration project footprint and the current vegetation communities, and Figure 3 shows the conceptual plan for restoring these areas. The goals of the Sharp Park restoration are to restore and enhance the wetland and upland habitat for the benefit of the San Francisco garter snake and California red-legged frog, which will contribute to the recovery of these species, and to reduce the potential recurrence of the conditions that negatively affect the wetland complex and habitat for these species, including sedimentation, eutrophication[12] due to the accumulation of dead and decaying vegetation, and loss of open water habitat due to accumulation of sediment and the proliferation of encroaching plant species. Although the primary restoration features discussed in this section are not likely to change, some modification may occur during consultation with the USFWS and/or CDFG pursuant to the state and federal Endangered Species Acts and during other regulatory approval processes. The main components of the restoration to achieve recovery of the California red-legged frog and San Francisco garter snake populations are as follows:

[12] Eutrophication—The process by which a body of water becomes enriched in dissolved nutrients that stimulate the growth of aquatic plant life resulting in the depletion of dissolved oxygen.

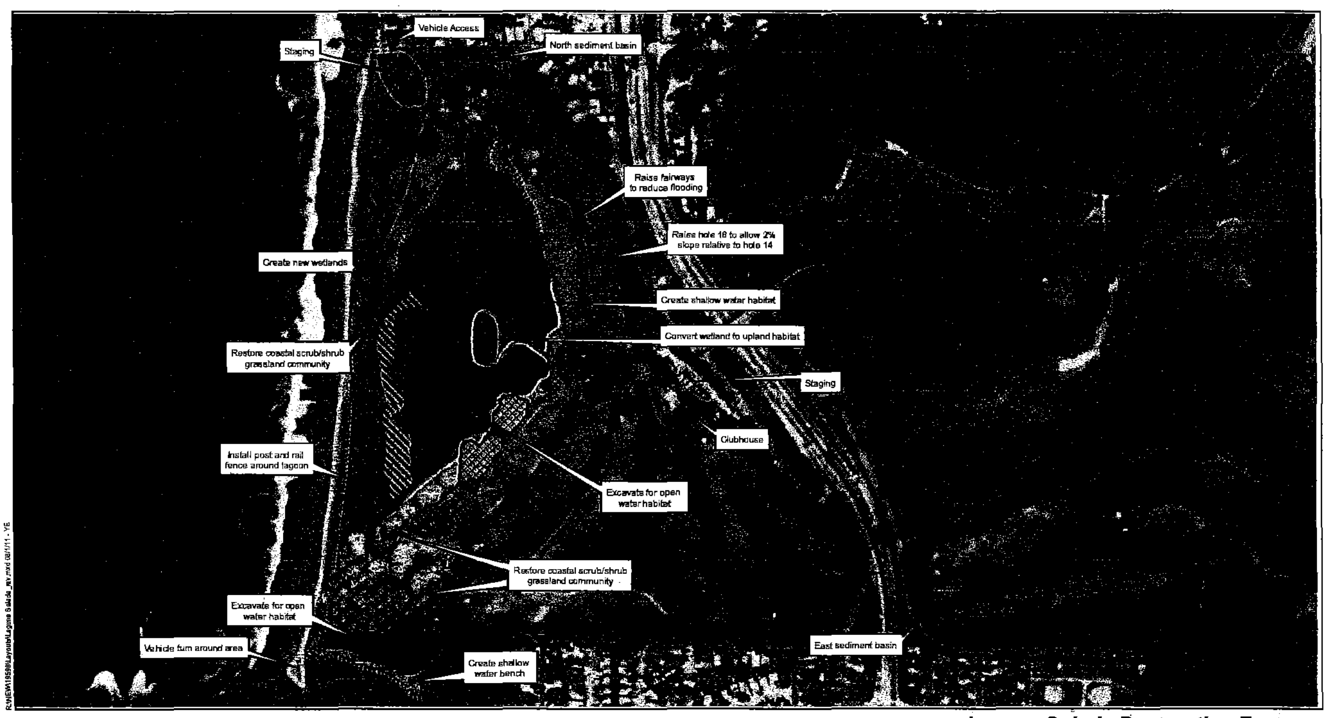
- Dredging up to 60,000 cubic yards of material to remove sediment, encroaching plant species, and decaying vegetation in Laguna Salada, Horse Stable Pond, and the channel that connects the two water bodies, resulting in the conversion of freshwater marsh, willow scrub, and wet meadow wetland habitat to open water habitat;
- Recontouring freshwater marsh wetland and ruderal (disturbed) habitat along the Laguna Salada, Horse Stable Pond, and channel shorelines to create shallow water wetland habitat;
- Creating an upland and wetland habitat corridor between Horse Stable Pond and Laguna Salada;
- Converting about half an acre of wet meadow/freshwater marsh wetland to upland habitat, creating an upland refuge in the middle of Laguna Salada to provide snakes and frogs with refugia from feral cats and other terrestrial predators, and creating about an acre of replacement wetland along the northern and western edges of the lagoon in place of coastal scrub habitat; and
- Constructing up to four acres of upland mounds on landscaped grass on the east side of the lagoon and between Laguna Salada and Horse Stable Pond. These mounds would be placed in the area currently occupied by part of the Hole 13 fairway, which would be narrowed and reconfigured.

Some areas that are currently open water within Laguna Salada and Horse Stable Pond would be deepened by one to three feet, and parts of the eastern portions of the lagoon and pond shorelines, as well as the connector channel, would be excavated to restore open water habitat and to ensure that ample edge habitat consisting of open water/emergent vegetation interface would persist for the foreseeable future. Excavation of accumulated sediments and encroaching wetland plants would result in the conversion of vegetated wetlands to open water habitat. This deepening would be conducted using excavating equipment positioned along the shore of the two water bodies. Up to 60,000 cubic yards of material would be excavated; of this, approximately 40,000 cubic yards would be used on-site and approximately 20,000 cubic yards would be stockpiled or spread at the Sharp Park rifle range site or disposed of at the Sharp Park organic dump. Excavated dredge spoils appropriate for use as golf course substrate materials would be used on-site to raise the elevation of Holes 10, 14, 15, and 18 and to create the upland habitat on the east edge of Laguna Salada. Prior to on-site use of dredged material, the sediments to be removed as part of the wetland restoration project would be tested for elevated concentrations of sulfides and other characteristics to determine whether the sediments would serve as soils suitable for supporting desired vegetation. If the

Laguna Salada Restoration Footprint

Pacifica, California

Figure 2



Laguna Salada Restoration Features

Pacifica, California

Figure 3

(Note: Because these cleanup and remediation activities are part of a separate process led by the SFRPD Capital Division, are complete, and have been evaluated under a separate CEQA review, they are not addressed as part of the SNRAMP in this EIR)

SFRPD would continue to use pumps to manage water levels in Horse Stable Pond to conserve the California red-legged frog by conducting post-rainfall inspections of the pond for California red-legged frog egg masses and making any pumping changes necessary to prevent stranding and other impacts to egg masses, if found to be present.

This EIR addresses the project-level impacts from both Laguna Salada routine maintenance and the Laguna Salada restoration activities at Sharp Park as part of the Sharp Park restoration analysis; routine maintenance within other parts of the park are addressed at the project-level; other programmatic projects at Sharp Park are evaluated programmatically.

III.I.24 Tank Hill (TK)

General Description

Tank Hill is in central San Francisco on Twin Peaks Boulevard near Golden Gate Park. The Natural Area is a 2.9-acre grassy knoll rich in local plant species. The property is publicly accessible via a wooden stairway from Twin Peaks Boulevard and a retained-earth stairway at the end of Belgrave Street.

Management Areas

The 1.5-acre MA-1 areas are grassland and rock outcrops that support sensitive species. The 0.6-acre MA-2 areas buffer the MA-1 areas. The 0.7-acre MA-3 areas include tree-dominated habitats and steep slopes in the southern portion of the Natural Area.

Recommended Management Actions

At Tank Hill, GR-1, GR-2, GR-4, GR-7, and GR-9 through GR-14 would be implemented to address management issues. In addition, the following site-specific management actions are recommended for the Tank Hill Natural Area:

- TK-1a—Contain and reduce herbaceous and woody invasive plants;
- TK-1b—Augment populations of sensitive plant species;
- TK-1c—Reintroduce sensitive plant species;

Sea level rise will put additional stress on the seawall at Sharp Park and could result in more frequent overtopping (SFRPD 2009a). Rising sea levels will also result in higher groundwater levels near the coast, as the water table rises to maintain net groundwater outflow to the ocean. Higher groundwater levels will reduce storage capacity of Laguna Salada somewhat and **will require more frequent or increased rates of pumping to maintain the water level in Laguna Salada below the elevation at which flooding impacts could occur.**

The Sharp Park Seawall Evaluation (Arup 2009) summarizes the results of efforts to assess and rank the current condition of the seawall, evaluates performance in five years and under projected sea-level rise in years 2040, 2060, and 2100, and assesses salt water intrusion into the wetlands. During the site assessment, no signs of seawater penetration through the seawall were observed. However, elevated salinity levels and a seep have been reported near the western edge of Horse Stable Pond, at the southern end of the seawall. This is the location of an abandoned drainage pipe, and it is possible that seawater is seeping along the drainage pipe during high tides (Arup 2009).

While portions of the seawall are in fair to good condition, mainly in armored areas, there are other portions of the seawall that are in poor condition. Significant erosion rills, near-vertical slope faces, and beach sand within two feet of the seawall are all issues that negatively affect the condition of the wall. If improvements are not performed to alleviate these conditions, **it is very likely that the seawall would be overtopped and breached during a 100-year storm or as a result of future sea level rise (Arup 2009).**

India Basin is the only Natural Area in San Francisco that borders San Francisco Bay. Elevations in the park range from sea level to approximately 25 feet above sea level. There are approximately 2.8 acres of tidal wetland in the 6.2-acre Natural Area (SFRPD 2006). A 4.6-foot sea level rise in this area would likely submerge the wetland, but upland areas would likely not be affected by the projected increase in sea level.

Water Quality

Islais Creek, Lake Merced, and San Francisco Bay next to India Basin are identified as impaired water bodies under Section 303(d) of the Clean Water Act. This is because they contain pollutants above levels considered consistent with their designated beneficial uses. The law requires determination of total maximum daily loads of the pollutants that cause the impairment and implementation of plans to maintain loadings below these levels.

some flows as groundwater to the sea, and some is pumped to the ocean during periods of high inflow.

If the water level of Laguna Salada or Horse Stable Pond were lowered below the elevation of the groundwater table, groundwater levels in the surrounding aquifer would be depressed and salt water from the ocean would migrate inland (salt water intrusion). The operation of pumps to control water levels in Horse Stable Pond and Laguna Salada would be designed to maintain water levels for the protected species and would also reduce the frequency of flooding of the golf course. Water levels in Laguna Salada and Horse Stable Pond would not be drawn down more than necessary to prevent flooding and would therefore not draw down groundwater levels, such that salt water would intrude.

Although the project would have an impact on groundwater levels by maintaining the elevation of the ponds, the groundwater impacts would be *less than significant* because the Sharp Park restoration project would not deplete groundwater supplies or interfere with groundwater recharge such that there would be a net deficit in groundwater volume or a lowering of the local groundwater table.

Erosion and Siltation

Programmatic Impacts

Impact HY-7: Implementation of the programmatic projects under the SNRAMP would result in substantial erosion or siltation. (Less than Significant with Mitigation)

The potential for erosion to impact surface water quality has been described and analyzed under Impact HY-1. Some of the proposed project activities, such as repairing gullies, recontouring or repaving roads, and implementing stream bank erosion control measures, might initially increase erosion, but they are anticipated to have long-term erosion reduction benefits. Vegetation removal/replacement and trail creation may slightly alter drainage patterns at the different Natural Areas and might even lead to a temporary increase in stormwater runoff until new vegetation becomes established. However, the small scale of these activities would not result in substantial erosion or siltation. The potential for erosion would be *less than significant* through implementation of the GR-12a (revegetate steep slopes) and GR-12b (phased invasive species removal to reduce erosion) erosion control measures and the erosion and sediment control BMPs described in M-HY-1, Implementation of Stormwater Pollution Prevention Measures.

Project-Level Impacts (Sharp Park Restoration)

Impact HY-12: Implementation of the Sharp Park restoration under the SNRAMP would not result in flooding. (Less than Significant)

Flooding of Sharp Park Golf Course has been a recurring problem since the 1940s. The pump system in Horse Stable Pond was installed in 1941 to control the water level in Laguna Salada by pumping water from the pond into the Pacific Ocean. One objective of pumping is to reduce the drawdown of the pond from December through March in order to create suitable habitat for the California red-legged frog to reproduce (SFRPD 2006). Another objective is to prevent excessive flooding of the golf course so that red-legged frogs would not lay their eggs high above the normal shoreline of Laguna Salada during floods, which would make them vulnerable to predators, and to maintain water levels that sustain tadpoles through metamorphosis. Computer modeling of storm scenarios shows that the pump capacity is likely to be exceeded at a frequency of about once every two years (SFRPD 2009a).

The golf course floods whenever the pumps in Horse Stable Pond are not able to keep up with the inflow from the watershed. Because the watershed east of Highway 1 is much larger than the golf course, most of the runoff from the watershed drains via Sanchez Creek to Horse Stable Pond. As water levels rise in Horse Stable Pond, water flows through the connecting channel into Laguna Salada. The capacity of Laguna Salada would be slightly increased through dredging that is proposed for Sharp Park, but the increase in volume would be small compared to the amount of runoff generated by a moderate to large storm. Therefore, changes to Laguna Salada would not significantly alter the frequency of flooding, which is regulated primarily by the rate at which the pumps in Horse Stable pond are able to discharge water to the ocean and by the intensity of rainfall in the watershed that governs the rate at which water is delivered to Horse Stable Pond via Sanchez Creek. Proposed regrading and filling of topographic depressions on the land surrounding Laguna Salada could allow more complete drainage to Laguna Salada and prevent localized ponding in low-lying areas.

Overall, implementing the project would not substantially alter the drainage pattern of the site or area and would not substantially increase the rate or amount of surface runoff so as to cause additional flooding, resulting in *less than significant* flooding impacts from the Sharp Park restoration project.

Maintenance Alternative has fewer potential environmental effects than the Maximum Recreation Alternative. First, the Maintenance Alternative would not create new trails, the construction of which could result in impacts to sensitive habitats and other biological resources. Second, over time the Maximum Recreation Alternative would result in Natural Areas with less native plant and animal habitat and a greater amount of nonnative urban forest coverage. The Maintenance Alternative, on the other hand, would preserve the existing distribution and extent of biological resources, including sensitive habitats. For these reasons, the Maintenance Alternative is the environmentally superior alternative.

It should be noted that one of the reasons that both the Maintenance Alternative and Maximum Recreation Alternative would result in less environmental impacts than the proposed project is because these alternatives would not provide a habitat corridor between Laguna Salada and Horse Stable Pond or provide the same degree of upland habitat as the proposed project and Maximum Restoration Alternative. The construction of the habitat corridor and upland refuge would require augmenting the Sharp Park Golf Course, resulting in significant and unavoidable impacts to the golf course as a historic resource. While the habitat corridor and upland refuge result in additional cultural and historic impacts, they are features of the proposed project that were developed based on early coordination efforts with the USFWS, CDFG and consulting biological experts and determined appropriate to achieve recovery of the San Francisco garter snake population.

VII.F ALTERNATIVES CONSIDERED BUT REJECTED

During the scoping process, **a public comment was received proposing a Sharp Park restoration alternative that included a model of natural flood control, outdoor recreation, environmental education, and endangered species recovery. This alternative would involve full restoration of the entire Sharp Park property, including the elimination of the golf course. This proposal was rejected as an individual alternative because it is not compatible with the 18-hole layout of the historic golf course.** This alternative would, through the elimination of the Sharp Park Golf Course, result in **greater significant and unavoidable impacts to cultural and recreational resources and therefore is not required to be analyzed under CEQA.** In accordance with CEQA Guidelines Section 15126.6, **"...alternatives to the proposed project shall include those that could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects."** In addition, an alternative that would convert the entire Sharp Park Natural Area would only address one of the many Natural Areas addressed by the SNRAMP and could not practicably be extrapolated to the other Natural Areas. **While rejected as an individual alternative, components and approaches embodied by this proposal have been incorporated into the Maximum Restoration Alternative.**

As part of the Sharp Park Conceptual Restoration Alternatives Report, the SFRPD proposed restoration alternatives that would be compatible with either a nine-hole layout at the Sharp Park Golf Course or with removal of the golf course entirely. **These alternatives have been rejected because they are not compatible with the existing and planned 18-hole layout of the historic golf course.**

Suggested alternatives or modifications to the project received during the scoping process have been considered and incorporated into the proposed project and the three project alternatives.

APPENDIX A

Notice of Preparation, Initial Study, and Scoping Report

- The deed transferring Sharp Park to San Francisco will be voided if the golf course is destroyed to create wetlands habitat. Any court reviewing those documents would find the proposed property change in violation of the transfer documents, and therefore Sharp Park would revert to the State of California. (Suzanne Valente)
- Recommend that measures around the most environmentally sensitive Sharp Park Golf Course areas (holes 12-15) consider creating native plant/no-golf areas surrounding "island" greens, relocating portions of the holes, incorporating raised causeways, restricting golf cart use, raising fairways, and temporarily closing fairways. (San Francisco Public Golf Alliance)

EIR Recommendations

Because redesigning or eliminating the Sharp Park Golf Course is a separate proposal being studied by SFRPD, it will not be included or evaluated as part of the proposed SNRAMP project analyzed in the EIR. Should changes to the Sharp Park Golf Course be proposed, they would undergo a separate regulatory review, including CEQA environmental review.

2.2 GENERAL PROJECT

Comments

- New areas should not be opened up for trail use; existing trails should be improved or closed. (Nature in the City)
- The plan should be revised to change the beginning of the nesting season from April 1 to February 15 (through July 15). The plan's practices for nesting birds should be applied to the February 15 to July 15 nesting season. Vegetation removal between January 1 and February 15 or July 15 to September 1 should be preceded by surveys for nests and nesting activity. (Golden Gate Audubon Society)
- Regarding GR-6b and c, nest boxes for cavity-nesting birds may be appropriate for woodlands with large trees, but would not be for other Natural Areas. Nest boxes should not be used to enhance nesting for nonnative species. (Golden Gate Audubon Society)
- Tree removal as described under GR-15c is not consistent with the leaving of snags and dead branches under GR-6a. This should be resolved and alternatives to guide the treatment of snags and standing dead trees should be addressed in the EIR. (Golden Gate Audubon Society)
- Regarding A5.15, India Basin Shoreline supports a large and multispecies collection of waterfowl from fall through spring. (Golden Gate Audubon Society)
- Regarding A5.18, Great Blue Herons should also be mentioned in this section. (Golden Gate Audubon Society)
- Regarding PL-2a, this measure should apply to all Natural Areas and include great horned owl, Western screech owl, and barn owl nests. (Golden Gate Audubon Society)
- The Natural Areas Management Plan and the EIR should acknowledge and be consistent with all approved San Francisco resolutions related to this project, including Resolution Number 0608-012 (and the two amendments addressing MA-3 areas and feral cats) and Resolution Number 0608-013. (Nancy Wuerfel)

11-00335S

SAN FRANCISCO RECREATION & PARKS

Edwin M. Lee, Mayor
Philip A. Ginsburg, General Manager

2011 AUG 26

August 24, 2011

Mr. Cameron Johnson
South Branch Chief
U. S. Army Corps of Engineers
1455 Market Street, 16th Floor
San Francisco, California 94103

Re: Section 404 Permit Application for Sharp Park Pumphouse Safety and Infrastructure Improvement Project

Dear Mr. Johnson:

With this correspondence and the enclosed Application for Department of the Army Permit and supporting documents, the San Francisco Recreation and Park Department (SFRPD) is requesting a Clean Water Act Section 404 permit for proposed improvements to the Sharp Park pumphouse located at the Sharp Park Golf Course in the City of Pacifica, San Mateo, California. The Sharp Park Pumphouse Safety and Infrastructure Improvement Project (Project) will ensure the operation and maintenance of the pumps and also addresses long standing worker safety issues resulting from the natural terrain and vegetation around the pumphouse.

After speaking with Bob Smith in your office, the SFRPD has determined that the proposed project requires a Section 404 permit because it requires the placement of fill in waters of the United States. Mr. Smith informed the SFRPD that it appears that the Project would be covered under Nationwide Permit 25, Structural Discharges.[1]

The Sharp Park pumphouse is at the southern end of a large wetland complex known as Laguna Salada, which is located within the Sharp Park Golf Course. The intakes for the pumps are located in Horse Stable Pond. The jurisdictional delineation attached to the permit application indicates the areas to the north, east, and west of the pumphouse are waters of the United States. The Jurisdictional Waters of the U.S. and Wetland Determination Report for the Laguna Salada Wetland Réstoration and Habitat Recovery Project was submitted to the U.S. Army Corps of Engineers (COE) in November 2008. Confirmation of COE jurisdiction was received on March 9, 2009 (File Number 2009-00044S). The wetland jurisdiction data in the attached application and supporting documents is based on this report.

The Project will ensure the ongoing operation of the flood control pumps and worker safety when operating and maintaining the pumps and pump intake. Two factors affect the operation of the pumps. First, pump operation is adversely affected by sediment buildup and vegetation growth around the pump intake structure. Second, the existing screens at the intake must be kept clear of vegetation buildup. The maintenance of the screens including the removal of debris buildup can occur as frequently as daily

[1] Nationwide Permit 25 permits"[d]ischarges of material such as concrete, sand, rock, etc., into tightly sealed forms or cells where the material will be used as a structural member for standard pile supported structures, such as bridges, transmission line footings, and walkways, or for general navigation, such as mooring cells, including the excavation of bottom material from within the form prior to the discharge of concrete, sand, rock, etc."

during the rainy season. Such maintenance often occurs while the pumps are being operated during or immediately after storm events when poor visibility, slippery conditions, and high water levels present natural hazards to access and maintenance. Currently there is no safe walking and working surface and access to the screens is only possible by lifting a heavy piece of chain link fence while clearing the screens (see Drawing 1 attached to the permit application).

In order to address these issues and ensure unimpeded water flow to the pumps, the Project includes the following components:

- Removal of approximately 435 cubic yards of cattails, bulrush and sediment from within the wetland in the area near the intake structure to reduce obstructions to water flow to the intake.
- Installation of steps leading down the slope from the access road to the pumphouse and the intake structure.
- Construction of a walkway on concrete support structures around the front of the pump intake box. This walkway will be supported by approximately 6 concrete support structures to be placed in the water. If feasible, a secondary screening system may be installed below the walkway surface and between the pilings to further reduce the amount of detritus from entering the pumps. It is estimated that this component of the project will require the placement of approximately 1.2 cubic yards of fill (concrete) in wetlands and waters of the U. S.
- Replacement of the failing wooden retaining wall at the base of the levee slope with a concrete retaining wall to prevent further soil deposition from the uplands from entering the waterway. The retaining wall will be placed in jurisdictional wetlands and is estimated to result in 0.4 cubic yards of fill.

The City has obtained several other permits for work at the Sharp Park pumphouse. In October 2008, SFRPD obtained authorization under Nationwide Permit 3 to repair the storm drain outfall at Sharp Park. At that time, the U.S. Fish and Wildlife Service (FWS), in consultation with COE, also issued a Biological Opinion (BO 81420-2008-F-1952) for the project pursuant to Section 7 of the federal Endangered Species Act (ESA). In 2010, the FWS reinitiated consultation regarding a project to replace one of the pumps in the pumphouse and to suction dredge a small section of the wetland in front of the pump intakes (less than 0.01 acre) to eliminate any obstacles to water flow to the pumps. On November 8, 2010, FWS issued an amendment to BO 81420-2008-F-1952 to cover the pump replacement and suction dredging.

For several years, the SFRPD has been working on a comprehensive long-term wetland restoration plan for the Laguna Salada wetland complex and resident native species. That long-term restoration plan is currently undergoing project-level environmental review under the California Environmental Quality Act as part of the Programmatic Environmental Impact Report for the San Francisco Natural Resource Areas Management Plan. Among other things, the plan will restore and enhance existing wetland and open water habitat, create upland habitat, and establish a habitat linkage between Laguna Salada and Horse Stable Pond to further the conservation of sensitive species.

That long-term project is separate and distinct from the Project. None of the infrastructure improvements in the Project is included in the long-term restoration project, and the purpose of the limited dredging included in this Project is eliminate obstacles to water flow to the pump intake, not solely to restore habitat, although it will restore more open water habitat favored by the California red-legged frog. Thus, the Project will undergo separate approval and environmental review.

The SFRPD is fully aware of the environmental sensitivity of the site and is committed to implement reasonable protective measures and monitoring for the San Francisco Garter Snake and the California red-legged frog as part of the project, We intend to implement avoidance, minimization, mitigation and monitoring measures similar to those which were required for the prior pump outfall repair project. Such measures include the avoidance of take of the fully protected San Francisco Garter Snake, as well as measures to avoid or minimize temporary impacts to the California red-legged frog. Any such measures will be subject to review, comment, and approval of the COE in consultation with other state and federal regulatory agencies.

At this time, SFRPD is planning on project construction to begin on October 15, 2011. Construction is expected to take approximately 30 days. This schedule will allow the City to complete the Project before the onset of the next rainy season, thereby minimizing any temporary construction impacts to the California red-legged frog, whose breeding season generally occurs between November 15 and April 15 each year.

Please let me know how SFRPD we may assist the COE with the permitting for this project including consultation with USFWS under Section 7 of the ESA.

Thank you for your time and consideration of this matter. I can be reached at 415-831-6326 and look forward to your response.

Lisa Wayne
SFRPD Natural Areas Program

cc: Bob Smith
Phil Ginsburg, SFRPD General Manager
Dawn Kamalanathan, SFRPD, Director of Planning and Capital Management

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APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT
(33 CFR 325)

OMB APPROVAL NO. 0710-0003
EXPIRES: 31 August 2012

Public reporting burden for this collection of information is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters, Executive Services and Communications Directorate, Information Management Division and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE
11-00338S			

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANTS NAME:
First - Phil Middle - Last – Ginsburg
Company – San Francisco Recreation and Park Department
E-mail Address – Phil.Ginsburg@sfgov.org

8. AUTHORIZED AGENT'S NAME AND TITLE (an agent is not required)
First - Lisa Middle - Beth Last – Wayne
Company – San Francisco Recreation and Park Department
E-mail Address – Lisa.Wayne@sfgov.org

6. APPLICANTS ADDRESS.
Address - 501 Stanyan Street
City – San Francisco State – CA Zip – 94117 Country – USA

9. AGENTS ADDRESS
Address - [illegible]
City – San Francisco State – CA Zip – 94117 Country – USA

7. APPLICANTS PHONE NOs. W/AREA CODE.
a. Residence
b. Business 415-831-2700
c. Fax

10. AGENTS PHONE NOs. W/AREA CODE
a. Residence
b. Business 415-831-6326
c. Fax 415-661-1979

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Lisa Wayne to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE

8-24-11
DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)
Sharp Park Pumphouse Safety and Infrastructure Improvement Project

13. NAME OF WATERBODY, IF KNOWN (if applicable)
Horse Stable Pond and Laguna Salada. (See San Francisco District, U.S. Army Corps of Engineers, Regulatory Division, Jurisdictional Delineation, ACOE File No. 2006-00044B, attached.)

14. PROJECT STREET ADDRESS (if applicable)
Address Highway 1 and Sharp Park Road
City - Pacifica State – CA Zip - 94044

15. LOCATION OF PROJECT
Latitude: °N 37.6243804
Longitude: °W 122.4894192

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)
State Tax Parcel ID Municipality City of Pacifica
Section – Township – T4S Range – R6W

17. DIRECTIONS TO THE SITE
From North: Take the Sharp Park Road Exit from Highway 1 in Pacifica California. Turn right at off ramp. Turn left into Sharp Park Golf Course Entry. The Pumhouse, shown in Drawing 1, is located on the far southwestern portion of the property adjacent to the levee and ocean.

18. Nature of Activity (Description of project, include all features)

See Attached

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

See Attached

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

The discharge is required to support a safety walkway that will enable personnel to maintain the debris screens on the pump intake box in a safe and efficient manner. Periodic removal of debris is required to protect the pump system from damage and breakdown. In addition, the existing retaining wall is failing, and its replacement with a more permanent and effective concrete wall is necessary to reduce sediments from entering the wetland and damaging the pump mechanism.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
Concrete walkway footings. Amount in CY: 1.2		Concrete retaining wall. Amount CY: 0.4

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres See Attached
Or
Liner Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

See Attached

24. Is Any Portion of the Work Already Complete? Yes ☐ No ☑ IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

Address – See Table 1 Attached

City – State – Zip –

26. List of Other Certifications or Approvals/Denials Received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
See Attached					

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE
	8-24-11		8/29/11

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Supporting Information for Application for Department of the Army
Sharp Park Pumphouse Safety and Infrastructure Improvement Project

Block 18. Nature of the Activity: The proposed Sharp Park PumpHouse Safety and Infrastructure Improvement Project includes several activities that will **improve water flow** and safety in the area around the Pumphouse. The proposed project includes the following:

1. Removal of cattails and tules in the area in front of the intake structure to reduce obstructions to water flow to the intake. Approximately 435 cubic yards of invasive tules, cattails and sediment would be removed from the pond (see Drawing 2). It is anticipated that a backhoe placed on top of an Aquamog (a compact multi-purpose aquatic vessel) will be used for excavation. Sediments would be removed to a depth not to exceed 3.5 feet. To the extent possible the shallow bench at the edge of the wetland, which does not contain emergent vegetation will not be excavated. The excavated material would be placed in a dewatering container (approximately 8' x 12') placed in the upland staging area adjacent to the Pumphouse. Once dewatered, the excavated material would be hauled to the organic dump east of Highway 1. It is anticipated that the equipment used for this project (the Aquamog, the Backhoe and the dewatering container) would be placed in the wetland, or in the case of the dewatering container, in an upland area adjacent to the wetland, using a crane from either the access road or the levee. The excavation work will remove sediment from the wetland but will not result in a discharge of dredge or fill into the wetlands.
2. Installation of steps from the access road to the intake structure. The steps will be approximately 3 feet wide and 14 feet long and constructed of wood (see Drawings 3-4). A 4-foot-high gate will be installed at the base of the steps to prevent unauthorized access to the intake structure (see Drawing 3). The step and gate installation will occur entirely in the upland area adjacent to the wetland and will not result in the discharge of dredge or fill material into waters of the U.S.
3. Construction of a walkway around the front of the intake. The walkway will be approximately 42 feet long at the perimeter and 4.6 feet wide and will wrap around the intake box (see Drawing 3). The walkway will be made of wood and supported by approximately 6 concrete support structures each approximately 1 foot in diameter and 10 feet tall. For each support structure, approximately 7 feet will be submerged below the mean high water mark in Horse Stable Pond to elevate the bottom of the pond and provide 3 feet of clearance above the pond surface for the walkway). It is expected that the concrete support structures will be constructed by placing cylindrical metal casings approximately 4 feet into the pond bottom and 3 feet into the water, dewatering and excavating sediment from the inside of the casings, and then filling the casings with concrete. If feasible, a secondary screening system will be installed below the walkway surface and between the pilings to further prevent detritus from entering the pumps. The concrete support structures will be installed into jurisdictional wetlands and waters and will elevate the bottom of Horse Stable Pond. It is estimated that this component of the project will result in 1.2 cubic yards of fill (concrete) to be placed in waters of the U.S.
4. Replacement of an existing wooden retaining wall at the base of the levee slope with a concrete retaining wall. Replacement of the existing wooden retaining wall will prevent further soil deposition from the uplands from entering the pond adjacent to the intake to

the pumphouse and interfering with the operation of the pumps. The wall will be approximately 12 feet long and will be approximately 5 feet high (2 feet will be placed under ground) (see Drawings 3 and 5). The retaining wall will be placed in jurisdictional wetlands. It is estimated that 0.4 cubic yards of fill (concrete) will be placed in the wetland.

Block 19. Project Purpose: The purpose of the proposed Sharp Park Pumphouse Safety and Infrastructure Improvement Project is to protect the safety of personnel responsible for operating and maintaining the pumps and periodically cleaning the existing screen at the pumphouse intake structure, and to ensure the ongoing operation of the pumps by reducing wear and tear and the risk of breakdown. Pump operation is adversely affected by sediment buildup and vegetation growth in the form of invasive tule and cattails around the pump intake structure. In order to maintain the existing and proposed new screening mechanisms at the pump intake from debris buildup that inhibits water flow, maintenance staff require a safe walking and working surface down to and around the intake structure. Such maintenance often occurs while the pumps are being operated during or immediately after storm events when poor visibility, slippery conditions, and high water levels present natural hazards to access and maintenance. Replacement of the wood retaining wall with a concrete wall will reduce the amount of sediment that will enter the area in front of the pump intake from the levee slope, thus reducing the rate of sedimentation and vegetation growth around the pump intake structure. The anticipated construction period for the proposed project is October 15, 2011 to November 15, 2011. This construction schedule will allow completion of construction activities prior to the beginning of the rainy season and the California red-legged frog breeding season, which generally occurs between November 15 and April 15.

Block 22. Surface Area in Acres of Wetlands or Other Waters Filled: The concrete walkway support structures will be installed in wetlands and waters of the U.S. The area of fill will be approximately 6 feet square feet (6 one-foot diameter support structures). If feasible, new debris screens will be suspended from the walkway, but not affixed to the pond bottom, and will be approximately 24 feet long and about 1 inch wide. The concrete retaining wall will be constructed in wetlands, and the area of fill will be approximately 6 square feet (12 feet long and 0.5 feet wide).

Block 23. Description of Avoidance, Minimization and Compensation. Impacts to wetlands will be minimized because the vegetation and sediment removal will be implemented by using a backhoe or similar equipment placed on top of an Aquamog, which floats on the pond surface, rather than a bulldozer or backhoe placed in the wetland. Also, the equipment (backhoe, Aquamog and dewatering container) are all expected to be delivered to the wetland and adjacent upland via a crane operating from the adjacent upland area. Impacts to waters of the U.S. also will be minimized by installing erosion control devices (coir rolls and sediment fencing) around the dewatering box in the adjacent upland area next to the pumphouse (see Drawing 2). This will prevent dredged sediment from flowing back into the pond. Construction staging will occur in the adjacent uplands and existing disturbed areas to the extent feasible. Compensatory mitigation should not be required because the area of impact is very small and the retaining wall portion is intended to replace an existing structure. Construction of the retaining wall and removal of sediment and tule will restore some of the open water habitat, which has been rapidly

diminishing, and which supports the breeding habitat of the California red-legged frog. In addition, the project will facilitate the efficient and reliable maintenance and operation of the pumps at Horse Stable Pond, which helps maintain consistent water levels during the rainy season. Maintaining consistent water levels (i.e., preventing flooding of Horse Stable Pond and Laguna Salada to the extent feasible) is beneficial to the California red-legged frog because it reduces the risk that the frogs will deposit egg masses in unsuitable habitat or upland areas that would dry out and strand the egg masses as flood waters receded. Therefore, the proposed project will have a long-term net beneficial effect on this threatened species.

Block 26. Other Agency Approvals: The project may require:
a. Biological Opinion including authorization of incidental take from the U.S. Fish and Wildlife Service pursuant to Section 7 of the federal Endangered Species Act because the project's direct and/or reasonably foreseeable indirect impacts may affect the California red-legged frog and/or its designated critical habitat and may affect the San Francisco garter snake.
b. Authorization of incidental take of the California red-legged frog from the California Department of Fish and Game pursuant to the California Endangered Species Act as well as consultation regarding avoidance of take of the fully protected San Francisco garter snake.
c. Fish and Game Code section 1602 Stream or Lake Alteration Agreement.
d. Coastal Development Permit or Permit Waiver from the California Coastal Commission.
e. Clean Water Act Section 401 Water Quality Certification from the California Regional Water Quality Control Board, San Francisco Bay Region.
f. City of Pacifica Building Permit.
g. City and County of San Francisco Planning Department CEQA Review.
h. Recreation and Park Commission Discretionary Project Approval.

Proposed Agenda
Meeting regarding Sharp Park

January 4, 2012

I. Introductions

II. Goals and expectations of the Corps, the Service, and the City for the meeting

III. Overview of City's current, interim and long-term management plans for Sharp Park
   - A. Bifurcated management strategy
   - B. **Long-term plan tiering off Significant Natural Resource Areas Management Plan including implementation of restoration plan, once Natural Areas CEQA process is complete**
   - C. Interim plan including
     - **implementation of modified compliance plan**
     - **pumphouse and tule removal project following consultation**
     - **activities under section 10(a)(1)(A) permit**
     - **continued collaboration with GGNRA**
   - D. Role of San Mateo County

IV. Pending section 404 application and request by the Corps to initiate consultation
   - A. Status of 30-day letter
   - B. Steps to timely completion of consultation
     - any additional information needed

V. Status of section 10(a)(1)(A) permits
   - A. **Continuing coverage of Jon Campo under GGNRA permit**
   - B. **Ability to remove aquatic vegetation and move egg masses that are in unsustainable habitat**
   - C. Potential to amend permit

VI. **Telemetry study proposed by GGNRA**

VII. Action items/next steps

Attendees on behalf of the City and County of San Francisco:

Phil Ginsburg, S.F. Recreation and Park Department (RPD) General Manager
Lisa Wayne, RPD Natural Areas Program Director
Dan Mauer, RPD Capital Project Manager
Virginia Dario Elizondo, Deputy City Attorney
Wayne White, Consultant to RPD
Paul Weiland, Esq., Counsel to City & County of San Francisco

OFFICE OF THE MAYOR
SAN FRANCISCO

EDWIN M. LEE
MAYOR

December 19, 2011

Members, Board of Supervisors
San Francisco City Hall
1 Dr. Carlton B. Goodlett Pl
San Francisco, California 94102

Dear Supervisors:

This letter communicates my veto of the ordinance pending in File Number 110966, finally passed by the Board of Supervisors on December 13, 2011. This ordinance proposes to amend the Park Code to require the Recreation & Park Department to enter into exclusive negotiations with the National Park Service pertaining to City-owned property at Sharp Park.

The Recreation and Park Department is presently conducting environmental analysis of a project at Sharp Park that would restore 19 acres of habitat. The Department has also been in discussions with the County of San Mateo for some time now to create a mutually beneficial partnership for the long-term management of the golf course that could help fund the needed habitat restoration, and continue to support an affordable and popular recreational activity.

The ordinance that I am vetoing would bring these productive discussions to a halt, and instead compel the Department to begin dialogue anew with the National Park Service about closing the golf course at Sharp Park. I believe in striving for equilibrium between environmental and recreational needs. The implicit aim of this legislation – cutting off talks with San Mateo County and envisioning the end of golf operations at Sharp Park – is not a balanced approach. Furthermore, the City could voluntarily choose at any time to enter into the type of discussion envisioned by this legislation, further making this ordinance unnecessary.

After lengthy discussions with Congresswoman Jackie Speier, it is clear to me that the Federal government cannot prioritize habitat restoration and recreational development at Sharp Park, and the National Park Service does not have the resources necessary to rehabilitate the natural areas and golf facilities.

San Mateo County officials, however, are ready and willing to partner with us to implement an environmentally responsible approach to species and habitat protection, all while keeping Sharp Park available to a variety of recreational users.

This ordinance explicitly prohibits San Francisco from entering into an agreement with San Mateo County, no matter how robust the environmental benefits of such an arrangement may be. For this reason, I am returning this legislation with a veto and encouraging the Board of Supervisors to support a balanced approach to Sharp Park.

Sincerely,

Edwin M. Lee
Mayor

cc: Angela Calvillo, Clerk of the Board of Supervisors

1 DR. CARLTON B. GOODLETT PLACE, ROOM 200
SAN FRANCISCO, CALIFORNIA 94102-4681
TELEPHONE: (415) 554-6141

RESOLUTION NO. ____________

BOARD OF SUPERVISORS, COUNTY OF SAN MATEO, STATE OF CALIFORNIA

* * * * * *

RESOLUTION
DIRECTING THE COUNTY MANAGER, OR HIS DESIGNEE, TO PROCEED WITH NEGOTIATIONS WITH THE CITY AND COUNTY OF SAN FRANCISCO WITH REGARD TO THE MANAGEMENT AND OPERATION OF SHARP PARK GOLF COURSE IN PACIFICA, CALIFORNIA

RESOLVED, by the Board of Supervisors of the County of San Mateo, State of California, that

WHEREAS, the City and County of San Francisco has been discussing the future of their golf courses including the Sharp Park Golf Course located in Pacifica; and

WHEREAS, the City of Pacifica has been working with the San Francisco Recreation and Parks Department Staff and elected officials to support the retention and revitalization of the Sharp Park Golf Course in Pacifica; and

WHEREAS, the Sharp Park Golf Course has been used for many years by youth and seniors from San Francisco and San Mateo Counties and has served as a prime recreational and social outlet for many citizens including retirees, youth, families and visitors. And has served as a venue for countless fundraising activities supporting non-profits and community organizations; and;

WHEREAS, the Sharp Park Golf Course and Club House are historically significant facilities; the golf course built in 1932 was designed by Alister MacKenzie, a world famous golf course architect who later designed the Masters

Course in Augusta, and the club house built in 1932 was designed by architect Willis Polk; and

WHEREAS, the County Manager and the San Francisco Recreation and Parks Department wish to work in conjunction with all parties of interest on the subject of the Sharp Park Golf Course and the remainder Sharp Park property to maximize the recreational opportunities offered by this historic property within the City of Pacifica, for the benefit of residents of San Francisco, San Mateo County and all visitors to the San Mateo County Coast.

NOW THEREFORE, IT IS HEREBY DETERMINED AND ORDERED that the County Manager or his designee is to proceed with negotiations with the City and County of San Francisco with regard to the management and operation of Sharp Park Golf Course in Pacifica, California. Any proposed final agreement resulting from such negotiations would be subject to review and approval by this Board.

* * * * * *

Sharp Park Outfall Repair

Biological Monitoring Form

Swaim Biological Inc.

Date: 23 Nov. 2008 Monitor(s) Onsite: J. Mitchell
Weather: Clear, warm
Time Onsite: 0700 - 1500

Construction Activities

Crew constructed a 'pig' from PVC pipe + dragged it through old pipe to test feasibility of using a sleeve inside old pipe. Drove mini excavator onto beach to pull cable through.

Removed pipe fittings from pumphouse. Cleared more iceplant from slope.

Sensitive Species

Special-status wildlife observed? (Y)/N
If so, describe actions taken:
3 CRLFs observed around HSP, outside work area.

Monitoring Checklist	
Biologist on-site for activities that could impact CRLF/SFGS?	(Y)/N
Construction activities confined to designated work area?	(Y)/N
All workers received environmental awareness training?	(Y)/N
Site free of food-related trash?	(Y)/N
Site free of monofilament netting, open trenches and other hazards to wildlife?	(Y)/N

For items marked No, describe actions taken:

Notes

Other issues and/or observations:
Several dead crayfish found at discharge end of pipe at beach. If crayfish can become entrained in pump then frogs might also. Rec and Parks should consider placing a net under the pipe end while pump is running to determine what animals are being affected.

City and County of San Francisco

Edwin M. Lee, *Mayor*
Philip A. Ginsburg
General Manager

Recreation and Park Commission

Mark Buell, *President*
Allan Low, *Vice President*

Gloria Bonilla
Tom Harrison
Meagan Levitan
Eric McDonnell

Margaret A. McArthur, *Commission Liaison*

NOTICE OF CANCELLATION
AND NOTICE OF SPECIAL MEETING

THE REGULAR MEETING OF RECREATION AND PARK COMMISSION SCHEDULED FOR THURSDAY, JANUARY 16, 2014 AT 10:00 A.M., CITY HALL, ROOM 416 IS CANCELLED

AND

A SPECIAL MEETING OF THE RECREATION AND PARK COMMISSION IS SCHEDULED FOR THURSDAY, JANUARY 23, 2014 AT 1:00 P.M., CITY HALL, ROOM 416

(415) 831-2750
(415) 831-2096 (FAX)

501 Stanyan Street
San Francisco, CA 94117-1898

Home Page Address:
http://parks.sfgov.org

RECREATION AND PARK COMMISSION "CULTIVATING THE FUTURE OF SAN FRANCISCO"

SPECIAL MEETING OF THE RECREATION AND PARK COMMISSION THURSDAY, JANUARY 23, 2014 1:00 P.M. CITY HALL, ROOM 416

RECREATION AND PARK COMMISSION	*RECREATION AND PARK DEPARTMENT*
Mark Buell, President **Allan Low, Vice President** **Gloria Bonilla** **Tom Harrison** **Meagan Levitan** **Eric McDonnell**	**Philip Ginsburg, General Manager** **Dennis Kern, Director of Operations** **Katie Petrucione, Director of Administration and Finance** **Dawn Kamalanathan, Planning and Capital Program Director** **Sarah Ballard, Director of Policy and Public Affairs** **Lisa Bransten, Director of Partnerships** **Nick Kinsey, Director of Property**

RECREATION AND PARK COMMISSION STANDING COMMITTEES

CAPITAL COMMITTEE
Commissioner Tom Harrison, Chair
Commissioner Mark Buell
Commissioner Allan Low

JOINT ZOO COMMITTEE
Commissioner Mark Buell
Commissioner Eric McDonnell

OPERATIONS COMMITTEE
Commissioner Meagan Levitan, Chair
Commissioner Gloria Bonilla
Commissioner Mark Buell

1. **ROLL CALL**

COMMUNICATIONS

Note: Each item on the Consent or Regular agenda may include the following documents:

- **a) Legislation**
- **b) Budget Analyst report**
- **c) Legislative Analyst report**
- **d) Recreation and Park Department cover letter and/or report**
- **e) Consultant report**
- **f) Public correspondence**
- **g) Report or correspondence from other Department or Agency**

These items will be available for review at McLaren Lodge, 501 Stanyan St., Commission Room. If any materials related to an item on this agenda have been distributed to the Recreation and Park Commission after distribution of the agenda packet, those materials are available for public inspection at McLaren Lodge, Commission Room, 501 Stanyan Street, San Francisco, CA during normal office hours. The documents for each item may be found on website at:
http://sfrecpark.org/about/recreation-park-commission/full-commission-documents/

Note: The Commission will hear public comment on each item on the agenda before or during consideration of that item.

2. **PRESIDENT'S REPORT (DISCUSSION ONLY)**
   - **a) Openings and Events**
   - **b) Commission Administrative Matters**
   - **c) Acknowledgements**

3. **GENERAL MANAGER'S REPORT (DISCUSSION ONLY)**
   - **a) Financial Matters**
   - **b) Capital Report**
   - **c) Property Management**
   - **d) Recreation Programs**
   - **e) Park, Recreation and Open Space Advisory Committee Report**
   - **f) Events**
   - **g) Legislation**

4. **GENERAL PUBLIC COMMENT - UP TO 15 MINUTES**
   At this time, members of the public may address the Commission on items of interest to the public that are within the subject matter jurisdiction of the Commission and that do not appear on the agenda. With respect to agenda items, your opportunity to address the Commission will be afforded when the item is reached in the meeting.

5. **CONSENT CALENDAR (ACTION ITEM)**

   A. MINUTES
   Discussion and possible action to approve the minutes of the November and December 2013 Commission meetings.

   B. SAN FRANCISCO ZOOLOGICAL SOCIETY ANIMAL TRANSACTIONS
   Discussion and possible action to approve the following animal transactions for the San Francisco Zoological Society, which were processed under Resolution No. 13572.

DONATION FROM:	ANIMAL SPECIES	PRICE	TOTAL DUE
Saint Louis Zoo One Government Drive Saint Louis, MO 63110 314/646-4825	3.3 White ibis *Eudocimus albus*	NIL	N/A

Philadelphia Zoo **3400 West Girard Ave.** **Philadelphia, PA 19104** **215/243-5368**	**1.0 Crested oropendola** ***Psaracolius decumanus***	**NIL**	**N/A**

GENERAL CALENDAR

6. ELECTION OF OFFICERS
Election of President and Vice President for calendar year 2014, in accordance with the Recreation and Park Commission Bylaws. (ACTION ITEM)

7. SAN FRANCISCO ZOO
Presentation and discussion only to update the Commission on operational and management issues at the San Francisco Zoo. (DISCUSSION ONLY)

8. MISSION DOLORES PARK RENOVATION – AWARD OF CONSTRUCTION CONTRACT AND ALLOCATION OF BOND CONTINGENCY FUNDS
Discussion and possible action to adopt a resolution: 1) awarding a construction contract in the amount of $12,395,641 to Alten Construction, Inc. for the Project and 2) approving the allocation of $4.8 million in contingency funds from the 2008 Clean and Safe Parks Bond for the Project. On June 20 2013, the Commission adopted a Final Mitigated Negative Declaration and a Mitigation Monitoring and Reporting Program for this project when it approved the conceptual design. (ACTION ITEM)
Staff: Jake Gilchrist – 581-2561

9. OPEN SPACE FUND CONTINGENCY RESERVE
Discussion and possible action to allocate $200,000 from the Open Space Fund Contingency Reserve to fund facility improvements at Camp Mather. (ACTION ITEM)
Staff: Denny Kern – 831-2710

10. HARDLY STRICTLY BLUEGRASS GRANT
Discussion and possible action to accept a grant in the amount of $86,760 from Big Billy Inc. dba Slim's on behalf of the Hardly Strictly Bluegrass festival to support the purchase of materials, supplies and equipment for Golden Gate Park and for irrigation system repairs in Sharon Meadows. (ACTION ITEM)
Staff: Lisa Bransten – 831-2704

11. SHARP PARK PUMPHOUSE – APPROVAL OF CONCEPTUAL PLAN
Discussion and possible action to approve a resolution: 1) adopting findings, a Final Mitigated Negative Declaration, and a Mitigation Monitoring and Reporting Program under the California Environmental Quality Act, and 2) approving the Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project, including the project's conceptual plan, which includes safety improvements to the pumphouse and habitat enhancement for the San Francisco Garter Snake and California Red-Legged Frog. Approval of this proposed action by the Commission is the Approval Action as defined by S.F. Administrative Code Chapter 31. (ACTION ITEM)
Staff: Stacy Bradley – 575-5609

12. COIT TOWER LEASE AGREEMENT
Discussion and possible action to recommend that the Board of Supervisors approve a five year lease agreement, with one three-year option to extend, between the City and Coit Tower LLC., for the lease and management of the gift shop, food and beverage operation and elevator operation concessions at Coit Tower. (ACTION ITEM)
Staff: Cassandra Costello – 831-2791

13. RECREATION AND PARK DEPARTMENT BUDGET FY 2014-2105 AND 2015-2016
Presentation and discussion only of the Recreation and Park Department's Proposed Budget for Fiscal Years 2014-15 and 2015-16. (DISCUSSION ONLY)
Staff: Katie Petrucione – 831-2703

14. **GENERAL PUBLIC COMMENT - CONTINUED**
At this time members of the public may address the Commission on items that are within the subject matter jurisdiction of the Recreation and Park Commission and that do not appear on the agenda.

15. **COMMISSIONERS' MATTERS**
This item is designed to allow Commissioners to raise issues they believe the Commission should address at future meetings. There will be no discussion of these items at this time.

16. **NEW BUSINESS/AGENDA SETTING (DISCUSSION ONLY)**
New Business/Agenda Setting
- **Permits Policy**
- **Disc Golf**
- **Energy Audit RFQ**
- **Maintenance and replacement costs for synthetic turf**
- **Scholarship Policy**
- **Lincoln Park Golf Course**
- **Golden Gate Park – HPC presentation on landmarking**
- **Lawn Bowling Club**
- **Golden Gate Park Stables**
- **Apprenticeship Program**
- **Beacon Street Hill Trail**
- **South Park Renovation Project**
- **Geneva Community Garden**
- **Noe Valley Town Square Grant Application**

17. **COMMUNICATIONS (DISCUSSION ONLY)**
Communications to the Recreation and Park Commission received between December 10, 2013 and January 10, 2014 that do not pertain to items on the agenda.
- **Email from Jerry Cadagan in regard to Lake Merced**
- **Email from the Controller's Office in regard to City Services Benchmarking: Recreation and Parks**
- **Email from Ana Sanchez in regard to Candlestick Park**
- **Emails from Peter Tannan, Janet McBride, Bern Smith and Susan Linton in regard to Portola Trail on Twin Peaks**
- **Emails from Mark Irwin and Jacqueline Roberts in regard to Christopher Playground**
- **From David Anderson in regard to Duboce Park**
- **Email from Sally Zappella-Smith in regard to Noe Courts.**

18. **ADJOURNMENT**

For questions about the meeting please contact 415-831-2750. The ringing of and use of cell phones, pagers and similar sound-producing electronic devices are prohibited at this meeting. Please be advised that the Chair may order the removal from the meeting room of any person(s) responsible for the ringing or use of a cell phone, pager, or other similar sound-producing electronic devices.

KNOW YOUR RIGHTS UNDER THE SUNSHINE ORDINANCE
Government's duty is to serve the public, reaching its decisions in full view of the public. Commissions, boards, councils, and other agencies of the City and County exist to conduct the people's business. This ordinance assures that deliberations are conducted before the people and that City operations are open to the people's review. For information on your rights under the Sunshine Ordinance (Chapters 67 of the San Francisco Administrative Code) or to report a violation of the ordinance, please contact:
Sunshine Ordinance Task Force Administrator
City Hall – Room 244 1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4683
415-554-7724 (Office); 415-554-7854 (Fax)
E-mail: SOTF@sfgov.org

Copies of the Sunshine Ordinance can be obtained from the Clerk of the Sunshine Task Force, the San Francisco Public Library and on the City's website at www.sfgov.org. Copies of explanatory documents are available to the public online at http://www.sfbos.org/sunshine or, upon request to the Commission Secretary, at the above address or phone number.

ACCESSIBLE MEETING POLICY

Per the American Disabilities Act and the Language Access Ordinance, Chinese, Spanish, and/or American Sign Language interpreters will be available upon request. Additionally, every effort will be made to provide a sound enhancement system, meeting materials in alternative formats, and/or a reader. Minutes may be translated after they have been adopted by the Commission. For all these requests, please contact Margaret McArthur, Commission Liaison, at least 48 hours before the meeting at 415-831-2750. Late requests will be honored if possible. The hearing room is wheelchair accessible.

In order to assist the City's efforts to accommodate persons with severe allergies, environmental illnesses, multiple chemical sensitivity or related disabilities, attendees at public meetings are reminded that other attendees may be sensitive to various chemical-based products. Please help the City to accommodate these individuals.

DISABILITY ACCESS

The Recreation and Park Commission meeting will be held in Room 416 at City Hall, 1 Dr. Carlton B. Goodlett Place, San Francisco. The meeting location is between Grove and McAllister Streets and is wheelchair accessible. The closet BART and Muni Metro Station is Civic Center, about three blocks from the meeting location. Accessible Muni lines nearest the meeting location are: 42 Downtown Loop, 49 Van Ness-Mission, F-Market & Muni Metro (Civic Center Station). For more information about Muni accessible services call 415-923-6142. There is accessible on-street parking available in the vicinity of the meeting location.

For assistance call 415-831-2750. In order to assist the City's efforts to accommodate persons with severe allergies, environmental illnesses, multiple chemical sensitivity or related disabilities, attendees at public meetings are reminded that others may be sensitive to various chemical based products. Please help the City accommodate these individuals.

LOBBYIST ORDINANCE

Individuals and entities that influence or attempt to influence local legislative or administrative action may be required by the San Francisco Lobbyist Ordinance [SF Campaign & Governmental Conduct Code 2.100] to register and report lobbying activity. For more information about the Lobbyist Ordinance, please contact the San Francisco Ethics Commission at 25 Van Ness Avenue, Suite 220, San Francisco, CA 94102, (415) 252-3100, FAX (415) 252-3112, website: sfgov.org/ethics.

CEQA APPEALS

<u>CEQA Appeal Rights under Chapter 31 of the San Francisco Administrative Code</u> **If the Commission approves an action identified by an exemption or negative declaration as the Approval Action (as defined in S.F. Administrative Code Chapter 31, as amended, Board of Supervisors Ordinance Number 161-13), then the CEQA decision prepared in support of that Approval Action is thereafter subject to appeal within the time frame specified in S.F. Administrative Code Section 31.16. Typically, an appeal must be filed within 30 calendar days of the Approval Action. For information on filing an appeal under Chapter 31, contact the Clerk of the Board of Supervisors at City Hall, 1 Dr. Carlton B. Goodlett Place, Room 244, San Francisco, CA 94102, or call (415) 554-5184. If the Planning Department's Environmental Review Officer has deemed a project to be exempt from further environmental review, an exemption determination has been prepared and can be obtained on-line at http://sf-planning.org/index.aspx?page=3447. Under CEQA, in a later court challenge, a litigant may be limited to raising only those issues previously raised at a hearing on the project or in written correspondence delivered to the Board of Supervisors, Planning Commission, Planning Department or other City board, commission or department at, or prior to, such hearing, or as part of the appeal hearing process on the CEQA decision.**

WRITTEN COMMENTS

Persons attending the meeting and those unable to attend may submit written comments regarding the subject of the meeting. Such comments will be made part of the official public record and will be brought to the attention of the Commission. Written comments should be submitted to:

Mark Buell, President
Recreation and Park Commission
McLaren Lodge, Golden Gate Park
501 Stanyan Street
San Francisco, CA 94117-1898
recpark.commission@sfgov.org
Fax Number: 415-831-2096

Para preguntas acerca de la reunión, por favor contactar el 415-831-2750. El timbrado de y el uso de teléfonos celulares, localizadores de personas, y artículos electrónicos que producen sonidos similares, están prohibidos en esta reunión Por favor tome en cuenta que el Presidente podría ordenar el retiro de la sala de la reunión a cualquier persona(s) responsable del timbrado o el uso de un teléfono celular, localizador de personas, u otros artículos electrónicos que producen sonidos similares.

CONOZCA SUS DERECHOS BAJO LA ORDENANZA SUNSHINE

El deber del Gobierno es servir al público, alcanzando sus decisiones a completa vista del público. Comisiones, juntas, concilios, y otras agencias de la Ciudad y Condado, existen para conducir negocios de la gente. Esta ordenanza asegura que las deliberaciones se lleven a cabo ante la gente y que las operaciones de la ciudad estén abiertas para revisión de la gente. Para obtener información sobre sus derechos bajo la Ordenanza Sunshine (capitulo 67 del Código Administrativo de San Francisco) o para reportar una violación de la ordenanza, por favor póngase en contacto con:

Administrador del Grupo de Trabajo de la Ordenanza Sunshine (Sunshine Ordinance Task Force Administrator)
City Hall – Room 244 1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4683
415-554-7724 (Oficina); 415-554-5163 (Fax)
Correo electrónico: SOTF@sfgov.org

Copias de la Ordenanza Sunshine pueden ser obtenidas del Secretario del grupo de Trabajo de la Ordenanza Sunshine, la Biblioteca Pública de San Francisco y en la página web del internet de la ciudad en www.sfgov.org. Copias de documentos explicativos están disponibles al público por Internet en http://www.sfbos.org/sunshine; o, pidiéndolas al Secretario de la Comisión en la dirección o número telefónico mencionados arriba.

POLITICA DE ACCESO A LA REUNION

De acuerdo con la Ley sobre Estadounidenses con Discapacidades y la Ordenanza de Acceso a Idiomas, intérpretes de chino, español, y lenguaje americano de señas estarán disponibles bajo solicitud. Adicionalmente, todo esfuerzo será hecho para tener un sistema de sonido, proporcionar materiales de la reunión en formatos alternativos, y/o proveer un leedor. Para solicitar estos servicios, por favor contactar a Margaret McArthur, Enlace de la Comisión, por lo menos 48 horas antes de la reunión al 415-831-2750. Si es posible, solicitudes tardías serán consideradas. La sala de audiencia es accesible a silla de ruedas.

Con el fin de ayudar a la ciudad en sus esfuerzos de dar cabida a personas con alergias severas, enfermedades ambientales, discapacidades relacionadas a múltiple sensibilidad a químicos o discapacidades relacionadas, se les recuerda a los participantes que otros participantes podrían ser sensitivos a diversos productos químicos. Por favor ayude a la Ciudad a acomodar estos individuos.

ACCESO DE DISCAPACITADOS

Las reuniones de la Comisión de Recreación y Parques se llevaran a cabo en la sala 416 de la Alcaldía, 1 Dr. Carlton B. Goodlett Place, San Francisco. El local de la reunión es entre las calles Grove y McAllister y es accesible a silla de ruedas. La estación del BART y del Metro de Muni es Civic Center, aproximadamente a tres cuadras del lugar de la reunión. Las líneas de buses de Muni cerca al lugar de reunión son: 42 Downtown Loop, 49 Van Ness-Mission, F-Market & Muni Metro (Estación de Civic Center). Para más información acerca de los servicios accesibles de Muni, llame al 415-923-6142. Hay parqueo accesible en la calle de la vecindad cerca del lugar de la reunión.

Para asistencia llame al 415-831-2750. Con el fin de ayudar a la ciudad en sus esfuerzos de dar cabida a personas con alergias severas, enfermedades ambientales, discapacidades relacionadas a múltiple

sensibilidad a químicos o discapacidades relacionadas, se les recuerda a los participantes que otros participantes podrían ser sensitivos a diversos productos químicos. Por favor ayude a la Ciudad a acomodar a estos individuos.

ORDENANZA DE CABILDEO

Individuos y entidades que influencian o intentan influenciar legislación local o acciones administrativas podrían ser requeridos por la Ordenanza de Cabildeo de San Francisco (SF Campaign & Governmental Conduct Code 2.100) a registrarse y a reportar actividades de cabildeo. Para más información acerca de la Ordenanza de Cabildeo, por favor contactar la Comisión de Ética: 30 Van Ness St., Suite 220, San Francisco, CA 94102, 415-252-3100, FAX 415-252-3112, sitio web: sfgov.org/ethics.

APELACIONES CEQA

Derechos de Apelación CEQA (por sus siglas en inglés) bajo el Capítulo 31 del Código Administrativo de San Francisco Si la Comisión aprueba una acción identificada por una exención o una declaración negativa como la Acción de Aprobación (según definida en el Capítulo 31 del Código Administrativo de San Francisco, según enmendada, Junta de Supervisores Ordenanza Número 161-13), entonces la decisión CEQA preparada en apoyo a esa Acción de Aprobación posteriormente está sujeta a apelación dentro del plazo establecido en la Sección 31.16 del Código Administrativo de San Francisco. Normalmente, una apelación debe presentarse dentro de 30 días calendario después de la Acción de Aprobación. Para información sobre cómo apelar bajo el Capítulo 31, comuníquese con la Secretaria de la Junta de Supervisores (Clerk of the Board of Supervisors) en la Alcaldía, 1 Dr. Carlton B. Goodlett Place, Sala 244, San Francisco, CA 94102, ó llame al (415) 554-5184. Si el Oficial de Revisión Ambiental del Departamento de Planificación (Planning Department's Environmental Review Officer) considera que un proyecto sea exento de revisión ambiental adicional, una determinación de exención se ha preparado y se puede obtener en línea visitando la página http://sf-planning.org/index.aspx?page=3447. Bajo CEQA, en una impugnación futura, un litigante estará limitado a presentar sólo aquellos asuntos planteados previamente en una audiencia sobre el proyecto o en correspondencia escrita entregada a la Junta de Supervisores, la Comisión de Planificación, el Departamento de Planificación u otra junta, comisión o departamento de la Ciudad en, o antes de, tal audiencia, o como parte del proceso de audiencia de apelación sobre la decisión de CEQA.

COMENTARIOS POR ESCRITO

Personas participando en la reunión y aquellos que no pueden participar pueden someter comentarios por escrito sobre el tema de la reunión. Tales comentarios formarán parte del archivo público oficial y serán sometidos a la consideración de la Comisión. Comentarios por escrito deben ser sometidos a:

Mark Buell, Presidente
Comisión de Recreación y Parques
McLaren Lodge, Golden Gate Park
501 Stanyan Street
San Francisco, CA 94117-1898
recpark.commission@sfgov.org
Número de Fax: 415-831-2096

如對會議有任何疑問，請致電 415-831-2750 查詢。當會議進行時，嚴禁使用手機及任何發聲電子裝置。會議主席可以命令任何使用手機或其他發出聲音裝置的人等離開會議場所。

了解你在陽光政策下的權益

政府的職責是為公眾服務，在具透明度的情況下作出決策。市及縣政府的委員會，市參事會，議會和其他機構的存在是為處理民眾的事務。本政策保證一切政務討論都在民眾面前進行，而市政府的運作也公開讓民眾審查。如果你需要知道你在陽光政策 (San Francisco Administrative Code Chapter 67)下擁有的權利，或是需要舉報違反本條例的情況，請聯絡：

陽光政策 專責小組行政官
地址：City Hall – Room 244 1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4683
電話號碼:415-554-7724 ; 傳真號碼415- 554-5163

電子郵箱: SOTF@sfgov.org

陽光政策的文件可以通過陽光政策專責小組秘書、三藩市公共圖書館、以及市政府網頁www.sfgov.org等途徑索取。民眾也可以到網頁http://www.sfbos.org/sunshine閱覽有關的解釋文件，或根據以上提供的地址和電話向委員會秘書索取。

利便參與會議的相關規定

根據美國殘疾人士法案和語言服務條例，中文、西班牙語、和/或美國手語翻譯人員在收到要求後會提供翻譯服務。另外，我們將盡力滿足增強會議中音響系統的不同要求。同時也將會提供不同格式的會議資料，
和/或者提供閱讀器。翻譯版本的會議記錄可在委員會通過後提供。上述的要求，請於會議前最少48小時致電415-831-2750聯繫委員會的聯絡人Margaret
McArthur提出。逾期提出的請求，若可能的話，亦會被考慮接納。聽證室設有輪椅通道。

殘障通路

公園委員會會議將在 Dr. Carlton B. Goodlett Place
市政廳的416室召開。會議地點位於Grove街和McAllister街之間，並設有殘障人士通道。最靠近會議地點的捷運及城市輕軌列車站是市政中心站(Civic Center)，
該站大約距離會議地點三個街口。駛經鄰近會議地點的公車路線包括: 42號市政中心循環線、 49號Van Ness街-米慎街循環線、 F -市場街線及城市輕軌列車線(市政中心站- Civic
Center)。如欲查詢更多有關公車服務的資訊，請致電415-923-6142。另外，
在會議地點附近街道設有泊車位。

如對本會議有任何疑問或希望尋求協助, 請致電415-831-
2750。市政府會致力關注有嚴重過敏、因環境產生不適、或對多種化學物質敏感的病患者，以及有相關殘疾的人士。請與會者協助市政府照顧這些個別人士的需要。

遊說者法令

依據「三藩市遊說者法令」（SF Campaign & Governmental Conduct Code 2.100）
能影響或欲影響本地立法或行政的人士或團體可能需要註冊，並報告其遊說行為。如需更多有關遊說者法令的資訊，請聯絡位於 Van Ness 街25號 220室的三藩市道德委員會，電話號碼:415- 252-3100，
傳真號碼 415-252-3112， 網址: sfgov.org/ethics。

CEQA 上訴

在三藩市行政法典第 31 章(San Francisco Administrative Code Chapter 31)之下的加州環境質量法(California Environmental Quality Act, CEQA)上訴權利。如委員會批准一項上訴行動，而該行動是按照批准行動(在三藩市行政法典第 31 章所界定的，按照市參事委員會修訂，條例編號 161-13) 所確定的豁免或否定聲明，則該項已準備以支持批准行動的 CEQA 決定，此後將在三藩市行政法典 31.16 節所指明的時間範圍內可被提出上訴。在一般情況下，上訴必須在批准行動的 30 個日曆日(30 calendar days)之內提出。要取得更多在第 31 章之下的上訴程序的資料，可聯繫位於市政廳的市參事委員會書記處，地址為:1 Dr. Carlton B. Goodlett Place, Room 244, San Francisco，郵區編號 CA94102，或致電 (415)554-5184。如規劃部 門的環境審核員認為相關計劃可免除進一步的審核，該豁免決定將可在網上透過網頁 http://sf-planning.org/index.aspx?page=3447 索取。根據 CEQA，在稍後的法院挑戰上，訴訟當事人可提出的問題，將只限於曾在以下各項提出的內容: 當中包括就相關計劃舉行的聽證會、或曾遞交予以下各項的書面往來，當中包括市參事委員會、規劃委員會、規劃部門以及其他市政府的董事會、委員會或部門，或在之前的、上述一類的聽證會、或是作為相關 CEQA 決定的上訴程序的一部份。

WRITTEN COMMENTS書面意見

與會人士或未能出席人士均可透過書面提交針對會議主題的意見。有關意見將作為官方公開記錄的一部份以及得到委員會的關注。書面意見可提交到:
Mark Buell主席
公園(Recreation and Park)委員會

地址:McLaren Lodge, Golden Gate Park
501 Stanyan Street
San Francisco, CA 94117-1898
電郵: recpark.commission@sfgov.org
傳真號碼: 415-831-2096

Translation provided by the **Office of Civic Engagement and Immigrant Affairs** (OCEIA), www.sfgov.org/oceia.

Traducción proporcionada por la **Oficina de Participación Cívica y Asuntos de Inmigrantes** (OCEIA), www.sfgov.org/oceia.

翻譯服務由**民政及移民辦事處**(OCEIA)提供, 網址: www.sfgov.org/oceia。
Перевод осуществлён **Управлением Гражданской Активности и Дел Иммигрантов** (OCEIA), www.sfgov.org/oceia.

SAN FRANCISCO RECREATION & PARKS

Edwin M. Lee, Mayor
Philip A. Ginsburg, General Manager

DATE: January 23, 2014

TO: Recreation and Park Commission

THRU: Philip A. Ginsburg, General Manager
Dawn Kamalanathan, Director of Capital and Planning Division

FROM: Matt Jasmin, Assistant Project Manager, Capital and Planning Division
Stacy Radine Bradley, Planner, Capital and Planning Division

RE: Sharp Park Pumphouse – Approval of Conceptual Plan

Agenda Item Wording:

Discussion and possible action to approve a resolution: 1) adopting findings, a Final Mitigated Negative Declaration, and a Mitigation Monitoring and Reporting Program under the California Environmental Quality Act, and 2) approving the Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project, including the project's conceptual plan, which includes safety improvements to the pumphouse and habitat enhancement for the San Francisco Garter Snake and California Red-Legged Frog. Approval of this proposed action by the Commission is the Approval Action as defined by S.F. Administrative Code Chapter 31. (ACTION)

Program Background and Project Description:

Sharp Park is a 417-acre property in the City of Pacifica in San Mateo County owned and operated by the City and County of San Francisco through RPD. See Attachment A – Site Location Map. The park's facilities include an 18-hole golf course, an archery range, a clubhouse, a remediated former rifle range, and natural areas including an approximately 27-acre wetland complex. See Attachment B – Project Area Map.

Sharp Park's managed wetland complex consists of three features:

(1) Horse Stable Pond (HSP), an open water pond and fresh-brackish water wetland;
(2) Laguna Salada (LS), which is located north of HSP; and
(3) An approximately 1,000-foot-long channel with culverts (metal pipes that that are located underneath golf cart pathways), which was constructed to drain water from LS to HSP.

RPD regularly maintains and adjusts the water levels in the LS wetland complex by existing pumps located in the pumphouse at the southwest corner of HSP. See Attachment F – Photograph of HSP Pumphouse. Flood waters in the wetland complex are removed by the pumps into the Pacific Ocean during the winter when water levels in the pond become too high.

The pumps control water levels in HSP and may affect water levels in LS when the channel connecting the two water bodies creates a surface water connection. The existing pump system consists of a large pump (rated 10,000 gallons per minute) and a small pump (rated 1,500 gallons per minute) located in a pumphouse with pipes built through the seawall to an outfall. Operation of the flood control pump system is necessary to manage floodwaters both on Sharp Park and adjacent properties. During normal rainfall years, floodwaters into LS back up onto the golf course. During heavy rainfall years, extensive flooding can occur in areas of play on the golf course and may also threaten nearby residences.

Proposed Project:
The proposed project includes elements that are analyzed and, in some instances required, by a Biological Opinion issued by the U.S. Fish and Wildlife Service (USFWS) and consists of the following:

1) Construction of a perennial pond, approximately 1,600 square feet (sf) in size, located approximately 400 to 500 feet southeast of HSP;
2) Realignment of a portion of an existing golf cart path located west of the fairway for golf course hole number 14 and east of the tee box for golf course hole number 15;
3) Removal of sediment and emergent vegetation within HSP and the connecting channel that links HSP with LS;
4) Construction of steps and a maintenance walkway approximately 4.6 feet in width at the existing HSP pumphouse; and
5) Replacement of an existing wooden retaining wall with a concrete retaining wall at the existing HSP pumphouse.

See Attachments C - Proposed Project Elements; D – Horse Stable Pond Detail; and E – Golf Cart Detail.

The project would be implemented in two locations, which combined total less than an acre (approximately 35,000 noncontiguous sf), within the 417-acre Sharp Park. The majority of work would be located in the southwest corner of the existing golf course, near HSP.

The purpose of the proposed construction of the new pond, the golf cart path realignment, the pumphouse improvements, and the sediment and vegetation removal is to: 1) restore habitat in several locations within the wetland complex for the California red-legged frog and the San Francisco garter snake, and 2) facilitate continued operation of pumps and maintenance of the existing infrastructure. Additionally, the sediment and vegetation removal would ensure that RPD can continue to manage water levels in the LS wetland complex by removing impediments to water flow within the wetland complex.

Sediment removal is typical of maintenance activities that occurred in the past at Sharp Park and is considered typical maintenance for managed wetlands to prevent excessive accumulation of sediment in the wetland complex. Excessive accumulation of sediment in HSP and the connecting channel could cause malfunction of the pumps by allowing sediment to enter the pump system and/or preventing the water from entering the pump intake. Another purpose of the proposed improvements to the pumphouse (which, as noted above, include construction of steps and a maintenance walkway and replacement of an existing wooden retaining wall with a new concrete retaining wall) is to improve the safety conditions of workers operating and maintaining the pumps by enhancing access to the pump intake structure.

Project Budget:

Construction Budget:	$420,000
Soft Costs:	$390,000
Contingency and Reserve:	$170,000
Total =	$1,000,000

Fund Source:
General Fund
Open Space
Open Space Contingency

Schedule:

Finalize drawings:	January 27, 2014
Bid and Award:	February 17 to May 15, 2014
Expected Construction Duration:	June 1 to October 31, 2014

Environmental Review:

The San Francisco Planning Department prepared a Preliminary Mitigated Negative Declaration (PMND) for the Project, which was published for public review on September 18, 2013. The PMND was available for public comment until October 18, 2013. The PMND finds that the Project could not have a significant effect on the environment. An appeal from Wild Equity was received by the Planning Department on October 18, 2013.

On January 16, 2014, the Planning Commission considered an appeal of the PMND and found that the contents of said report and the procedures through which the PMND was prepared, publicized, and reviewed complied with the California Environmental Quality Act (CEQA) and Chapter 31 of the San Francisco Administrative Code.

On January 16, 2014, the Planning Commission found the PMND was adequate, accurate and objective, reflected the independent analysis and judgment of the Department of City Planning and the Planning Commission, and approved the Final Mitigated Negative Declaration (FMND) for the Project in compliance with CEQA, the CEQA Guidelines, and Chapter 31. The Planning Department staff prepared a Mitigation Monitoring and Reporting Program (MMRP). See Attachment G for the FMND and MMRP. Both documents are also available online at http://www.sf-planning.org/index.aspx?page=1828.

Supported By:

USFWS
California Department of Fish and Wildlife
County of San Mateo
San Francisco Public Golf Alliance

Opposed By:

Wild Equity Institute
Surfrider Foundation

Recommendation:

Staff recommends that the commission approves a resolution: 1) adopting findings, a Final Mitigated Negative Declaration, and a Mitigation Monitoring and Reporting Program under the California Environmental Quality Act, and 2) approving the Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project, including the project's conceptual plan, which includes safety improvements to the pumphouse and habitat enhancement for the San Francisco Garter Snake and California Red-Legged Frog.

Attachments:

Attachment A – Site Location Map
Attachment B – Project Area Map
Attachment C – Proposed Project Elements
Attachment D – Horse Stable Pond Detail
Attachment E – Golf Cart Detail
Attachment F – Photographs of HSP Pumphouse
Attachment G – FMND and MMRP
Attachment H – Resolution

Attachment H

RECREATION & PARK COMMISSION

RESOLUTION NO. ____

RESOLUTION TO 1) ADOPT FINDINGS, A FINAL MITIGATED NEGATIVE DECLARATION, AND A MITIGATION MONITORING AND REPORTING PROGRAM UNDER THE CALIFORNIA ENVIRONMENTAL QUALITY ACT, AND 2) APPROVE THE SHARP PARK SAFETY, INFRASTRUCTURE IMPROVEMENT AND HABITAT ENHANCEMENT PROJECT, INCLUDING THE PROJECT'S CONCEPTUAL PLAN, WHICH INCLUDES SAFETY IMPROVEMENTS TO THE PUMPHOUSE AND HABITAT ENHANCEMENT FOR THE SAN FRANCISCO GARTER SNAKE AND CALIFORNIA RED-LEGGED FROG.

WHEREAS, The City and County of San Francisco ("the City") owns and operates certain real property, through its Recreation and Park Department ("RPD"), in the City of Pacifica in San Mateo County, which is commonly known as Sharp Park ("Sharp Park" or "Park"); and,

WHEREAS, Sharp Park contains, among other amenities, an 18-hole golf course, an archery range, a clubhouse, a remediated former rifle range, and natural areas including an approximately 27-acre wetland complex consisting of Horse Stable Pond (HSP), Laguna Salada (LS), a channel and culverts that connect HSP to LS, and adjacent wetlands; and,

WHEREAS, RPD proposes to implement the Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project ("Project") in two locations, which, combined, total less than an acre (approximately 35,000 noncontiguous square feet), within Sharp Park, which is 417 acres total; and,

WHEREAS, the Project includes elements that are analyzed and, in some instances required, by a Biological Opinion issued by the U.S. Fish and Wildlife Service (USFWS). The conceptual plan for the Project includes the following key elements: 1) construction of a perennial pond, approximately 1,600 square feet in size, located approximately 400 to 500 feet southeast of HSP; 2) realignment of a portion of an existing golf cart path located west of the fairway for golf course hole number 14 and east of the tee box for golf course hole number 15; 3) removal of sediment and emergent vegetation within HSP and the connecting channel that links HSP with Laguna Salada (LS); 4) construction of steps and a maintenance walkway approximately 4.6 feet in width at the existing HSP pumphouse; and 5) replacement of an existing wooden retaining wall with a concrete retaining wall at the existing HSP pumphouse; and,

WHEREAS, The purpose of the Project is to: 1) restore habitat in several locations within the wetland complex for the California red-legged frog ("Frog") and the San Francisco garter snake ("Snake"), and 2) facilitate continued operation of pumps and maintenance of the existing infrastructure. Additionally, the sediment and vegetation removal would ensure RPD can continue to manage water levels in the LS wetland complex by removing impediments to water flow within the wetland complex. Sediment removal is typical of maintenance activities that occurred in the past at Sharp Park and is considered typical maintenance for managed wetlands to prevent excessive accumulation of sediment in the wetland complex. Excessive accumulation of sediment in HSP and the connecting channel could cause malfunction of the pumps by allowing sediment to enter the pump system and/or preventing the water from entering the pump intake. Another purpose of the proposed improvements to the pumphouse (which, as noted above, include construction of steps and a maintenance walkway and replacement of an existing wooden retaining wall with a new concrete retaining wall) is

to improve the safety conditions of workers operating and maintaining the pumps by enhancing access to the pump intake structure; and,

WHEREAS, The Planning Department prepared a Preliminary Mitigated Negative Declaration (PMND) for the Project, which was published for public review on September 18, 2013; and,

WHEREAS, The PMND was available for public comment until October 18, 2013; and,

WHEREAS, The PMND finds that the Project could not have a significant effect on the environment. This finding is based, in part, upon the criteria of the Guidelines of State Secretary for Resources, Sections 15064 (Determining Significant Effect), 15065 (Mandatory Findings of Significance), and 15070 (Decision to Prepare a Negative Declaration); and

WHEREAS, On January 16, 2014, the Planning Commission considered an appeal of the PMND and found that the contents of said report and the procedures through which the PMND was prepared, publicized, and reviewed complied with the California Environmental Quality Act (California Public Resources Code Sections 21000 et seq.) ("CEQA"), 14 California Code of Regulations Sections 15000 et seq. (the "CEQA Guidelines"), and Chapter 31 of the San Francisco Administrative Code ("Chapter 31"); and

WHEREAS, On January 16, 2014, the Planning Commission found the PMND was adequate, accurate and objective, reflected the independent analysis and judgment of the Department of City Planning and the Planning Commission, and approved the Final Mitigated Negative Declaration ("FMND") for the Project in compliance with CEQA, the CEQA Guidelines, and Chapter 31; and

WHEREAS, The Planning Department is the custodian of records for the Project's environmental review, located in File No. 2012.1427E, at 1650 Mission Street,

Fourth Floor, San Francisco, California, and the Recreation and Park Department is the custodian of record for the Project's approval before this Commission; and

WHEREAS, The Planning Department staff prepared a Mitigation Monitoring and Reporting Program ("MMRP"), which is attached as Exhibit A to this Resolution and has been made available to the public and this Commission for this Commission's review, consideration and action; now therefore, be it

RESOLVED, That the Recreation and Park Commission has reviewed and considered the FMND and finds that there is no substantial evidence that the Project will have a significant effect on the environment with the adoption of the mitigation measures contained in the MMRP to avoid potentially significant environmental effects associated with the Project, and hereby adopts the FMND; and, be it

FURTHER RESOLVED, That the Recreation and Park Commission hereby adopts the MMRP attached hereto as Exhibit A and incorporated herein as part of this Resolution by this reference thereto and commits to all required mitigation measures identified in the MND and contained in the MMRP; and, be it

FURTHER RESOLVED, That the Recreation and Park Commission approves the Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project, including the Project's conceptual plan, which includes safety improvements to the pumphouse and habitat enhancement for the San Francisco Garter Snake and California Red-Legged Frog.

APPROVED

DATE:
BY:

Attachment: Exhibit A

SAN FRANCISCO
PLANNING DEPARTMENT

Mitigated Negative Declaration

1650 Mission St.
Suite 400
San Francisco,
CA 94103-2479

Reception:
415.558.6378

Fax:
415.558.6409

Planning
Information:
415.558.6377

Date: **January 17, 2014**; amended on January 9, 2014
(Amendments to the PMND are shown in deletions as ~~strikethrough~~; additions in double underline)

Case No.: **2012.1427E**

Project Address: **Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project**

Project Location: Sharp Park

Project Sponsor: San Francisco Recreation and Parks Department (SFRPD)
Stacy Bradley, (415) 575-5609
stacy.bradley@sfgov.org

Staff Contact: Kei Zushi - (415) 575-9036
kei.zushi@sfgov.org

PROJECT DESCRIPTION:

The project site is located within Sharp Park in the City of Pacifica in San Mateo County. Sharp Park is a public park, approximately 417 acres in size, that is owned and operated by the City and County of San Francisco's (CCSF's) Recreation and Park Department (SFRPD). The proposed project consists of: 1) construction of a perennial pond, approximately 1,600 sf in size, located approximately 400 to 500 feet southeast of Horse Stable Pond (HSP); 2) realignment of a portion of an existing golf cart path located west of the fairway for golf course hole number 14 and east of the tee box for golf course hole number 15; 3) removal of sediment and emergent vegetation within HSP and the connecting channel that links HSP with Laguna Salada (LS); 4) construction of a maintenance walkway approximately 4.6 feet in width at the existing HSP pumphouse; 5) replacement of a wooden retaining wall near the pumphouse with a concrete retaining wall at the existing HSP pumphouse; and 6) construction of steps from the access road to the existing HSP pumphouse.

The project would be implemented in two locations, which cover a total of 35,000 noncontiguous square feet (sf) within Sharp Park. The majority of work would be located on the southwest corner of the existing golf course, near HSP. One segment of an existing golf cart path is proposed to be realigned as part of this project. This golf cart path segment is located to the northeast of LS and to the southwest of Lakeside Avenue.

The proposed project is being constructed in accordance with a Biological Opinion issued by the U.S. Fish and Wildlife Service (USFWS) and is separate and independent from the proposed Significant Natural Resource Areas Management Plan (SNRAMP), which is currently undergoing separate environmental review.

The Approval by the San Francisco Recreation and Park Commission is the Approval Action for the whole of the proposed project.

FINDING:

This project could not have a significant effect on the environment. This finding is based upon the criteria of the Guidelines of the State Secretary for Resources, Sections 15064 (Determining Significant Effect), 15065 (Mandatory Findings of Significance), and 15070 (Decision to prepare a Negative Declaration), and the following reasons as documented in the Initial Evaluation (Initial Study) for the project, which is attached.

Mitigation measures are included in this project to avoid potentially significant effects. See pages 116 and 127.

In the independent judgment of the Planning Department, there is no substantial evidence that the project could have a significant effect on the environment.

SARAH B. JONES
Environmental Review Officer

January 17, 2014
Date of Adoption of Final Mitigated Negative Declaration

cc: Stacy Bradley, Project Contact
Historic Preservation Distribution List
Distribution List
Virna Byrd, M.D.F

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INITIAL STUDY

Case No. 2012.1427E – Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project

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A. PROJECT DESCRIPTION

Project Location and Site Characteristics

Sharp Park is a public park, approximately 417 acres in size, located in the City of Pacifica in San Mateo County that is owned and operated by the City and County of San Francisco's (CCSF's) Recreation and Park Department (SFRPD). It is bisected from north to south by the Pacific Coast Highway (PCH), with the project site located west of PCH. Sharp Park is bounded by the Pacific Ocean to the west. To the north and south, portions of Sharp Park are bordered by residential development. Sharp Park abuts portions of the Golden Gate National Recreation Area (GGNRA) to the south and east (see Figures 1 and 2). Sharp Park contains an 18-hole golf course, an archery range, a clubhouse, a remediated former rifle range, a parking lot, and extensive natural areas including an approximately 27-acre wetland complex consisting of Horse Stable Pond (HSP), Laguna Salada (LS), a channel and culverts that connect HSP to LS, and adjacent wetlands.

The SFRPD, as project sponsor, proposes to implement the project in two locations, which cover a total of 35,000 noncontiguous square feet (sf) within Sharp Park. The majority of work would be located on the southwest corner of the existing golf course, near HSP. One segment of an existing golf cart path is proposed to be realigned as part of this project. This golf cart path segment is located to the northeast of LS and to the southwest of Lakeside Avenue (see Figure 3).

The Sharp Park Golf Course is located within an 845-acre watershed.[1] HSP is located south of LS and consists of an open water pond and a fresh-to-brackish water wetland. It is connected to LS via an approximately 1,000-foot-long channel that was constructed to drain water from the lagoon to HSP, and together these three features form a wetland complex. In addition to water from LS, HSP receives water from Sanchez Creek from the east (see Figure 4). HSP is shallower and smaller than LS, and typical water depths range from one to three feet. Flood waters in the wetland complex are ~~drained~~removed by pumps located at the southwest corner of HSP, which pump water into the Pacific Ocean during the winter, when water levels in the pond become too high.

The LS wetland system is naturally maintained by groundwater during periods of low surface water inflow, such as during the summer. At these times, the water elevation in HSP and LS represents the groundwater table. Groundwater flow from the watershed to the ocean maintains HSP elevations above sea level. Over the course of the year, surface inflows to LS exceed groundwater inflows to LS by 600 percent. Some of the excess surface water inflow is lost to evaporation and uptake by plants, some flows as groundwater to the sea, and some is pumped to the ocean during periods of high inflow.[2]

There is a seawall located along the western boundary of Sharp Park. This seawall was originally constructed between 1941 and 1952 and eliminated the historic hydrologic connection between the Pacific Ocean and the wetland complex. The aforementioned pumps control water levels in HSP and may affect water levels in LS when the channel connecting the two water bodies creates a surface water connection between them. The existing pump system consists of a large pump

[1] U.S. Fish and Wildlife Service (USFWS). *In Reply Refer To: 08ESMF00-2012-F-0082-2, Formal Endangered Species Consultation on the Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project in San Mateo County, California*, October 2, 2012 ("Biological Opinion"). This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[2] Kamman Hydrology & Engineering, Inc. *Report for the Hydrologic Assessment and Ecological Enhancement Feasibility Study: Laguna Salada Wetland System, Pacifica, California, Prepared For: Tetra Tech, Inc.*, March 30, 2009 ("Hydrologic Assessment"). This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

(rated 10,000 gallons per minute) and a small pump (rated 1,500 gallons per minute) located in a pumphouse with pipes built through the seawall to an outfall. Operation of the flood control pump system is necessary to manage floodwaters both on Sharp Park and adjacent properties. During normal rainfall years, floodwaters into LS back up onto the golf course.[3,4]

Two factors adversely affect the operation of the pumps. First, pump operation is impaired by sediment buildup and vegetation growth around the pump intake structure and along the connecting channel between HSP and LS. Second, pump operation is impaired by the buildup of vegetation on the pump intake screens. In order for the pumps to function properly, the existing screens at the intake must be kept clear of vegetation buildup. The maintenance of the screens, including the removal of debris buildup, can be required as frequently as daily during the rainy season. Such maintenance often occurs while the pumps are being operated during or immediately after storm events when poor visibility, slippery conditions, and high water levels present hazards to maintenance workers. Currently, there is no safe walking and working surface, and maintenance workers have to lift a piece of chain link fence to access the screens for cleaning.[5]

In November 2008, a wetland delineation report was prepared in support of the proposed LS Wetland Restoration and Habitat Recovery Project.[6] The study area for the wetland delineation report included HSP, LS, and areas of the Sharp Park Golf Course adjacent to the lagoon. The report concluded that a total of 27.42 acres of waters of the U.S.[7] were delineated within the study area. Jurisdictional areas were classified into four habitat types: freshwater marsh, willow scrub, wet meadow, and unvegetated pond (open water) (see Sections E.13, Biological Resources for more information). In May 2013, another wetland delineation report was prepared by the SFRPD to evaluate wetlands located in the proposed project area that meet the California Coastal Commission (CCC)-only wetland criteria.[8,9]

There are several special-status species[10] that are known to occur on and near the project site. These species include the California red-legged frog (CRLF), San Francisco garter snake (SFGS),

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[3] Arup North America. *Sharp Park Sea Wall Evaluation*, February 5, 2010. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[4] USFWS. *Biological Opinion*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[5] Ibid.

[6] Tetra Tech, Inc. *Jurisdictional Waters of the US and Wetland Determination Report, Laguna Salada Wetland Restoration and Habitat Recovery Project*, November 2008 ("LS Wetland Determination Report"). This report is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[7] Under the Federal Clean Water Act (FCWA) Sections 404 and 401, "jurisdictional wetlands and waters of the U.S." include one of the following: 1) traditional navigable waters; 2) wetlands next to traditional navigable waters; 3) nonnavigable tributaries of traditional navigable waters that are relatively permanent, where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); or 4) wetlands that directly abut the tributaries described in Item 3), above. See Section E.13, Biological Resources, for more information about the definition of "jurisdictional wetlands and waters of the U.S."

[8] San Francisco Recreation and Park Department (SFRPD). *Single Parameter Wetland Delineation for the Sharp Park Pumphouse Safety, Infrastructure Improvement and Habitat Enhancement Project*, May 7, 2013 ("Single Parameter Wetland Delineation Report"). This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[9] See the discussion concerning the California Coastal Act under Section C, Compatibility with Existing Zoning and Plans, page 19, for the definition of CCC-only wetlands.

[10] See Section E.13, Biological Resources, for the definition of "Special-Status Species."

western pond turtle (WPT), salt marsh common yellowthroat, black-crowned night heron, and San Francisco dusky-footed woodrat. CRLF is listed as "threatened" under the Federal Endangered Species Act (FESA) and a California Species of Special Concern (SSC).[11,12] SFGS is listed as "endangered" under the FESA and classified as "endangered" and "fully protected" under the California Fish and Game Code.[13,14,15,16,17] The black-crowned night heron is a California Special Animal.[18] WPT, salt marsh common yellowthroat, and San Francisco dusky-footed woodrat are listed as a California SSC. The San Francisco dusky-footed woodrat is known to occur on the east side of PCH (see Section E.13, Biological Resources for more information).

Proposed Project

The proposed project includes elements that are required under a Biological Opinion issued by the U.S. Fish and Wildlife Service (USFWS)[19] and consists of: 1) construction of a perennial pond approximately 1,600 sf in size; 2) realignment of a portion of an existing golf cart path located west of the fairway for golf course hole number 14 and east of the tee box for golf course hole number 15; 3) removal of sediment and emergent vegetation within HSP and the connecting channel that links HSP with LS; 4) construction of a maintenance walkway approximately 4.6 feet in width; 5) replacement of a wooden retaining wall near the pumphouse with a concrete retaining wall; and 6) construction of steps from the access road to the existing HSP pumphouse (see Figures 5 and 6).

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[11] The Federal Endangered Species Act (FESA) defines "Threatened Species" as any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

[12] A Species of Special Concern (SSC) is a species, subspecies, or distinct population of an animal (fish, amphibian, reptile, bird, and mammal) native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria:

- is extirpated from the State or, in the case of birds, in its primary seasonal or breeding role;
- is listed as Federally-, but not State-, threatened or endangered; meets the State definition of threatened or endangered but has not formally been listed;
- is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (not reversed) that, if continued or resumed, could qualify it for State threatened or endangered status;
- has naturally small populations exhibiting high susceptibility to risk from any factor(s), that if realized, could lead to declines that would qualify it for State threatened or endangered status.

[13] The FESA defines "Endangered Species" as any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of the FESA would present an overwhelming and overriding risk to man.

[14] The California Fish and Game Code defines "Endangered Species" as a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease. Any species determined by the Fish and Game Commission as "endangered" on or before January 1, 1985, is an "endangered species."

[15] The classification of "Fully Protected" was the State's initial effort in the 1960's to identify and provide additional protection to those animals that were rare or faced possible extinction. Lists were created for fish, mammals. amphibians and reptiles, birds and mammals. Most fully protected species have also been listed as threatened or endangered species under the more recent endangered species laws and regulations.

[16] California Department of Fish and Wildlife (CDFW). *Fully Protected Animals*. Available online at: *http://www.dfg.ca.gov/wildlife/nongame/t_e_spp/fully_pro.html*. Accessed July 19, 2013.

[17] CDFW. *State and Federally Listed Endangered & Threatened Animals of California*, January 2013. Available online at: *http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEAnimals.pdf*. Accessed July 19, 2013.

[18] "Special Animals" is a general term that refers to all of the taxa the California Natural Diversity Database (CNDDB) is interested in tracking, regardless of their legal or protection status.

[19] USFWS. *Biological Opinion*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

The primary purposes of the proposed construction of a pond, golf cart path realignment, and sediment and vegetation removal are to: 1) restore habitat in several locations within the wetland complex for CRLF and SFGS; and 2) remove impediments to water flow within the wetland complex. The primary purposes of the proposed improvements to the pumphouse are to: 1) enhance access to the pump intake structure and improve the safety conditions of workers operating and maintaining the pumps; and 2) enhance existing habitat for CRLF and SFGS.

The following is a description of each element of the proposed project:

1) **Construction of a perennial pond.** An approximately 1,600-sf perennial pond would be constructed to provide habitat for CRLF. The proposed pond would be located approximately 400 to 500 feet to the southeast of HSP within Sharp Park (see Figure 5). The SFRPD has tentatively identified two possible locations for the proposed pond. The final specific location would be determined in consultation with the USFWS. The proposed pond would be constructed by excavating up to five feet in depth in a similar manner to nearby ponds recently completed by GGNRA. Depending on the results of hydrologic surveys to be conducted as part of this project, the pond may be lined with clay bentonite to prolong water retention. The pond would be designed to capture and hold surface water runoff in the immediate vicinity of the pond and may also be fed by groundwater.

   Several types of plants would be removed and others planted in and near the proposed pond. The plants to be removed would primarily include invasive species such as poison hemlock *(Conium maculatum)*, mustard, and annual grasses; however, some areas containing common native upland species such as coyote brush (*Baccharis pilularis)* and California aster (*Symphyotrichum chiloensis*) may also be affected. The pond margins would be planted with wetland species such as common rush (*Juncus effuses*), common threesquare (*Schoenoplectus pungens*) and common silverweed (*Potentilla anserina*) which would provide suitable attachment sites for CRLF egg masses. The uplands surrounding the pond would be revegetated with the grassland-scrub mosaic species which may include coastal sagewort (*Artemesia pycnocephala*), sticky monkey flower (*Mimulus aurantiacus*), California aster and native grass species, which would provide high quality foraging and refuge habitat for CRLF and SFGS. The SFRPD would monitor the pond for CRLF breeding success by surveying for egg masses on an annual basis and would document habitat conditions for five years following pond construction.

2) **Golf cart path realignment.** One segment of an existing cart path, located west of the fairway for golf course hole number 14 and east of the tee box for golf course hole number 15, frequently floods, even during drought years. This golf cart path segment is located in low lying depression, which prevents surface water from draining into LS and causes surface water to pond on the path. This segment of the golf cart path, approximately 100 feet in length and seven feet in width, would be realigned to shift it 5 to 10 feet further away from habitat areas (see Figure 6). To maintain the natural look of the area adjacent to the cart path, the new path may be constructed using interlocking, permeable pavers.

3) **Removal of sediment and emergent vegetation within HSP and the connecting channel.** Sediment and emergent vegetation, including cattails (*Typha angustifolia*) and bulrush (*Scirpus americanus*), near the existing pumphouse would be removed in order to reduce obstructions to water flow into the pump intake structure and to enhance existing habitat for CRLF and SFGS (see Figure 5). HSP is approximately 5,900 sf in size, of which 2,350 sf is filled with cattails and bulrush. From this area, approximately 435 cubic yards (CYs) of sediment and emergent vegetation would be removed. The connecting channel

between HSP and LS is approximately 6,500 sf in size. This project would also remove approximately 480 CYs of sediment and emergent vegetation from the connecting channel. To facilitate the proposed sediment and emergent vegetation removal and to reduce potential impacts to CRLF, any of the following measures, or a combination of two or more of these measures, may be implemented in consultation with the USFWS: 1) lowering the water level of HSP and the connecting channel through the use of the existing pumps; 2) installing temporary barricades within the connecting channel to prevent the water from flowing into the work areas, or 3) utilizing suction hydraulic equipment to minimize the disturbance of sediments in the water.

The sediment and vegetation removal around the pumphouse would likely require establishing an equipment access route through the jurisdictional wetland on the north side of HSP. A compact multi-purpose aquatic vessel (i.e., an Aquamog) equipped with a long boom and clam shell or bucket type attachment that can reach sediment and vegetation may be used near the pumphouse. If it is determined in consultation with regulatory agencies that it is preferable to remove water from the work area around the pumphouse prior to sediment removal, then a small bobcat or similar equipment on tracks may be used to remove sediment. It is anticipated that an excavator or Grade-all stationed on the golf course would be used for the proposed sediment and emergent vegetation removal in the connecting channel.

Sediment and vegetation removed from both HSP and the connecting channel would be placed in an elevated dewatering container located in an adjacent cleared upland area or placed directly into a dump truck and transported to the former rifle range in the Upper Canyon of Sharp Park on the east side of PCH. The sediment and vegetation would be spread over flat grassland areas in the former rifle range. No dewatering vehicles or containers would be left overnight within work areas.

4) **Construction of a maintenance walkway**. The proposed maintenance walkway would be approximately 4.6 feet in width and wrap around the pump intake structure, and would be constructed in compliance with the California Uniform Building Code. The maintenance walkway would be made of wood and supported by approximately six concrete support structures to be placed in jurisdictional wetlands. The support structures for the proposed maintenance walkway would result in 1.2 CYs of fill in jurisdictional wetlands and waters of the U.S., which would require a permit from the U.S. Army Corps of Engineers (USACE). A new concrete slab (5 feet by 5 feet) and metal guardrail (3.5 feet in height and 3 feet in length) may be installed at the entrance door to the pumphouse. In addition, a secondary, metal debris screen would be installed at the pump intake structure in consultation with the USFWS. This screen would be metal mesh with holes measuring approximately one inch by one half inch.

5) **Replacement of an existing wooden retaining wall.** An existing wooden retaining wall located next to the pumphouse, approximately 12 feet in length and 3 feet in height, would be replaced with a new concrete retaining wall of the same size, in order to prevent upland soil from entering the water. The proposed retaining wall would be constructed in compliance with the California Uniform Building Code. The proposed retaining wall would result in 0.4 CYs of fill in jurisdictional wetlands and waters of the U.S., which would require a permit from the USACE (see Figure 5).

6) **Construction of steps.** The proposed project includes construction of 12 steps, approximately 3 feet in width and 14.3 feet in length, leading down the slope from the access road to the existing pumphouse. The proposed steps would be constructed in compliance with the California Uniform Building Code.

The proposed project would result in excavation up to a maximum of five feet below ground surface (bgs). Best Management Practices (BMPs) for erosion control would be implemented for all elements of the proposed project and may include placement of fiber rolls, silt fences, straw blankets, hydroseeding, and straw mulch/wood chips. In addition, the SFRPD would implement the following BMPs to control the spread of mosquito-borne disease as part of this project (see Impact HZ-2 for more information):

1. Educate staff about the most effective ways to avoid being bitten by mosquitoes;

2. Remove small water features that contain standing water or treat those features with *Bacillus thuringiensis israelis* a biological control agent for mosquito larvae, if the features were to remain and Public Health Services were to identify a potential health hazard; and

3. Encourage staff to drain any standing water in stored equipment or temporary depressions.

While the proposed activities associated with sediment and vegetation removal in HSP and the connecting channel and the native plant restoration associated with the construction of the pond are similar to those identified as long-term management goals in the SFRPD's proposed 2006 Significant Natural Resource Areas Management Plan (SNRAMP), this project is a separate and independent project to improve the habitat of the CRLF and SFGS in compliance with the USFWS Biological Opinion while improving the safety of workers who maintain the pumphouse. The proposed 2006 SNRAMP, which is currently undergoing environmental review, is a management plan intended to guide SFRPD's natural resource protection, habitat restoration, trail and access improvements, and maintenance activities over time and concerns all of the identified "natural areas" within the SFRPD's jurisdiction.

Although a neighborhood notice distributed on January 15, 2013 for the proposed project indicated that the project would include restoration of a half-acre upland habitat around the wetland complex, the Planning Department has since determined that the upland habitat restoration is separate, and has independent utility, from the proposed project. The upland habitat restoration, to remove invasive plant species and revegetate with native species on a total of 0.5 acres of upland area within Sharp Park, neither relies upon nor requires the approval of the proposed project. A Categorical Exemption (Planning Case No. 2013.1008E) was issued on August 5, 2013 concerning the upland habitat restoration pursuant to the California Environmental Quality Act (CEQA). The notice also indicated that two cart paths would be realigned. The SFRPD has decided to leave the southern cart segment in its current location and manually route carts onto the fairway as needed to avoid flooded areas.

A Biological Assessment[20] was prepared by the SFRPD and a Biological Opinion[21] was issued by the USFWS for the proposed project. At the request of the USFWS, the Biological Assessment and Biological Opinion included the proposed project listed above, as well as the ongoing operations and maintenance of the golf course.[22] Although ongoing golf course operations, such as pump

[20] SFRPD. *Biological Assessment, Sharp Park Safety, Infrastructure Improvement and Habitat Enhancement Project,* May 2, 2012 ("Biological Assessment"). This Biological Assessment was amended on August 16, 2012. These documents are available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[21] USFWS. *Biological Opinion.* This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[22] The proposed project is part of the project for which the Biological Opinion was issued by the USFWS. The proposed project, except for the construction of a 1,600-sf pond, is outlined under "Construction Action" on pages 5 and 6 of the

management and operation, mowing, and golf cart use, are discussed in the Biological Opinion, these ongoing operations and maintenance activities are not considered part of the proposed project for purposes of this CEQA analysis, but rather are considered part of the existing, or baseline, conditions. No changes to golf course operations and maintenance, including operations of the pumps, are proposed as part of this project.

Construction activities are required to be undertaken between June 1 and October 31 to minimize the proposed project's impact to CRLF and SFGS in accordance with the Biological Opinion. Construction is anticipated to occur for approximately 60 days over 18 months in the appropriate construction window in accordance with the Biological Opinion. Workers for the proposed project would include up to three to ten SFRPD employees and contractors.

The Biological Opinion includes a number of Conservation Measures and Terms and Conditions, intended to minimize the project's impacts to CRLF and SFGS. These Conservation Measures and Terms and Conditions are included as mitigation measures for this project (see Section E.13, Biological Resources for more information).

Project Approvals Required

The proposed project would require the following project approvals, with the Approval by the San Francisco Recreation and Park Commission identified as the Approval Action for the whole of the proposed project:

- Approval by the San Francisco Recreation and Park Commission
- FESA Section 7 formal consultation, Biological Opinion, and Incidental Take Statement Approval by the USFWS[23]
- California Endangered Species Act (CESA) consultation with the California Department of Fish and Wildlife (CDFW)[24] concerning fully protected species (i.e., SFGS)
- Federal Clean Water Act (FCWA) Section 404 Approval by the USACE
- FCWA Section 401 Water Quality Certification Approval by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB)
- Fish and Game Code Section 1602 Lake or Streambed Alteration Agreement Approval by the CDFW
- Coastal Development Permit Approval by the CCC

In addition, the proposed project may require the following project approval:

- ~~Approval of an amended~~ National Pollution Discharge Elimination System (NPDES) Permit by SFBRWQCB

Biological Opinion. The proposed construction of a 1,600-sf pond is outlined under "Conservation Measures for Golf Course Maintenance and Operations" on page 19 of the Biological Opinion.

[23] A Biological Opinion including an Incidental Take Statement has been issued by the USFWS for the proposed project.

[24] Formerly known as the California Department of Fish and Game (CDFG)

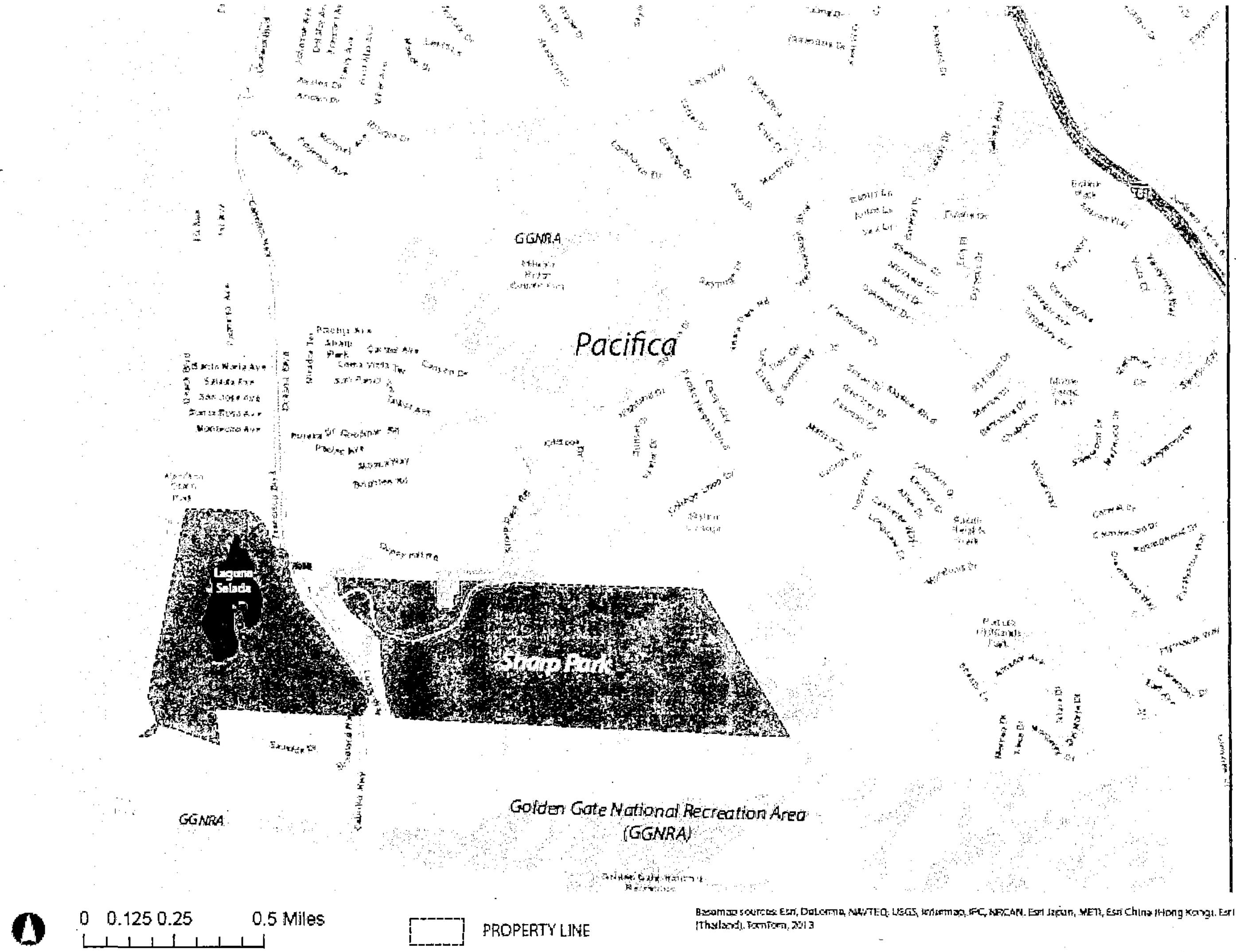


Figure 1. Vicinity Map

Source: San Francisco Recreation and Park Department

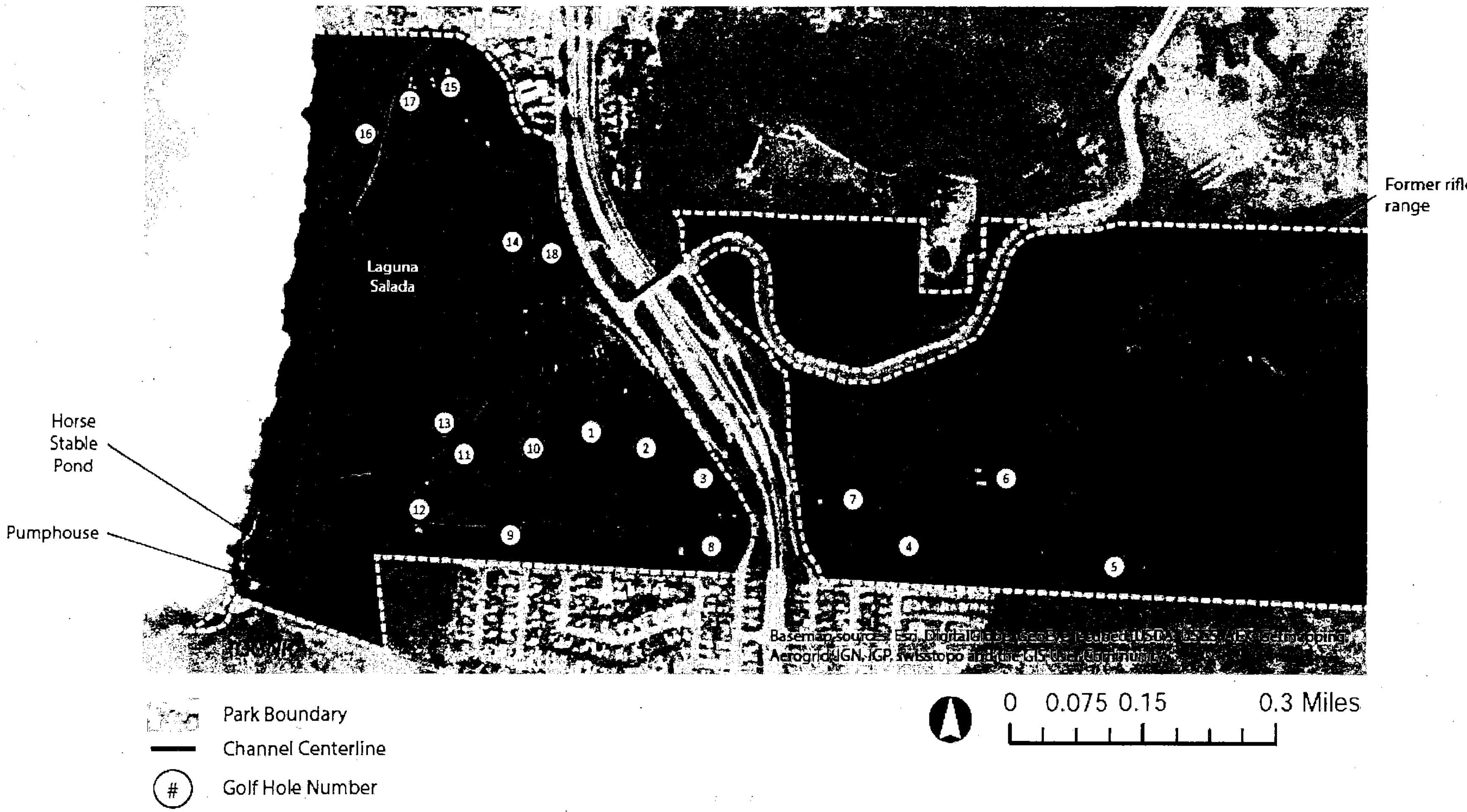


Figure 2. Map of Sharp Park and Golf Course

Source: San Francisco Recreation and Park Department

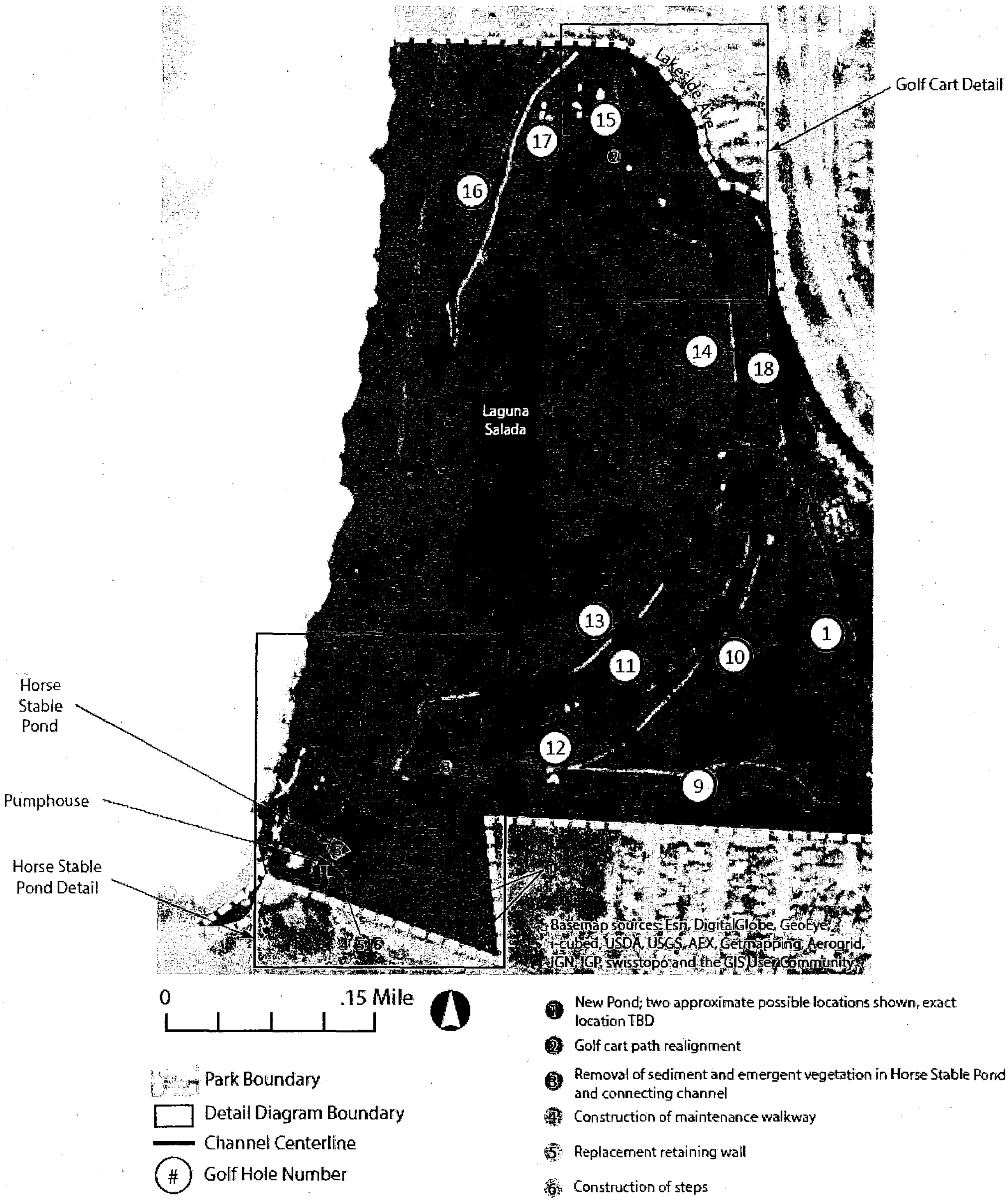


Figure 3. Location of Proposed Project

Source: San Francisco Recreation and Park Department

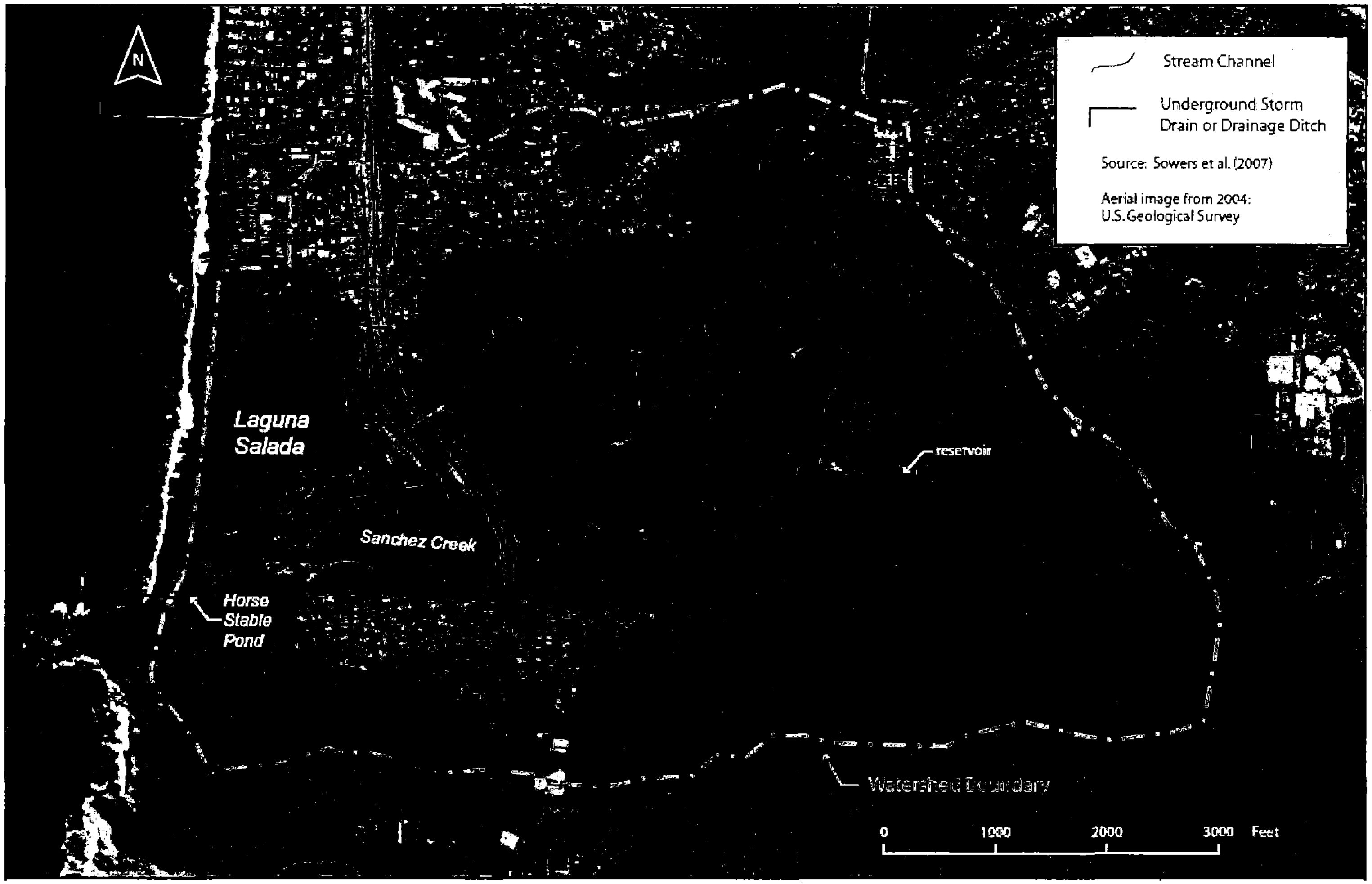


Figure 4. Drainage Network Map[25]
Source: Kamman Hydrology & Engineering, Inc.

[25] Kamman Hydrology & Engineering, Inc. *Hydrologic Assessment*. This report is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

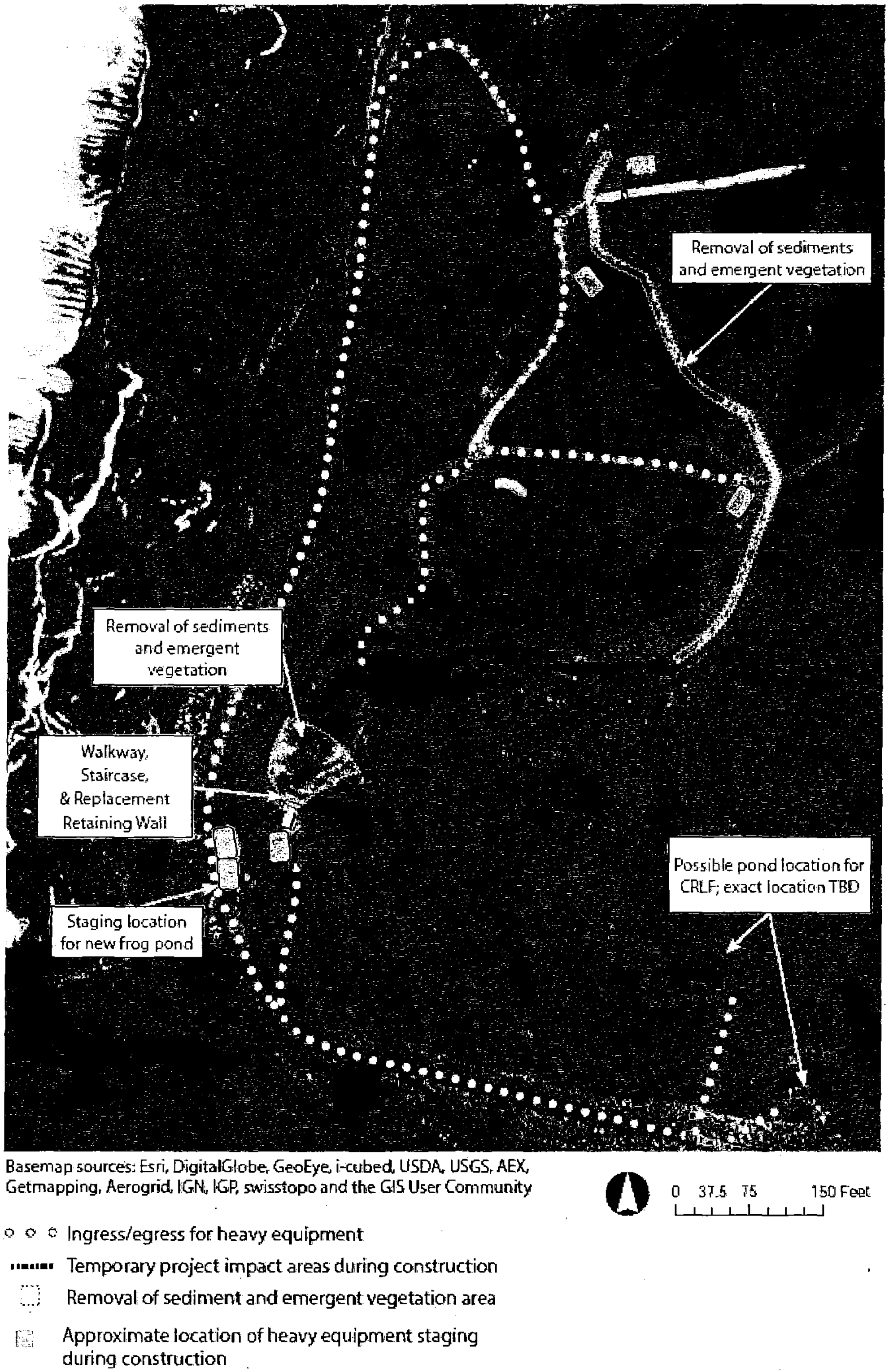
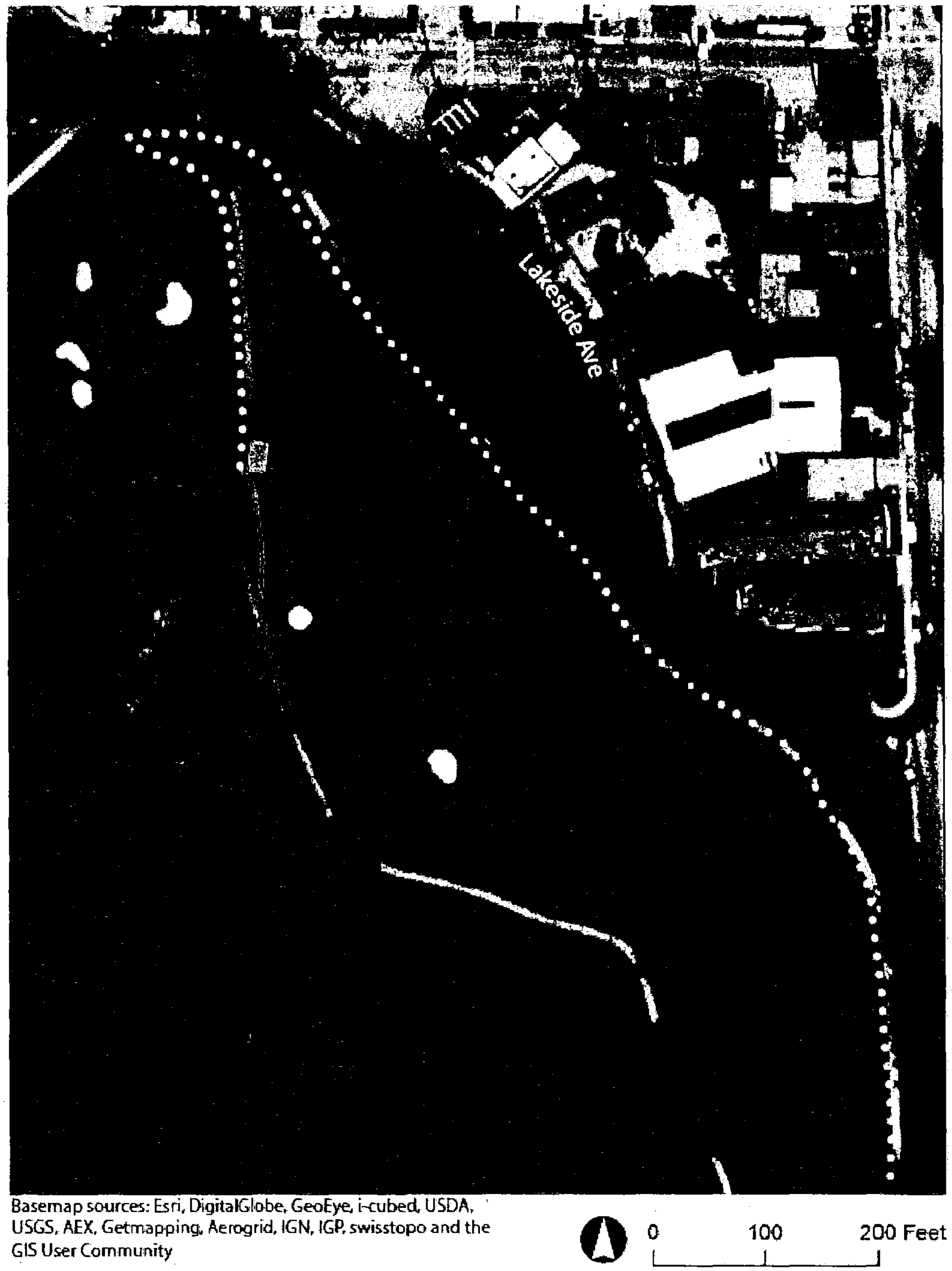


Figure 5. Detail of Proposed Project near HSP

Source: San Francisco Recreation and Park Department



○ ○ ○ Ingress/egress for heavy equipment

Temporary project impact areas during construction

Approximate location of heavy equipment staging during construction

New cart path

Figure 6. Detail of Proposed Golf Cart Path Realignments

Source: San Francisco Recreation and Park Department

B. PROJECT SETTING

Sharp Park is a public park, approximately 417 acres in size, located in the City of Pacifica in San Mateo County, that is owned and operated by the SFRPD. It is bisected from north to south by the PCH, and the proposed project site is located to the west of PCH. Sharp Park is bounded by the Pacific Ocean to the west. To the north and south, portions of Sharp Park are bordered by residential development. To the south and east, Sharp Park abuts portions of the GGNRA. Sharp Park contains an 18-hole golf course, an archery range, a clubhouse, a remediated former rifle range, a parking lot, and extensive natural areas including an approximately 27-acre wetland complex consisting of HSP, LS, a channel and culverts that connect HSP to LS, and adjacent wetlands.

C. COMPATIBILITY WITH EXISTING ZONING AND PLANS

	Applicable	*Not Applicable*
Discuss any variances, special authorizations, or changes proposed to the Planning Code or Zoning Map, if applicable.	☐	☒
Discuss any conflicts with any adopted plans and goals of the City or Region, if applicable.	☒	☐
Discuss any approvals and/or permits from City departments other than the Planning Department or the Department of Building Inspection, or from Regional, State, or Federal Agencies.	☒	☐

Plans and Policies

San Francisco Plans and Policies

San Francisco land use plans and policies are primarily applicable to projects within the jurisdictional boundaries of San Francisco, although in some cases they may apply to projects outside San Francisco. This information is relevant to the evaluation of impacts of the proposed project with respect to specific significance criteria under CEQA that require analysis of the compatibility of a proposed project with certain aspects of local land use plans and policies.

The SFRPD is guided by the San Francisco City Charter along with other applicable city codes, plans, and policies. These plans include the San Francisco General Plan, which sets forth the comprehensive, long-term land use policy for CCSF, and the San Francisco Sustainability Plan, which addresses the long-term sustainability of CCSF. The plans and policies applicable to the proposed project, as well as other relevant plans and policies, are discussed herein.

This section discusses the project's inconsistencies, if any, with applicable plans and policies that may result in physical environmental effects. If no inconsistencies are identified, the discussion lists the plans that were reviewed and states that no inconsistencies were identified.

Policy conflicts do not, in and of themselves, indicate a significant environmental effect within the meaning of CEQA, in that the intent of CEQA is to determine physical effects associated with a project. Many of the plans of CCSF and the other relevant jurisdictions contain policies that address multiple goals pertaining to different resource areas. To the extent that physical environmental impacts of a proposed project may result from conflicts with one of the goals related to a specific resource topic, such impacts are analyzed in this Initial Study in that respective topic section, such as Section E.7, Air Quality, and Section E.13, Biological Resources.

San Francisco General Plan

Although the General Plan was developed for lands within the jurisdictional boundaries of CCSF, its underlying goals apply to CCSF projects outside the boundaries of CCSF. The San Francisco General Plan provides general policies and objectives to guide land use decisions. The General Plan contains 10 elements (Commerce and Industry, Recreation and Open Space, Housing, Community Facilities, Urban Design, Environmental Protection, Transportation, Air Quality, Community Safety, and Arts) that set forth goals, policies, and objectives for the physical development of San Francisco. The compatibility of the proposed project with General Plan goals, policies, and objectives that do not relate to physical environmental issues will be considered by decision-makers as part of their decision whether to approve or disapprove the proposed project. No inconsistencies with the *San Francisco General Plan* were identified.

Proposition M – The Accountable Planning Initiative

In November 1986, the voters of San Francisco approved Proposition M, the Accountable Planning Initiative, which added Section 101.1 to the *Planning Code* to establish eight Priority Policies. These policies, and the subsection of Section E of this Initial Study addressing the environmental issues associated with the policies, are: (1) preservation and enhancement of neighborhood-serving retail uses; (2) protection of neighborhood character (Topic 1, Land Use and Land Use Planning, Question 1c); (3) preservation and enhancement of affordable housing (Topic 3, Population and Housing, Question 3b, with regard to housing supply and displacement issues); (4) discouragement of commuter automobiles (Topic 5, Transportation and Circulation, Questions 5a, 5b, and 5f); (5) protection of industrial and service land uses from commercial office development and enhancement of resident employment and business ownership (Topic 1, Land Use and Land Use Planning, Question 1c); (6) maximization of earthquake preparedness (Topic 14, Geology and Soils, Question 14a through 14d); (7) landmark and historic building preservation (Topic 4, Cultural Resources, Question 4a); and (8) protection of open space (Topic 9, Wind and Shadow, Questions 9a and 9b; and Topic 10, Recreation, Questions 10a and 10c).

Prior to issuing a permit for any project which requires an Initial Study under the CEQA, prior to issuing a permit for any demolition, conversion, or change of use, and prior to taking any action that requires a finding of consistency with the General Plan, the City is required to find that the proposed project or legislation would be consistent with the Priority Policies. As noted above, the consistency of the proposed project with the environmental topics associated with the Priority Policies is discussed in Section E, Evaluation of Environmental Effects, of this Initial Study, providing information for use in the approval for the proposed project.

No inconsistencies with the General Plan Priority Policies were identified.

1995/2006 Significant Natural Resource Areas Management Plans

On January 19, 1995, the San Francisco Recreation and Park Commission approved the first SNRAMP. While San Francisco is by and large a densely developed urban area, fragments of unique plant and animal habitats, known as Significant Natural Resource Areas ("Natural Areas"), have been preserved within the parks of San Francisco and Pacifica that are managed by the SFRPD. The SNRAMP was developed to preserve, restore, and enhance the remnant Natural Areas and to promote environmental stewardship of these areas.

The proposed project is consistent with the adopted 1995 SNRAMP as it conforms with three of the overall Program Objectives: 1) determine management needs for natural resources, particularly those identified by other agencies as rare, threatened or endangered; 2) consult and coordinate with other city departments, agencies and groups with special expertise for implementation strategies; and 3) implement measures designed to address immediate problems. The proposed project was created in consultation with the USFWS, USACE and CDFW to protect

CRLF and SFGS while also implementing measures to improve the safety of workers around the pumphouse.

The project is also consistent with the following 1995 SNRAMP's General Policies and Management Actions listed under Vegetation, Wildlife, and Water Resources: 1) vegetation, by promoting indigenous plant species around the new pond, enhancing riparian areas in HSP and the connecting channel and preserving habitat which supports wildlife; 2) wildlife, by consulting with agencies such as the USFWS, USACE, and CDFW on habitat enhancement for CRLF and SFGS; 3) water resources, by maintaining and improving the water quality of the connecting channel and HSP and protecting this riparian zone from sedimentation. As such, this project is consistent with the 1995 SNRAMP.

Over the course of several years, the SFRPD updated and expanded the level of detail in the 1995 SNRAMP, ultimately resulting in a new SNRAMP, with a final draft plan published in February 2006. The San Francisco Recreation and Park Commission approved the final draft plan for CEQA evaluation in August 2006. The proposed 2006 SNRAMP contains detailed information on the biology, geology, and trails within 32 Natural Areas, 31 in San Francisco and one (Sharp Park) in Pacifica. The proposed 2006 SNRAMP is currently undergoing environmental review. A draft Environmental Impact Report ("Draft EIR") was published on August 31, 2011, and the Planning Department is currently preparing responses to comments received on the Draft EIR.

Sustainability Plan for San Francisco

The Sustainability Plan for San Francisco was endorsed by the San Francisco Board of Supervisors in 1997. Although the Board has not committed CCSF to perform the actions addressed in the plan, the plan serves as a blueprint for sustainability, with many of its individual proposals requiring further development and public comment should they be proposed for implementation. The underlying goals of the plan are to maintain the physical resources and systems that support life in San Francisco and to create a social structure that will allow such maintenance. It is divided into 15 topic areas, 10 that address specific environmental issues (Air Quality; Biodiversity; Energy, Climate Change and Ozone Depletion; Food and Agriculture; Hazardous Materials; Human Health; Parks, Open Spaces and Streetscapes; Solid Waste; Transportation; and Water and Wastewater), and five that are broader in scope and cover many issues (Economy and Economic Development; Environmental Justice; Municipal Expenditures; Public Information and Education; and Risk Management). Each topic area in the plan has a set of indicators that are to be used over time to determine whether San Francisco is moving in a sustainable direction in that particular area. The Biodiversity section, which includes 39 specific actions, addresses the goals of increased ecological understanding, protection, and restoration of remnant natural ecosystems; increased habitat value in developed and naturalistic areas; and collection, organization, and development of historic information on habitat and biodiversity.

The Sustainability Plan for San Francisco was developed to address San Francisco's long-term environmental sustainability, and it includes many of the goals and objectives of the 1995 SNRAMP. No inconsistencies with the Sustainability Plan for San Francisco were identified.

Regional Plans and Policies

San Francisco Bay Basin (Region 2) Water Quality Control Plan

The San Francisco Bay Basin (Region 2) Water Quality Control Plan contains water quality regulations adopted by the SFBRWQCB. It has been approved by the California State Water Resources Control Board, the Office of Administrative Law, and the U.S. Environmental

Protection Agency (USEPA).[26] It also contains statewide regulations adopted by the California Water Resources Control Board and other state agencies that refer to activities regulated by the board. No inconsistencies with the San Francisco Bay Basin (Region 2) Water Quality Control Plan were identified.

If the preferred method for sediment and emergent vegetation removal involves pumping water from HSP to lower the water level, the SFRPD would seek ~~modification of the existing~~ Section 401 and NPDES permits to be issued by the SFBRWQCB, as required by the SFBRWQCB. No inconsistencies with the San Francisco Bay Basin (Region 2) Water Quality Control Plan were identified.

Other Regional Plans and Policies

The five principal regional planning agencies and their policy documents that guide planning in the nine-county Bay Area are the Plan Bay Area,[27] the Bay Area Air Quality Management District's (BAAQMD's) 2010 Clean Air Plan, the Metropolitan Transportation Commission's (MTC's) Regional Transportation Plan – Transportation 2035, the SFBRWQCB's San Francisco Basin Plan, and the San Francisco Bay Conservation and Development Commission's (BCDC's) San Francisco Bay Plan. Due to the scope and nature of the proposed project, there would be no anticipated conflicts with regional plans.

California Coastal Act

The California Coastal Act (CCA) applies to development occurring in the coastal zone. The act limits development in wetlands and coastal waters to certain types of projects (restoration projects, for example, are included among the list of permitted projects) and stipulates criteria under which such projects may be permitted. Under the CCC's regulations, an area may be classified as a wetland ("CCA-only wetland") if it meets one or more of the three parameters required that define wetlands under Section 404 of the FCWA: hydric soils, hydrophytic vegetation, or wetland hydrology. A portion of Sharp Park near the LS wetland complex is in the Coastal Zone under the CCC jurisdiction.[28] The majority of the project activities would take place entirely within the CCC jurisdiction and require a coastal development permit from the CCC. The final location of the proposed pond would be determined in consultation with the CCC.

The CCA includes specific policies that address issues such as public access and recreation, lower cost visitor accommodations, terrestrial and marine habitat protection, visual resources, landform alteration, agricultural lands, commercial fisheries, industrial uses, water quality, offshore oil and gas development, transportation, development design, power plants, ports, and public works. The policies of the CCA are the statutory standards that apply to planning and regulatory decisions made by the CCC and by local governments pursuant to the CCA. The CCA's policies are implemented in part through local coastal programs, which include local government land use plans, zoning codes, and other implementing plans and ordinances.

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[26] San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). *Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin.* Available online at: *http://www.waterboards.ca.gov/rwqcb2/basin_planning.shtml.* Accessed May 16, 2013.

[27] Scott Edmondson, San Francisco Planning Department. *Email to Kei Zushi, San Francisco Planning Department, ABAG projections 2009,* July 23, 2013. This email is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[28] Darryl Rance, California Coastal Commission (CCC). *Memorandum sent to John R. Bock, Tetra Tech, Boundary Determination No. 08-2011, Sharp Park Restoration Plan, San Mateo County,* May 31, 2011. This memorandum is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

No inconsistencies with the CCA were identified (see Section E.1, Land Use and Land Use Planning for more information).

CRLF Recovery Plan

The Recovery Plan for CRLF[29] approved by the USFWS notes that the objective of the Recovery Plan is to delist CRLF. The Recovery Plan further states that the strategy for recovery of CRLF will involve: 1) protecting existing populations by reducing threats; 2) restoring and creating habitat that will be protected and managed in perpetuity; 3) surveying and monitoring populations and conducting research on the biology of and threats to the subspecies; and 4) reestablishing populations of the subspecies within its historic range. No inconsistencies with the Recovery Plan for CLRF were identified.

City of Pacifica Plans and Policies

Although the SFRPD and the proposed project in Sharp Park are not subject to City of Pacifica land use ordinances, plans, and policies, the following discussion is presented for informational purposes.

City of Pacifica Local Coastal Land Use Plan

The City of Pacifica's Local Coastal Land Use Plan (LUP) serves as the land use plan for the City of Pacifica's coastal zone and was written in accordance with the policies of the CCA. The LUP was adopted in 1980, and is undergoing an update. The LUP includes 33 Coastal Act policies, most of which are applicable to particular General Plan elements. The policies cover such topics as access, facilities, recreation, habitat protection, scenic and visual qualities, and cultural resources. No inconsistencies with the LUP were identified.

The majority of the project activities would take place entirely within the CCC jurisdiction and require a coastal development permit from the CCC. The final location of the proposed pond would be determined in consultation with the CCC.

Neighborhood Notification

A "Notification of Project Receiving Environmental Review" was sent out on January 15, 2013, to the owners of properties within 300 feet of the Sharp Park boundaries and to occupants of properties adjacent to the project site, as well as to other interested parties. The Planning Department received several letters in response to the notice. Respondents requested to receive environmental review documents and/or expressed concerns regarding the proposed project, which included: (1) impacts to CRLF and SFGS; (2) impacts to other special-status species and wetland habitats; and 3) historic resource impacts. These issues are addressed in the appropriate topic areas in Section E, Evaluation of Environmental Effects.

[29] USFWS, Region 1. *Recovery Plan for the California Red-legged Frog, (Rana aurora draytonii)*. Approved May 28, 2002. Available online at: *http://www.amphibians.org/wp-content/uploads/2013/07/California-Red-legged-Frog-Recovery-Plan.pdf*. Accessed December 17, 2013.

D. SUMMARY OF ENVIRONMENTAL EFFECTS

The proposed project could potentially affect the environmental factor(s) checked below. The following pages present a more detailed checklist and discussion of each environmental topic.

☐ Land Use	☒ Air Quality	☐ Geology and Soils
☐ Aesthetics	☐ Wind and Shadow	☒ Hydrology and Water Quality
☐ Population and Housing	☐ Recreation	☐ Hazards/Hazardous Materials
☒ Cultural and Paleo. Resources	☐ Utilities and Service Systems	☐ Mineral/Energy Resources
☐ Transportation and Circulation	☐ Public Services	☐ Agricultural Resources
☐ Noise	☒ Biological Resources	☒ Mandatory Findings of Significance

This Initial Study examines the proposed project to identify potential effects on the environment. For each item on the Initial Study Checklist, the evaluation has considered the impacts of the proposed project both individually and cumulatively. All items on the Initial Study Checklist that have been checked "Less than Significant with Mitigation Incorporated," "Less than Significant Impact," "No Impact," or "Not Applicable" indicate that, upon evaluation, staff has determined that the proposed project could not have a significant adverse environmental effect relating to that issue. A discussion is included for those items checked "Less than Significant with Mitigation Incorporated" and "Less than Significant Impact" and for most items checked "No Impact" or "Not Applicable." For all of the items checked "No Impact" or "Not Applicable" without discussion, the conclusions regarding potential significant adverse environmental effects are based upon field observation, staff experience and expertise on similar projects, and/or standard reference material available within the Planning Department, such as the Department's Transportation Impact Analysis Guidelines for Environmental Review, or the California Natural Diversity Database (CNDDB) and maps, published by the CDFW. The environmental topics checked above have been determined to be "Less than Significant with Mitigation Incorporated."

E. EVALUATION OF ENVIRONMENTAL EFFECTS

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
1. LAND USE AND LAND USE PLANNING—Would the project:					
a) Physically divide an established community?	☐	☐	☐	☒	☐
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☒	☐	☐
c) Have a substantial impact upon the existing character of the vicinity?	☐	☐	☒	☐	☐

Impact LU-1: The proposed project would not physically divide an established community. (No Impact)

Implementation of the proposed project would occur entirely within the boundaries of Sharp Park (see Figure 3), which is an existing recreation facility that includes a golf course and open space. There is no existing established community within Sharp Park. Although the proposed construction of a perennial pond would result in the conversion of a portion of Sharp Park to open water wetland habitat for CRLF and SFGS, (see Figure 5), the proposed project would not include construction of any features that would divide Sharp Park or any existing community. None of the proposed project activities would alter the overall existing land use of the project site or vicinity, and the project site would remain as a public park, with a golf course and open space, upon completion of construction activities. Therefore, the proposed project would have no impact with respect to the physical division of an established community.

Impact LU-2: The proposed project would be consistent with the applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect. (Less than Significant)

Land use regulations applicable to the project include the CCSF General Plan and CCA. As discussed in Section C, Compatibility with Existing Zoning and Plans, the project would not conflict with the General Plan. In addition, the proposed project is not subject to the City of Pacifica or San Mateo County plans and policies.

In Section C, Compatibility with Existing Zoning and Plans, the CCA is discussed and the City of Pacifica Local Coastal LUP is addressed for informational purposes. The primary objective of the CCA is the protection of wetlands and other environmentally sensitive habitats, water quality, public access and recreation, low cost visitor facilities, and the scenic and visual qualities of coastal areas and the control of coastal erosion and other hazards.[30,31]

The proposed project would not restrict access to or within Sharp Park and would not affect low cost visitor facilities. As discussed in Section E.2, Aesthetics, none of the project elements would result in a significant impact to the visual quality of the nearby coastal areas. The proposed project would involve improvements to an existing pumphouse and habitat for CRLF and SFGS. The project would be subject to various mitigation measures to protect wetlands and other environmentally sensitive habits and water quality and minimize soil erosion and other hazards that could result from the proposed project (see Sections E.13, Biological Resources, E.14, Geology and Soils, E.15, Hydrology and Water Quality, and E.16, Hazards and Hazardous Materials, for more information).

A portion of Sharp Park near the LS wetland complex is in the Coastal Zone under the CCC jurisdiction.[32] The majority of the project activities would take place entirely within the CCC jurisdiction and require a coastal development permit from the CCC. The final location of the proposed pond would be determined in consultation with the CCC. Development within the coastal zone may not commence until a coastal development permit has been issued by the CCC.

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[30] CCC. *Program Overview*. Available online at: *http://www.coastal.ca.gov/whoweare.html*. Accessed July 19, 2013.

[31] CCC. *Laws, Regulations, and Legislative Information*. Available online at: *http://www.coastal.ca.gov/ccatc.html*. Accessed July 19, 2013.

[32] Darryl Rance, CCC. *Memorandum sent to John R. Bock, Tetra Tach, Boundary Determination No. 08-2011, Sharp Park Restoration Plan, San Mateo County*, May 31, 2011. This memorandum is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

Through its review of the coastal development permit, the CCC would ensure that the project would be consistent with the applicable provisions of the CCA.

In light of the above, the proposed project would be consistent with the San Francisco General Plan and CCA on balance, and therefore this impact is less than significant.

Impact LU-3: The proposed project would not have a substantial impact upon the existing character of the vicinity. (Less than Significant)

Sharp Park is an existing park, which includes a golf course and open space, including wetland habitat areas. It is bisected from north to south by PCH. To the north and south, portions of Sharp Park are bordered by residential development. Sharp Park is bounded by the Pacific Ocean to the west. The Mori Point GGNRA property borders the southwestern edge, and the Sweeney Ridge GGNRA property borders Sharp Park on the southeastern and eastern edges. The project site is primarily surrounded by open space and wetland habitat areas.

The proposed project would entail improvements to existing facilities and habitat areas within Sharp Park. The proposed improvements to the existing pumphouse and golf cart path realignment would be minor in scope, and would not alter the overall character of Sharp Park or its vicinity. The proposed project includes removal of emergent vegetation (cattails and bulrush) in HSP and the connecting channel to enhance habitat and establish native vegetation. This work would result in a reduction in the amount of vegetation in HSP and the connecting channel and could be noticeable to park visitors, but would not have a substantial impact on the existing character of Sharp Park. The proposed construction of a perennial pond would result in the conversion of a portion of Sharp Park to open water wetland habitat for CRLF and SFGS. The pond and associated wetland features would be aesthetically compatible with the existing character of the area. Project activities would not include construction of any features that would substantially affect the existing character of Sharp Park and its vicinity and Sharp Park would continue to be used as a park.

In light of the above, the proposed project would not result in any changes to the project site that could have a substantial impact on the character of Sharp Park or its vicinity, and this impact is less than significant.

Impact C-LU: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant land use impacts. (Less than Significant)

As of September 2013, there are no known past or present projects in the project vicinity that would interact with the proposed project to result in cumulative significant land use impacts. The Draft EIR prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP would not result in any significant land use impacts. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including land use impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[33] Thus, no cumulative impact to land use within the project site vicinity exists to which this project could potentially contribute.

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33 San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

Moreover, the proposed project would not divide any existing community, conflict with plans and policies established for protecting the environment, or affect the existing land use characteristics of Sharp Park or its surroundings. Therefore, the proposed project would not contribute to a cumulative impact on land use and land use planning, even if one existed.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
2. AESTHETICS—**Would the project:**					
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and other features of the built or natural environment which contribute to a scenic public setting?	☐	☐	☒	☐	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area or which would substantially impact other people or properties?	☐	☐	☐	☒	☐

A visual quality analysis is somewhat subjective and considers the proposed project in relation to the surrounding visual character, heights and building types of surrounding uses, the project's potential to obstruct public scenic views, and its potential to create light and glare. A proposed project would have a substantial effect on the visual landscape if it were to cause a substantial demonstrable adverse change to the aesthetic value of the project site or its surroundings.

The intensity of the impact depends, in part, on viewers and their sensitivity to changes to scenic resources at the project site and its surroundings. Residents, for example, are normally sensitive to changes in their surroundings, as are those recreating. However, roadway travelers might not be as sensitive because changes to the environment are only viewed for a short period of time.

Sharp Park is bordered by the Pacific Ocean to the west and bisected by PCH. LS, HSP, and most of the Sharp Park Golf Course are on the western side of PCH; an archery range, the remaining golf course holes, and extensive canyon are on the eastern side. Sanchez Creek originates in the Upper Canyon of Sharp Park and approximately bisects the park in an east-west direction. Sharp Park is surrounded by open spaces, including Mori Point and Sweeney Ridge. The vegetation of Sharp Park is dominated by non-native (eucalyptus) forest and a golf course, but also contains areas with wetlands and scrub vegetation. Views of the project site are limited to the seawall, golf course, and GGNRA properties.

The proposed project does not include outdoor or indoor lighting or other components that would create new sources of light or glare. In addition, nighttime construction lighting would not be required because construction would be conducted between 7:00 a.m. and 5:00 p.m. Therefore, the project would result in no impact with respect to light and glare, and Question 2d is not discussed further.

Impact AE-1: The proposed project would not have a substantial adverse effect on scenic views and vistas. (Less than Significant)

A project would have a significant effect on scenic vistas if it would substantially degrade important public view corridors or obstruct scenic views from public areas viewable by a substantial number of people. View corridors are defined by physical elements such as buildings and structures that direct lines of sight and control view directions available to the public. The project site is adjacent to a golf course and open space, and therefore, no particular view corridors exist at or near the project site. Scenic views and vistas in the project site vicinity are limited to the seawall, golf course, and GGNRA properties.

The proposed project includes construction of steps and a maintenance walkway and replacement of an existing retaining wall around the existing pumphouse at HSP. These proposed structures would be constructed at locations lower in elevation than the existing nearby trails or access roads. In addition, these changes to the pumphouse are insignificant in scale and character and would not obstruct or restrict existing scenic views. Therefore, the proposed improvements would generally be unnoticeable to park visitors following project completion. The realigned golf cart path would be constructed at grade level and would not obstruct or restrict any scenic vistas. The proposed construction of a perennial pond would result in the conversion of a portion of Sharp Park to open water wetland habitat for CRLF and SFGS. The pond would be aesthetically compatible with the existing character of the areas and would not result in degradation of scenic views of the areas.

In summary, none of the proposed structures or other project improvements would substantially change existing scenic views and vistas. In light of the above, the proposed project's impact with respect to scenic views and vistas is less than significant.

Impact AE-2: The proposed project would not substantially damage any scenic resources. (Less than Significant)

Scenic resources are the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features.) Changes to specific scenic resources of concern, such as vegetation, are described below. An existing access road located on top of the seawall, through which the primary project access would be provided, is not a designated scenic roadway.

While the visual setting of the project area would be temporarily altered by the presence of construction equipment such as a backhoe, Aquamog, long-arm excavator, and trucks, construction-related impacts would be short term and temporary and would not result in long-term adverse impacts to the scenic resources of the project area or Sharp Park as a whole.

Given the minor scope of the proposed project, scenic resources would not be substantially affected by the proposed project. The proposed changes to the pumphouse and golf cart path would be virtually unnoticeable to those recreating on publicly accessible areas including the seawall, Mori Point, and the golf course. Changes to HSP and the connecting channel resulting from the emergent vegetation (cattails and bulrush) removal would include diminished vegetation cover and may be noticeable to visitors. Over time, the progression of natural processes would reduce these impacts, and given the relatively minor scale of the vegetation removal work, this would not result in a significant impact to scenic resources. The proposed pond would blend in with the surrounding areas which are characterized by open space, shrubs, and wetland features.

In light of the above, the proposed project's impact to scenic resources is less than significant.

Impact AE-3: The proposed project would result in a change to the existing character of the project site, but this change would not degrade the visual character or quality of the site and its surroundings. (Less than Significant)

During the proposed project construction, equipment such as a backhoe, Aquamog, long-arm excavator, and trucks would be visible. The presence of construction equipment and construction activities would temporarily detract from the overall visual quality of the area. Less visible equipment would also be part of project construction and include, for example, workers weeding and constructing the proposed structures. Construction is anticipated to occur for approximately 60 days over 18 months in the appropriate construction window in accordance with the Biological Opinion. While the equipment and project activities would temporarily detract from the overall visual quality of the areas, the equipment and these types of activities are temporary and not considered completely out of place or new to Sharp Park because maintenance activities similar to those involved in the proposed project have been conducted on a regular basis. Therefore, there would be less-than-significant impacts on the visual character or quality of the area from the proposed construction.

The proposed project includes construction of steps and a maintenance walkway and replacement of an existing retaining wall around the pumphouse at HSP. These changes to the pumphouse would not constitute a substantial change in scale and character of the pumphouse. The proposed construction of a perennial pond would result in the conversion of a portion of Sharp Park to open water wetland habitat for CRLF and SFGS. The pond and associated wetland features would be aesthetically compatible with the existing character of the area and would not result in degradation of the visual character or quality of the areas.

In summary, although the project would result in small changes to the existing character of the project site, the project would not degrade the visual character or quality of the site and its surroundings. Therefore, this impact is less than significant.

Impact C-AE: The proposed project, in combination with past, present, and reasonably foreseeable future development in the site vicinity, would not make a considerable contribution to any cumulative significant aesthetics impacts. (Less than Significant)

The geographic context for the analysis of visual resources consists of Sharp Park and the immediate surroundings. As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in cumulative significant aesthetics impacts. The Draft EIR prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP would not result in a significant impact with respect to aesthetics. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including aesthetics impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[34] Thus, no cumulative aesthetics impact within the project vicinity exists to which this project could potentially contribute.

The proposed project would not substantially affect the visual character or quality of Sharp Park or its surroundings. The proposed project would not substantially damage any scenic resources. Therefore, the proposed project would not contribute to a cumulative impact on aesthetics.

[34] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
3. POPULATION AND HOUSING— Would the project:					
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐	☐
b) Displace substantial numbers of existing housing units or create demand for additional housing, necessitating the construction of replacement housing?	☐	☐	☐	☒	☐
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☐	☒

The proposed project involves improvements to existing facilities and creation of habitat for CRLF and SFGS. It would not displace any residential uses, thus Question 3c is not applicable.

Impact PH-1: The proposed project would not induce population growth on the project site or in its vicinity, either directly or indirectly. (Less than Significant)

The proposed project would not entail construction of new residences or businesses, and therefore would not result in any direct impacts related to growth inducement. Workers for the proposed project include up to three to ten individuals, including SFRPD employees and contractors. The proposed project would not be likely to attract new employees to San Francisco because the project only involves minor construction work, which typically does not provide wages high enough to induce relocation. Even if all of these individuals were to move to the San Francisco Bay Area for this project, the increase in the population would be considered insignificant compared to the overall population of the San Francisco Bay Area. Therefore, the project would not induce substantial population growth or create significant demand for additional housing, and this impact is less than significant.

Impact PH-2: The proposed project would not displace existing housing units, or substantial numbers of people, or create demand for replacement housing. (No Impact)

The proposed project would not result in the displacement of any housing units or residents. Therefore, the proposed project would not create demand for replacement housing and no impact with respect to the displacement of housing units or people would result from the proposed project.

Impact C-PH: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant population and housing impacts. (Less than Significant)

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in cumulative significant population or housing impacts. The Initial Study prepared for the proposed 2006 SNRAMP concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to population or housing. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including population impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[35] Thus, no cumulative impact to population or housing within the project vicinity exists to which this project could potentially contribute.

The proposed project would not induce any population growth, nor have significant physical environmental effects on population or housing demand. Therefore, the proposed project would not contribute to a cumulative impact on population and housing, even if one existed.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
4. CULTURAL AND PALEONTOLOGICAL RESOURCES—Would the project:					
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5, including those resources listed in Article 10 or Article 11 of the San Francisco *Planning Code*?	☐	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐	☐

Historic Resources

As part of the analysis conducted to prepare the Draft EIR for the proposed 2006 SNRAMP, an historical resources evaluation (HRE) of the Sharp Park Golf Course and an Historic Resource Evaluation Response (HRER) for Sharp Park were completed.[36,37] In addition, an HRER has been

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[35] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: http://www.sf-planning.org/index.aspx?page=3447. Accessed December 17, 2013.

[36] Tetra Tech, Inc. *Historical Resources Evaluation Report for the Sharp Park Golf Course, Part of the Natural Areas, City and County of San Francisco, Pacifica, San Mateo County*, January 2011. This report is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

prepared by the Planning Department for the proposed project.[38] Sharp Park is not listed on the state or national registries. The property is considered a "Category A" (Known Historic Resource) property for the purposes of the Planning Department's CEQA review based upon the previous reviews cited above.

Under CEQA, a property qualifies as a historic resource if it is "listed in, or determined to be eligible for listing in, the California Register of Historical Resources." To be a historical resource for the purpose of CEQA, a property must not only be shown to be significant under the California Register of Historical Resources criteria, but it must also retain historic integrity.[39]

The HRER prepared for this project found that Sharp Park appears eligible for listing on the California Register as a historic landscape for its significance under Criteria 1 (Events) and 3 (Architecture). The golf course's development is associated with the broader events of the golden age of golf in the U.S. and California. The course is also an important example of a seaside golf course designed by a master landscape architect, Alister Mackenzie.

The HRER for the proposed project states that the character-defining features of the property include:

- The original features and design of the clubhouse;
- The original features and design of the permanent maintenance building; and
- The original features and design of the golf course, including the 12 original holes (current holes 1, 2, 3, 8, 9, 10, 11, 13, 14, 15, 17, and 18), the original landscape features, and the cypress tree plantings that line the fairways.

<u>Archeological Resources</u>

As part of the analysis conducted to prepare the Draft EIR for the proposed 2006 SNRAMP, records searches were completed in June and October 2008 from the California Historical Resources Information System's Northwest Information Center (NWIC) at Sonoma State University (File Nos. 07-1792 and 08-0414).

Impact CP-1: The proposed project would not result in a substantial adverse change in the significance of historical architectural resources, including the Sharp Park historic landscape. (Less than Significant)

The HRER prepared for this project concluded that the proposed project would not result in any significant impacts to historic resources, and is summarized below. Furthermore, the work would comply with the Secretary of the Interior Standards for the Treatment of Historic Properties and the Guidelines for Rehabilitating Cultural Landscapes.

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37 Shelley Caltagirone, San Francisco Planning Department. *Historic Resource Evaluation Response (HRER), Significant Natural Resource Areas Management Plan: Sharp Park Golf Course, Pacifica,* February 15, 2011. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

38 Shelley Caltagirone, San Francisco Planning Department. *Historic Resource Evaluation Response (HRER), Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project,* February 12, 2013. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

39 "Integrity" is defined as "the authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during the property's period of significance." Historic integrity enables a property to illustrate significant aspects of its past.

The proposed improvements to the HSP pumphouse would not significantly alter the overall form of the pumphouse structure or affect the historic setting or character of Sharp Park. The existing pumphouse is not considered to be an historic character-defining feature. In addition, the proposed changes would maintain the existing character and the setting of hole number 12, which is an altered but contributing feature of the historic landscape.

The proposed perennial pond would be located to the southeast of HSP, along the southern edge of Sharp Park. This periphery location would ensure the preservation of the Sharp Park setting. The proposed pond would be in keeping with the existing character of the wetland area in this location. While the proposed project would involve the removal of emergent vegetation in the wetland complex areas, it would not result in disturbance to any historically significant plantings (i.e., the cypress tree plantings that line the fairways).

The existing circulation pattern of the course would remain essentially unchanged, except that one segment of an existing golf cart path, which is not a character-defining feature of the site, would be slightly re-routed near the tee box for hole number 15. Hole number 15 is a contributing feature of the historic landscape. However, this change would not significantly alter the character of a historic fairway or hole as it would only shift the path 5 to 10 feet east of its current location, essentially maintaining the existing route. In addition, this change would not result in removal of any historically significant material.

In light of the above, the proposed project would not result in a significant impact to historical resources.

Impact CP-2: The proposed project ~~w~~could result in damage to, or destruction of, as-yet unknown archeological remains, should such remains ~~exist beneath the~~ be present within soils affected by activities resulting from the proposed project ~~site~~. (Less than Significant with Mitigation)

When determining the potential for encountering archeological resources, relevant factors include the location, depth, and the extent of excavation proposed, as well as any recorded information on known resources in the area. An Environmental Planning Preliminary Archeological Review (PAR): Checklist has been prepared by the Planning Department's archeologist for the proposed project and is summarized below.

The PAR Checklist notes that there is no previous archeological documentation for the project site and that it is unknown to what extent grading or re-contouring has historically occurred within the project area or to what extent the current landscape is the result of human modifications as no geological or geotechnical studies were available for the review of this project.

The Sharp Park area is sensitive for prehistoric resources. A number of prehistoric shell midden sites (CA-SMA-162, CA-SMA-268, S-31602 and C-116) have been recorded/documented. CA-SMA-268 is a prehistoric shell midden settlement site that contained artifactual material, including obsidian projectile points, a groundstone pestle, chert debitage, and fire-cracked rock along Calera Creek to the southeast of the project site. There is a limestone quarry site near the coastal shoreline southwest of HSP. The limestone quarry was quarried by Mission neophytes working at the Mission Dolores assistencia of San Pedro y San Pablo to the east for whitewash and plaster for adobe structures at the assistencia, Mission Dolores and the Presidio de San Francisco. Ethnohistorically, the Aramai village of Timigtac is thought to have been located at Mori Point. CA-SFR-162, a prehistoric shell midden deposit is located just to the southwest of HSP. CA-SFR-162 may be a redeposited shell midden deposit. Finally, to the west of the proposed project site is a recorded historical archeological feature associated with the Sharp Park Temporary Detention Station/Sharp Park State Relief Camp (1930s-1946).

~~Based on the above, the PAR Checklist concluded that the proposed project could have significant effects on archeological resources given the location of the project and the depth of excavation resulting from the project, which would be a maximum of five feet below ground surface (bgs), and that~~ Although the proposed project is expected to result in shallow sub-grade effects (three feet below ground surface (bgs) within wetland deposits and five feet bgs within non-wetland deposits) the project's ecological setting and the general sensitivity of the project vicinity for prehistoric sites create a reasonable concern that otherwise undocumented prehistoric deposits could be affected by the proposed project. Although the shallowness of the potential project effects renders the potential to affect prehistoric deposits low to moderate, mitigation of this potential by accidental discovery or archeological consultant monitoring requirements may not be sufficient if any prehistoric shell midden deposit has been stained as a result of organic or iron-sulfide processes. ~~i~~Implementation of **Mitigation Measure M-CP-2** requiring archeological testing below would reduce the potential ~~impacts~~ of the proposed project to adversely affect archeological resources to a less-than-significant level.

Mitigation Measure M-CP-2 - ~~Accidental Discovery~~ Archeological Testing

~~The following mitigation measure is required to avoid any potential adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in *CEQA Guidelines* Section 15064.5(a)(c). The project sponsor shall distribute the Planning Department archeological resource "ALERT" sheet to the project prime contractor; or to any project subcontractor (including demolition, excavation, grading, etc. firms) involved in soils disturbing activities within the project site. Prior to any soils disturbing activities being undertaken each contractor is responsible for ensuring that the "ALERT" sheet is circulated to all field personnel including, machine operators, field crew, supervisory personnel, etc. The project sponsor shall provide the Environmental Review Officer (ERO) with a signed affidavit from the responsible parties (prime contractor and subcontractor(s)) to the ERO confirming that all field personnel have received copies of the Alert Sheet.~~

~~Should any indication of an archeological resource be encountered during any soils disturbing activity of the project, the project Head Foreman and/or project sponsor shall immediately notify the ERO and shall immediately suspend any soils disturbing activities in the vicinity of the discovery until the ERO has determined what additional measures should be undertaken.~~

~~If the ERO determines that an archeological resource may be present within the project site, the project sponsor shall retain the services of an archaeological consultant from the pool of qualified archaeological consultants maintained by the Planning Department archaeologist. The archeological consultant shall advise the ERO as to whether the discovery is an archeological resource, retains sufficient integrity, and is of potential scientific/historical/cultural significance. If an archeological resource is present, the archeological consultant shall identify and evaluate the archeological resource. The archeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by the project sponsor.~~

~~Measures might include: preservation in situ of the archeological resource; an archaeological monitoring program; or an archeological testing program. If an archeological monitoring program or archeological testing program is required, it shall be consistent with the Environmental Planning (EP) division guidelines for such programs. The ERO may also~~

require that the project sponsor immediately implement a site security program if the archeological resource is at risk from vandalism, looting, or other damaging actions.

The project archeological consultant shall submit a Final Archeological Resources Report (FARR) to the ERO that evaluates the historical significance of any discovered archeological resource and describes the archeological and historical research methods employed in the archeological monitoring/data recovery program(s) undertaken. Information that may put at risk any archeological resource shall be provided in a separate removable insert within the final report.

Copies of the Draft FARR shall be sent to the ERO for review and approval. Once approved by the ERO, copies of the FARR shall be distributed as follows: California Archaeological Site Survey Northwest Information Center (NWIC) shall receive one (1) copy and the ERO shall receive a copy of the transmittal of the FARR to the NWIC. The EP division of the Planning Department shall receive one bound copy, one unbound copy and one unlocked, searchable PDF copy on CD of the FARR along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. In instances of high public interest or interpretive value, the ERO may require a different final report content, format, and distribution than that presented above.

Based on a reasonable presumption that archeological resources may be present within the project site, the following measures shall be undertaken to avoid any potentially significant adverse effect from the proposed project on buried or submerged historical resources. The project sponsor shall retain the services of an archaeological consultant from the rotational Department Qualified Archaeological Consultants List (QACL) maintained by the Planning Department archaeologist. The project sponsor shall contact the Department archeologist to obtain the names and contact information for the next three archeological consultants on the QACL. The archeological consultant shall undertake an archeological testing program as specified herein. In addition, the consultant shall be available to conduct an archeological monitoring and/or data recovery program if required pursuant to this measure. The archeological consultant's work shall be conducted in accordance with this measure at the direction of the Environmental Review Officer (ERO). All plans and reports prepared by the consultant as specified herein shall be submitted first and directly to the ERO for review and comment, and shall be considered draft reports subject to revision until final approval by the ERO. Archeological monitoring and/or data recovery programs required by this measure could suspend construction of the project for up to a maximum of four weeks. At the direction of the ERO, the suspension of construction can be extended beyond four weeks only if such a suspension is the only feasible means to reduce to a less than significant level potential effects on a significant archeological resource as defined in CEQA Guidelines Sect. 15064.5 (a)(c).

Consultation with Descendant Communities: On discovery of an archeological site[40] associated with descendant Native Americans, the Overseas Chinese, or other descendant group an appropriate representative[41] of the descendant group and the ERO shall be contacted. The representative of the descendant group shall be given the opportunity to monitor

[40] By the term "archeological site" is intended here to minimally included any archeological deposit, feature, burial, or evidence of burial.

[41] An "appropriate representative" of the descendant group is here defined to mean, in the case of Native Americans, any individual listed in the current Native American Contact List for the City and County of San Francisco maintained by the California Native American Heritage Commission and in the case of the Overseas Chinese, the Chinese Historical Society of America. An appropriate representative of other descendant groups should be determined in consultation with the Department archeologist.

archeological field investigations of the site and to consult with ERO regarding appropriate archeological treatment of the site, of recovered data from the site, and, if applicable, any interpretative treatment of the associated archeological site. A copy of the Final Archaeological Resources Report shall be provided to the representative of the descendant group.

Archeological Testing Program. The archeological consultant shall prepare and submit to the ERO for review and approval an archeological testing plan (ATP). The archeological testing program shall be conducted in accordance with the approved ATP. The ATP shall identify the property types of the expected archeological resource(s) that potentially could be adversely affected by the proposed project, the testing method to be used, and the locations recommended for testing. The purpose of the archeological testing program will be to determine to the extent possible the presence or absence of archeological resources and to identify and to evaluate whether any archeological resource encountered on the site constitutes an historical resource under CEQA.

At the completion of the archeological testing program, the archeological consultant shall submit a written report of the findings to the ERO. If based on the archeological testing program the archeological consultant finds that significant archeological resources may be present, the ERO in consultation with the archeological consultant shall determine if additional measures are warranted. Additional measures that may be undertaken include additional archeological testing, archeological monitoring, and/or an archeological data recovery program. No archeological data recovery shall be undertaken without the prior approval of the ERO or the Planning Department archeologist. If the ERO determines that a significant archeological resource is present and that the resource could be adversely affected by the proposed project, at the discretion of the project sponsor either:

A) The proposed project shall be re-designed so as to avoid any adverse effect on the significant archeological resource; or

B) A data recovery program shall be implemented, unless the ERO determines that the archeological resource is of greater interpretive than research significance and that interpretive use of the resource is feasible.

Archeological Monitoring Program. If the ERO in consultation with the archeological consultant determines that an archeological monitoring program shall be implemented the archeological monitoring program shall minimally include the following provisions:

- The archeological consultant, project sponsor, and ERO shall meet and consult on the scope of the AMP reasonably prior to any project-related soils disturbing activities commencing. The ERO in consultation with the archeological consultant shall determine what project activities shall be archeologically monitored. In most cases, any soils- disturbing activities, such as demolition, foundation removal, excavation, grading, utilities installation, foundation work, driving of piles (foundation, shoring, etc.), site remediation, etc., shall require archeological monitoring because of the risk these activities pose to potential archaeological resources and to their depositional context;
- The archeological consultant shall advise all project contractors to be on the alert for evidence of the presence of the expected resource(s), of how to identify the evidence of

the expected resource(s), and of the appropriate protocol in the event of apparent discovery of an archeological resource;

- The archeological monitor(s) shall be present on the project site according to a schedule agreed upon by the archeological consultant and the ERO until the ERO has, in consultation with project archeological consultant, determined that project construction activities could have no effects on significant archeological deposits;
- The archeological monitor shall record and be authorized to collect soil samples and artifactual/ecofactual material as warranted for analysis;
- If an intact archeological deposit is encountered, all soils-disturbing activities in the vicinity of the deposit shall cease. The archeological monitor shall be empowered to temporarily redirect demolition/excavation/pile driving/construction activities and equipment until the deposit is evaluated. If in the case of pile driving activity (foundation, shoring, etc.), the archeological monitor has cause to believe that the pile driving activity may affect an archeological resource, the pile driving activity shall be terminated until an appropriate evaluation of the resource has been made in consultation with the ERO. The archeological consultant shall immediately notify the ERO of the encountered archeological deposit. The archeological consultant shall make a reasonable effort to assess the identity, integrity, and significance of the encountered archeological deposit, and present the findings of this assessment to the ERO.

Whether or not significant archeological resources are encountered, the archeological consultant shall submit a written report of the findings of the monitoring program to the ERO.

Archeological Data Recovery Program. The archeological data recovery program shall be conducted in accord with an archeological data recovery plan (ADRP). The archeological consultant, project sponsor, and ERO shall meet and consult on the scope of the ADRP prior to preparation of a draft ADRP. The archeological consultant shall submit a draft ADRP to the ERO. The ADRP shall identify how the proposed data recovery program will preserve the significant information the archeological resource is expected to contain. That is, the ADRP will identify what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. Data recovery, in general, should be limited to the portions of the historical property that could be adversely affected by the proposed project. Destructive data recovery methods shall not be applied to portions of the archeological resources if nondestructive methods are practical.

The scope of the ADRP shall include the following elements:

- *Field Methods and Procedures.* Descriptions of proposed field strategies, procedures, and operations.
- *Cataloguing and Laboratory Analysis.* Description of selected cataloguing system and artifact analysis procedures.
- *Discard and Deaccession Policy.* Description of and rationale for field and post-field discard and deaccession policies.
- *Interpretive Program.* Consideration of an on-site/off-site public interpretive program during the course of the archeological data recovery program.

- *Security Measures.* Recommended security measures to protect the archeological resource from vandalism, looting, and non-intentionally damaging activities.
- *Final Report.* Description of proposed report format and distribution of results.
- *Curation.* Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

Human Remains and Associated or Unassociated Funerary Objects. The treatment of human remains and of associated or unassociated funerary objects discovered during any soils disturbing activity shall comply with applicable State and Federal laws. This shall include immediate notification of the Coroner of the City and County of San Francisco and in the event of the Coroner's determination that the human remains are Native American remains, notification of the California State Native American Heritage Commission (NAHC) who shall appoint a Most Likely Descendant (MLD) (Pub. Res. Code Sec. 5097.98). The archeological consultant, project sponsor, and MLD shall make all reasonable efforts to develop an agreement for the treatment of, with appropriate dignity, human remains and associated or unassociated funerary objects (CEQA Guidelines. Sec. 15064.5(d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects.

Final Archeological Resources Report. The archeological consultant shall submit a Draft Final Archeological Resources Report (FARR) to the ERO that evaluates the historical significance of any discovered archeological resource and describes the archeological and historical research methods employed in the archeological testing/monitoring/data recovery program(s) undertaken. Information that may put at risk any archeological resource shall be provided in a separate removable insert within the final report.

Once approved by the ERO, copies of the FARR shall be distributed as follows: California Archaeological Site Survey Northwest Information Center (NWIC) shall receive one (1) copy and the ERO shall receive a copy of the transmittal of the FARR to the NWIC. The Environmental Planning division of the Planning Department shall receive one bound, one unbound and one unlocked, searchable PDF copy on CD of the FARR along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. In instances of high public interest in or the high interpretive value of the resource, the ERO may require a different final report content, format, and distribution than that presented above.

Impact CP-3: The proposed project would have the potential to destroy paleontological resources or other unique geological features, should such remains exist beneath the project site. (Less than Significant with Mitigation)

The proposed project would involve excavation of up to five feet bgs. It is possible that this depth may reach Pleistocene deposits that may contain paleontological resources or a unique geological formation; therefore, it is anticipated that excavation associated with the proposed project could encounter paleontological resources, potentially resulting in a significant impact. With the implementation of **Mitigation Measure M-CP-3**, as outlined below, the proposed project's impacts on paleontological resources would be less than significant.

Mitigation Measure M-CP-3 - Paleontological Training Program and Alert Sheet

To reduce the potential for the proposed project to result in a significant impact on paleontological resources, the SFRPD shall arrange for a paleontological training by a qualified paleontologist regarding the potential for such resources to exist in the project site and how to identify such resources. The training shall also include a review of penalties for looting and disturbance of these resources. An alert sheet shall be issued and shall include the following:

1. A discussion of the potential to encounter paleontological resources;

2. Instructions for reporting observed looting of a paleontological resource; and instruct that if a paleontological deposit is encountered within a project area, all soil-disturbing activities in the vicinity of the deposit shall cease and the ERO shall be notified immediately.

3. If an unanticipated paleontological resource is encountered during project activities, all project activities shall stop, and a professional paleontologist shall be hired to assess the potential paleontological resource and its significance. The findings shall be presented to the ERO, who shall determine the additional steps to be taken before work in the vicinity of the deposit is authorized to continue.

Impact CP-4: The proposed project could substantially disturb human remains, should such remains exist beneath the project site. (Less than Significant with Mitigation)

There is a possibility that intact burials exist within the project area footprint. Therefore, the proposed project has the potential to result in significant impacts to human remains. With the implementation of **Mitigation Measure M-CP-4** as outlined below, the proposed project's impacts to human remains would be less than significant.

Mitigation Measure M-CP-4 - Human Remains, Associated or Unassociated Funerary Objects

The treatment of human remains and of associated or unassociated funerary objects discovered during any ground-disturbing activity shall comply with applicable State and Federal Laws, including immediate notification to the San Mateo County Coroner and in the event of the Coroner's determination that the human remains are Native American remains, notification to the Native American Heritage Commission (NAHC) who shall appoint a Most Likely Descendant (MLD) (Pub. Res. Code Sec. 5097.98). The project archaeological consultant, SFRPD, and MLD shall make all reasonable efforts to develop an agreement for the treatment of, with appropriate dignity, human remains and associated or unassociated funerary objects (CEQA Guidelines. Sec. 15064.5(d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, curation, possession, and final disposition of the human remains and associated or unassociated funerary objects.

Impact C-CP: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant impacts to cultural or paleontological resources. (Less than Significant with Mitigation)

Historic Resources

Potential cumulative impacts to historic resources caused by the proposed project and the proposed 2006 SNRAMP were evaluated in the HRER[42] prepared for this project.

At the time of writing, the Final EIR for the proposed 2006 SNRAMP has not been prepared. However, the Draft EIR for the proposed 2006 SNRAMP identified several significant historical resource impacts to the golf course at Sharp Park, which include the following:

- The closure of hole number 12 would cause a significant impact to the historic resource as the work would eliminate an original hole and fairway on the west side of the course. Its removal would significantly alter the original golf course design and boundaries.
- Modifying approximately 13 acres of the golf course to create upland habitat along the east side of the lagoon would require slightly shortening or narrowing hole numbers 10 and 13. This alteration would significantly alter the character of these original fairways. Therefore, the work would cause a significant impact to the historic resource.
- The recreation analysis of the Draft EIR prepared for the proposed 2006 SNRAMP proposes a mitigation measure (Option 1) that would create a new hole on the east side of PCH as a replacement for hole number 12. This would result in a total of 13 holes on the west side of the highway and five holes on the east side. This arrangement would not maintain the historic balance of holes on either side of the highway and would change the historic boundaries of the course. This would cause a significant impact to the original design of the historic resource.
- The recreation analysis of the Draft EIR prepared for the proposed 2006 SNRAMP proposes a mitigation measure (Option 2) that would create a new hole on the west side of PCH as a replacement for hole number 12. While the mitigation measure would change the layout of the holes, this alternative mitigation measure would restore some of the elements that Alister Mackenzie had implemented in his original design by placing the new holes in areas of the course where holes were historically placed. The proposed holes would also be in keeping with the historic boundaries of the golf course. Because of the restorative aspect of the work, this mitigation would cause a less-than-significant impact to the resource.

In summary, the proposed 2006 SNRAMP project would result in significant impacts to several character-defining features of the golf course, including hole numbers 10, 12, and 13. Because the proposed project would not cause any substantial adverse changes to the historic resource, the project would not contribute considerably to any cumulative impacts to historic resources in combination with the proposed 2006 SNRAMP project. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including historic resources impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[43]

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42 Shelley Caltagirone, San Francisco Planning Department. *Historic Resource Evaluation Response (HRER), Sharp Park Safety, Infrastructure Improvement, and Habitat Enhancement Project*, February 12, 2013. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

43 San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: http://www.sf-planning.org/index.aspx?page=3447. Accessed December 17, 2013.

Archeological and Other Cultural Resources

The Draft EIR for the proposed 2006 SNRAMP concluded that with the implementation of mitigation measures the proposed 2006 SNRAMP would not result in any significant impacts to archeological and paleontological resources and human remains that could be present within Sharp Park. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including archeological resources and other cultural resources impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[44]

As discussed above, the proposed project would have the potential to result in significant impacts, however, **Mitigation Measures M-CP-2, M-CP-3,** and **M-CP-4** would reduce the project's potential impact to archaeological resources, paleontological resources, and human remains to a less-than-significant level. Therefore, the proposed project would not contribute considerably to a cumulative impact associated with archeological resources, paleontological resources, or human remains.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
5. TRANSPORTATION AND CIRCULATION—Would the project:					
a) Cause an increase in traffic which 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)?	☐	☐	☒	☐	☐
b) Exceed, either individually or cumulatively, a level of service 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)?	☐	☐	☒	☐	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels, obstructions to flight, or a change in location, that results in substantial safety risks?	☐	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses?	☐	☐	☐	☒	☐

[44] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
e) Result in inadequate emergency access?	☐	☐	☐	☒	☐
f) Result in inadequate parking capacity that could not be accommodated by alternative solutions?	☐	☐	☒	☐	☐
g) 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 which cannot be accommodated by existing or proposed transit capacity or alternative travel modes?	☐	☐	☒	☐	☐

Sharp Park is bisected from north to south by PCH (see Figure 1). Public streets located near the project site include: Francisco Boulevard; Bradford Way; Fairway Drive; an existing access road located on top of the seawall; Clarendon Road; Lakeside Avenue; and Laguna Way. The main project access would be provided via the existing access road located on top of the seawall.

The project site is not located near a public or private airport or within an airport land use plan area. Therefore, Question 5c would not apply to the proposed project.

Impact TR-1: The proposed project would not conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation, nor would the proposed project conflict with an applicable congestion management program, nor would it exceed any applicable level of service standards and travel demand measures. (Less than Significant)

The proposed project would not include any activities that would conflict with any applicable transportation or congestion management plan, ordinance, or policy. While vehicles would be used during project construction, the frequency of trips by these vehicles would be minimal. Workers for the proposed project would include approximately three to ten individuals, including SFRPD employees or contractors. The increase in the traffic volume resulting from the proposed project, which would be implemented over 18 months, would be negligible compared to the overall traffic volume in the project site vicinity or the San Francisco Bay Area. With the exception of the realigned golf cart path, the majority of the proposed improvements would be conducted in publicly inaccessible areas. Therefore, it is not anticipated that the proposed improvements would attract substantially more visitors. As such, the project would not be expected to generate a substantial number of additional visitors to the project site.

The proposed project would not be expected to generate substantially more traffic over existing levels following project construction. As a result, the proposed project would not increase traffic such that the project would result in exceedance of any level of service standard, and therefore this impact is less than significant.

Impact TR-2: The proposed project would not increase hazards as a result of a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses. (No Impact)

The proposed project does not include any design features that would substantially increase traffic hazards (e.g., creating a new sharp curve or dangerous intersections), and would not include any incompatible uses, as discussed above in Section E.1, Land Use and Land Use Planning. The proposed project does not include any changes to existing roadways, and involves minor realignment of an existing golf cart path. The realigned path would be substantially similar to the existing path in terms of width, shape, and material. Therefore, there would be no impacts associated with increased traffic hazards resulting from the proposed project.

Impact TR-3: The proposed project would not result in inadequate emergency access. (No Impact)

The proposed project would be implemented within the existing boundaries of Sharp Park, and would not result in any changes in access to adjacent facilities or residences or to Sharp Park itself. Therefore, no impact on emergency access would result from the proposed project.

Impact TR-4: The proposed project would not result in inadequate parking capacity that could not be accommodated by alternative solutions (Less than Significant)

The proposed project would not involve establishment of new land uses or a change in land use that would require additional parking spaces. As mentioned in Impact TR-1, it is not anticipated that the proposed improvements would attract substantially more visitors. As such, the project would not be expected to generate substantial parking demand and this impact is less than significant.

Impact TR-5: The proposed project would not conflict with adopted policies, plans or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such features. (Less than Significant)

The proposed project would be implemented within the existing boundaries of Sharp Park, and would not conflict with any adopted policies, plans or programs regarding public transit. Furthermore, the proposed project would not impact any bicycle or pedestrian facilities (see Figure 3). During the construction period, several equipment storage and staging areas would be established in the project area. None of these storage and staging areas would significantly affect movements of park users on the project site or the seawall. As part of the proposed project, one segment of an existing golf cart path, totaling approximately 100 feet in length, would be relocated to shift the path approximately 5 to 10 feet further away from habitat areas (see Figure 6). The golf cart path segment becomes inundated during seasonal flooding and covered with mud or grass. The proposed realignment would enhance the safety and usability of the path and this impact is less than significant. Another nearby segment of the golf cart path (to the south of the path segment proposed for realignment) floods seasonally as well. It was determined that this south segment would not be realigned as part of this project and golf carts would be manually routed around the flooded area as needed.

Impact C-TR: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant transportation impacts. (Less than Significant)

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in cumulative transportation impacts during the construction period of the proposed project. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including transportation impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[45]

The Initial Study prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP would not result in any significant transportation impacts to which this project could potentially contribute.

The proposed project would not result in any significant project-specific impacts to transportation and circulation. The number of trips generated as a result of the proposed project would be minimal. The project would not result in any significant impacts on transit, bicycle, and pedestrian facilities. Therefore, the proposed project would not contribute to a cumulative transportation impact.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
6. NOISE—Would the project:					
a) Result in 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?	☐	☐	☒	☐	☐
b) Result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐	☐
c) Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐	☐
d) Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐	☐
e) For a project located within an airport land use plan area, or, where such a plan has not been adopted, in an area within two miles of a public airport or public use airport, would the project expose people residing or working in the area to excessive noise levels?	☐	☐	☐	☐	☒
f) For a project located in the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☐	☒
g) Be substantially affected by existing noise levels?	☐	☐	☒	☐	☐

[45] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

The project site is not within an airport land use plan area, nor is it in the vicinity of a private airstrip. Therefore, Questions 6e and 6f are not applicable.

Impact NO-1: The proposed project would not result in a substantial permanent increase in ambient noise levels in the project vicinity, nor would it expose persons to noise levels and vibration in excess of standards established in the local general plan or noise ordinance. (Less than Significant)

There are no known or established noise standards applicable to the proposed project. With respect to project-generated traffic, generally, traffic must double in volume to produce a noticeable increase in average noise levels. Project-generated traffic during construction would not result in an audible change given the small scale of this project, which would involve a total of three to ten SFRPD employees and contractors. The proposed project involves improvements to existing facilities (primarily the existing pumphouse) and habitat. Once construction is complete, noise resulting from the project would be the same as under existing, or baseline, conditions. Further, the proposed project would not add any new source of permanent groundborne vibration or noise. As a result, the proposed project would not substantially increase ambient noise levels[46] or expose persons to substantial noise levels and vibration. Therefore, this impact is less than significant.

Impact NO-2: The proposed project would not result in a substantial temporary or periodic increase in ambient noise levels and vibration in the project vicinity. (Less than Significant)

During project implementation, construction equipment operation (a backhoe, Aquamog, long-arm excavator, and trucks) would temporarily increase noise levels and vibration in the project area and its vicinity, and could be considered an annoyance by occupants of nearby properties or visitors to Sharp Park. Construction noise and vibration levels would fluctuate depending on the construction phase, equipment type and duration of use, distance between noise source and receptor, and presence or absence of barriers. During construction, which is anticipated to occur for approximately 60 days over 18 months in the appropriate construction window in accordance with the Biological Opinion, there would be truck traffic to and from the site, delivering building materials and transporting material and debris removed from the project site. Potential noise impacts are expected to be discontinuous and of very short duration during the day time. Given the relatively minor scope of the proposed project, temporary and intermittent use of construction equipment would not be considered to result in substantial noise or vibration. As a result, the proposed project's impacts associated with noise and vibration would be less than significant.

Impact C-NO: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant noise impacts. (Less than Significant)

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in cumulative construction noise impacts during the construction period of the proposed project. The Initial Study prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to noise. Furthermore, the proposed project's construction activities would not overlap with those identified in the proposed 2006 SNRAMP. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)

[46]Ambient noise—the background noise in an area or environment, being a composite of sounds from many sources near and far.

concluded that the proposed restoration would not result in any significant effects on the environment, including noise impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[47] Thus, no construction noise cumulative impact within the project vicinity exists to which this project could potentially contribute.

Even if a cumulative impact due to traffic noise were to result from future foreseeable residential and non-residential development in the vicinity, because the proposed project would not substantially increase traffic volumes, the project would not contribute considerably to any cumulative traffic-related increases in ambient noise. Therefore, the project's cumulative noise impacts are considered less than significant.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
7. AIR QUALITY					
Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:					
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☒	☐	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal, state, or regional ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☒	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐	☐

Setting

Sharp Park is located within the San Francisco Bay Area Air Basin (SFBAAB). The BAAQMD is the regional agency with jurisdiction over the nine-county SFBAAB, which includes San Francisco, Alameda, Contra Costa, Marin, San Mateo, Santa Clara, and Napa Counties and portions of Sonoma and Solano Counties. The BAAQMD is responsible for attaining and maintaining air quality in the SFBAAB within federal and state air quality standards, as established by the federal Clean Air Act (CAA) and the California Clean Air Act (CCAA),

[47] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

respectively. Specifically, the BAAQMD has the responsibility to monitor ambient air pollutant levels throughout the SFBAAB and to develop and implement strategies to attain the applicable federal and state standards. The CAA and the CCAA require plans to be developed for areas that do not meet air quality standards. The most recent air quality plan, the *2010 Clean Air Plan (CAP)*, was adopted by the BAAQMD on September 15, 2010. The *2010 CAP* updates the *Bay Area 2005 Ozone Strategy* in accordance with the requirements of the CCAA to implement all feasible measures to reduce ozone; provide a control strategy to reduce ozone, particulate matter, air toxics, and greenhouse gases in a single, integrated plan; and establishes emission control measures to be adopted or implemented. The *2010 CAP* contains the following primary goals:

- Attain air quality standards;
- Reduce population exposure and protect public health in the San Francisco Bay Area; and
- Reduce greenhouse gas emissions and protect the climate.

The proposed project consists of the following construction elements:

- Construction of steps (approximately 3 feet in width and 14.3 feet in length) from the access road to the existing HSP pumphouse;
- Construction of a maintenance walkway (approximately 4.6 feet in width);
- Replacement of a wooden retaining wall with a concrete retaining wall;
- Removal of sediment and emergent vegetation within HSP and the connecting channel that links HSP with LS;
- Construction of a perennial pond approximately 1,600 sf; and
- Realignment of a segment of the existing golf cart path.

Construction activities are required to be undertaken between June 1 and October 31 in accordance with the USFWS-issued Biological Opinion. Construction is anticipated to occur for approximately 60 days over 18 months in the appropriate construction window in accordance with the Biological Opinion. Upon completion of construction activities, short-term air pollutant emissions would cease. Ongoing maintenance activities that may result in emissions of air pollutants, including those from vehicle trips, would be substantially similar to existing levels and therefore operational air pollutant emissions would not measurably increase upon completion of the proposed project. Therefore, the following analysis focuses on construction-related air quality impacts that would result from implementation of the proposed project.

Impact AQ-1: The proposed project would not conflict with or obstruct implementation of the applicable air quality plan. (Less than Significant)

Air quality plans developed to meet federal requirements are referred to as State Implementation Plans. The CAA and CCAA require plans to be developed for areas designated as nonattainment (with the exception of areas designated as nonattainment for the state PM_{10} standard). As discussed above, on September 15, 2010, the BAAQMD, in cooperation with the Metropolitan Transportation Commission and the Association of Bay Area Governments (ABAG), adopted the *2010 Clean Air Plan* (*CAP*).[48] The *2010 CAP* represents the most current applicable air quality plan for the SFBAAB. Consistency with this plan is the basis for determining whether the proposed project would conflict with or obstruct implementation of an applicable air quality plan.

The *2010 CAP* includes stationary-source control measures to be implemented through BAAQMD regulations; mobile-source control measures to be implemented through incentive

[48] Bay Area Air Quality Management District (BAAQMD). *2010 Clean Air Plan*. Available online at: *http://www.baaqmd.gov/Divisions/Planning-and-Research/Plans/Clean-Air-Plans.aspx*. Accessed December 26, 2012.

programs and other activities; and transportation control measures to be implemented through transportation programs in cooperation with the Metropolitan Transportation Commission, local governments, transit agencies, and others. The *2010 CAP* represents the Bay Area's most recent triennial assessment of the region's strategy to attain the state one-hour ozone standard.

In determining whether the proposed project would conflict with the *2010 CAP*, the following analysis considers the degree to which the proposed project: (1) supports the primary goals of the *2010 CAP*; (2) is consistent with the 55 control measures listed in the *2010 CAP*; and (3) whether the project would hinder implementation of the *2010 CAP*.

The proposed project would not introduce a new land use that would induce traffic trips in numbers that would constitute a significant impact on the local roadway network, local transit lines, or local bicycle and pedestrian networks. During the project's approximately 60-day (over 18 months in accordance with the Biological Opinion) construction period, temporary and intermittent traffic impacts would result from truck movements to and from the project site. However, construction would be a temporary activity and would not result in long-term air pollutant emissions. Given the nature and relatively minor scope of the proposed project, the proposed project would be consistent with the *2010 CAP*, would not conflict with the primary goals of the plan, and would not disrupt, delay, or otherwise hinder implementation of the plan. Thus, the proposed project would not conflict with or obstruct implementation of the applicable air quality plan and this impact would be less than significant.

Impact AQ-2: The proposed project would result in significant fugitive dust emissions during construction. (Less than Significant with Mitigation)

Project-related excavation, grading, and other construction activities may cause wind-blown dust that could contribute particulate matter into the local atmosphere. These emissions are termed "fugitive dust." Although there are federal standards for air pollutants and implementation of state and regional air quality control plans, air pollutants continue to have impacts on human health throughout the country. Dust can be an irritant causing watering eyes or irritation to the lungs, nose, and throat. Depending on exposure, adverse health effects can occur due to this particulate matter in general and also due to specific contaminants such as lead or asbestos that may be constituents of soil. The current health burden of particulate matter demands that, where possible, public agencies take feasible available actions to reduce sources of particulate matter exposure.

Fugitive dust emissions are typically generated during construction phases. Studies have shown that the application of BMPs at construction sites significantly control fugitive dust.[49] Individual measures have been shown to reduce fugitive dust by anywhere from 30 to 90 percent.[50] The BAAQMD recommends that construction projects within the SFBAAB employ a set of BMPs to control fugitive dust emissions during construction and considers these projects to result in less-than-significant fugitive dust impacts.[51]

Construction associated with improvements to the pumphouse and wetland complex could generate fugitive dust during soil-disturbing activities including soil/vegetation removal, excavation, site grading, installation of proposed structures and realignment of the golf cart path.

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[49] Western Regional Air Partnership. 2006. *WRAP Fugitive Dust Handbook*. September 7, 2006. This document is available online at *http://www.wrapair.org/forums/dejf/fdh/content/FDHandbook_Rev_06.pdf*. Accessed February 16, 2012.

[50] BAAQMD, *Revised Draft Options and Justification Report, California Environmental Quality Act Thresholds of Significance*, October 2009, page 27.

[51] BAAQMD, *CEQA Air Quality Guidelines*, May 2011.

Although the proposed project would involve mostly wet soils and earthen access routes, unmitigated, fugitive dust generated by the proposed project could result in significant air quality impacts. Under such conditions, watering active construction areas would address most impacts from fugitive dust. **Mitigation Measure M-AQ-2**, below, requires the SFRPD to incorporate the following measures to reduce constructed-related fugitive dust emissions.

Mitigation Measure M-AQ-2 - Preparation and Implementation of a Dust Control Plan
The SFRPD shall comply with the following requirements to control fugitive dust:

- The SFRPD shall designate an individual to monitor compliance with dust control requirements identified in this mitigation measure;
- Water all active construction areas sufficiently to prevent dust from becoming airborne (without creating runoff) in any area of land clearing, earth movement, excavation, and other dust-generating activity. Watering shall occur as needed, and whenever wind speeds exceed 15 miles per hour. Reclaimed water shall be used whenever possible;
- Establish shutdown conditions based on wind, soil migration, and other factors;
- Limit the area subject to construction activities at any one time;
- During excavation and dirt-moving activities, wet sweep or vacuum the routes and paths where work is in progress at the end of the workday;
- Cover any inactive (no disturbance for more than seven days) stockpiles greater than ten cubic yards or 500 square feet of excavated materials, backfill material, import material, gravel, sand, road base, and soil with a 10 mil (0.01 inch), wildlife-friendly polyethylene plastic or equivalent tarp and brace it down or use other equivalent soil stabilization techniques;
- Limit the amount of soil in hauling trucks to the size of the truck bed, and secure the load with a tarpaulin;
- Enforce a 10-mile per hour (mph) speed limit for vehicles entering and exiting construction areas;
- All soil stockpiles, if any, shall be protected against wind and rainfall erosion at all times. Wildlife-friendly plastic sheeting or other similar material shall be used to cover soils and shall be securely anchored by sandbags or other suitable means. At no time shall any stockpiled materials be allowed to erode into any water body or drainage facility or onto any roadway; and
- Install and use wheel washers to clean truck tires.

The SFRPD shall prepare and submit a site-specific Dust Control Plan to the ERO for records. The Plan shall detail a protocol for project compliance with the above requirements.

Implementation of **Mitigation Measure M-AQ-2**, above, includes the BAAQMD-recommended BMPs and additional dust control measures and would reduce construction-related fugitive dust emissions to a less-than-significant level.

Impact AQ-3: The proposed project would emit criteria air pollutants during construction, but not at levels that would violate an air quality standard, contribute to an existing or projected air quality violation, or result in a cumulatively considerable net increase in criteria air pollutants. (Less than Significant)

In accordance with the state and federal CAAs, air pollutant standards are identified for the following six criteria air pollutants: ozone, carbon monoxide (CO), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead. These air pollutants are termed criteria air pollutants because they are regulated by developing specific public health- and welfare-based criteria as the basis for setting permissible levels. In general, the SFBAAB experiences low concentrations of most pollutants when compared to federal or state standards. The SFBAAB is designated as either in attainment[52] or unclassified for most criteria pollutants with the exception of ozone, $PM_{2.5}$, and PM_{10},[53] for which these pollutants are designated as non-attainment under the state or federal standards. By its very nature, regional air pollution is largely a cumulative impact in that no single project is sufficient in size to, by itself, result in non-attainment of regional air quality standards. Instead, a project's individual emissions contribute to existing cumulative air quality impacts. If a project's contribution to cumulative air quality impacts is considerable, then the project's impact on air quality would be considered significant.[54]

As discussed above, the proposed project would contribute to regional criteria air pollutants during construction, but would not result in a measurable increase in emissions thereafter. Table 1, below, identifies air quality significance thresholds that are the basis for determining significant air quality impacts for the proposed project, followed by a discussion of each threshold. The thresholds identified in Table 1 are based on the BAAQMD's *Revised Draft Options and Justification Report, California Environmental Quality Act Air Quality Significance Thresholds.*[55] Projects that would result in criteria air pollutant emissions below these significance thresholds would not violate an air quality standard, contribute substantially to an air quality violation, or result in a cumulatively considerable net increase in criteria air pollutants within the SFBAAB.

Table 1. Criteria Air Pollutant Significance Thresholds

Pollutant	Construction Thresholds
	Average Daily Emissions (lbs./day)
ROG	54
NO_x	54
PM_{10}	82 (exhaust)
$PM_{2.5}$	54 (exhaust)
Fugitive Dust	Construction Dust Ordinance or other Best Management Practices

Ozone Precursors. As discussed above, the SFBAAB is currently designated as non-attainment for ozone and particulate matter (PM_{10} and $PM_{2.5}$). Ozone is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic gases (ROG) and oxides of nitrogen (NO_x). The potential for a project to result in a cumulatively considerable net increase in criteria air pollutants, which may contribute to an existing or projected air quality violation, are based on the state and federal Clean Air Acts emissions limits for stationary sources. The federal New Source Review (NSR) program was created by the federal CAA to ensure that sources of air pollution are constructed in a manner that is consistent with attainment of federal health based ambient air quality standards. Similarly, to ensure that new

[52] "Attainment" status refers to those regions that are meeting federal and/or state standards for a specified criteria pollutant. "Non-attainment" refers to regions that do not meet federal and/or state standards for a specified criteria pollutant. "Unclassified" refers to regions where there is not enough data to determine the region's attainment status.

[53] PM_{10} is often termed "coarse" particulate matter and is made of particulates that are 10 microns in diameter or larger. $PM_{2.5}$, termed "fine" particulate matter, is composed of particles that are 2.5 microns or less in diameter.

[54] BAAQMD, *California Environmental Quality Act Air Quality Guidelines*, May 2011, page 2-1.

[55] BAAQMD, *Revised Draft Options and Justification Report, California Environmental Quality Act Thresholds of Significance*, October 2009.

stationary sources do not cause or contribute to a violation of an air quality standard, BAAQMD Regulation 2, Rule 2 requires that any new source that emits criteria air pollutants above a specified emissions limit must offset those emissions. For ozone precursors ROG and NO_x, the offset emissions level is an annual average of 10 tons per year (or 54 pounds (lbs.) per day).[56] These levels represent emissions by which sources of air pollution are not anticipated to contribute to an air quality violation or result in a considerable net increase in criteria air pollutants.

Particulate Matter (PM_{10} and $PM_{2.5}$). For PM_{10} and $PM_{2.5}$, the emissions limit under the federal NSR is 15 tons per year. These emissions limits represent levels at which a source is not expected to have an impact on air quality.[57] Similar to ozone precursor thresholds identified above, these thresholds can be applied to the proposed project to evaluate the impact of the project's construction emissions on regional air quality.

Impact Analysis

Construction activities would emit criteria air pollutants from the combustion of fuel used by construction equipment, construction worker vehicles, and trucks delivering and removing materials to and from the site.

An evaluation of potential air quality impacts resulting from project construction activities was prepared using the California Emissions Estimator Model™ (CalEEMod), version CalEEMod.2011.1.[58] CalEEMod is a statewide land use emissions computer model designed to provide a uniform platform for quantifying criteria air pollutant emissions from the construction and operation of land use projects. CalEEmod contains the California Air Resources Board (ARB) Mobile Vehicle Emission Inventory Program 2007 and data specific to the SFBAAB. Construction equipment assumptions were provided by the SFRPD. Where specific information was unknown, default equipment, horsepower and operating hours were used, providing a conservative (i.e., worst case) estimate of criteria air pollutants. Results of the criteria air pollutant analysis are shown below in Table 2. These results reflect criteria air pollutant emissions that would result from both the improvements at the pumphouse and within the wetland complex.[59]

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[56] BAAQMD, *Revised Draft Options and Justification Report, California Environmental Quality Act Thresholds of Significance*, October 2009, page 17.

[57] *Revised Draft Options and Justification Report, California Environmental Quality Act Thresholds of Significance*, October 2009, page 16.

[58] California Emissions Estimator Model (CalEEMod). Available online at: *http://www.caleemod.com/*. Accessed February 26, 2013.

[59] Detailed modeling assumptions and CalEEmod output sheets are available for public review as part of Case File No. 2012.1427E, at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103.

Table 2. Project Construction Emission and Air Quality Significant Thresholds

Air Pollutant	Construction Emissions (lbs./day)	
	Project Emissions	Significance Threshold
Reactive organic gases (ROG)	1.9	54
Nitrogen oxides (NO_x)	11.5	54
Coarse particulate matter (PM_{10})	1.2 (exhaust only)	82 (exhaust only)
Fine particulate matter ($PM_{2.5}$)	0.8 (exhaust only)	54 (exhaust only)

As shown in Table 2, the proposed project would result in construction emissions that are well below the applicable air quality significance thresholds. Therefore, the proposed project would not violate an air quality standard, contribute to an existing or projected air quality violation, or result in a cumulatively considerable net increase in criteria air pollutants. Criteria air pollutant impacts would be less than significant.

Impact AQ-4: The proposed project would not expose sensitive receptors to substantial pollutant concentrations. (Less than Significant)

In addition to criteria air pollutants, individual projects may emit toxic air contaminants (TACs). TACs collectively refer to a diverse group of air pollutants that are capable of causing chronic (i.e., of long-duration) and acute (i.e., severe but of short-term) adverse effects to human health, including carcinogenic effects. Human health effects of TACs include birth defects, neurological damage, cancer, and death. There are hundreds of different types of TACs with varying degrees of toxicity. The ARB identified diesel particulate matter (DPM) as a TAC in 1998, primarily based on evidence demonstrating cancer effects in humans.[60] Mobile sources such as trucks and buses are among the primary sources of diesel emissions, and concentrations of DPM are higher near heavily traveled roadways. The estimated cancer risk from exposure to diesel exhaust is much higher than the risk associated with any other TAC routinely measured in the region. Heavy-duty vehicles and equipment used during construction activities would result in emissions of DPM, an identified TAC.

Air pollution does not affect every individual in the population in the same way, and some groups are more sensitive to adverse health effects than others. Land uses such as residences, schools, children's day care centers, hospitals, and nursing and convalescent homes are considered to be the most sensitive to poor air quality because the population groups associated with these uses have increased susceptibility to respiratory distress or, as in the case of residential receptors, their exposure time is greater than for other land uses. Exposure assessment guidance typically assumes that residences would be exposed to air pollution 24 hours per day, 350 days per year, for 70 years. Therefore, assessments of air pollutant exposure to residents typically result in the greatest adverse health outcomes of all population groups.

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[60] California Air Resources Board (ARB). *Fact Sheet, The Toxic Air Contaminant Identification Process: Toxic Air Contaminant Emissions from Diesel-fueled Engines,* October 1998.

The project area is located within Sharp Park, which includes a golf course, many trails/two , and passive recreational areas. The nearest sensitive receptors from the HSP area, in which the proposed sediment and emergent vegetation removal and other project activities would occur, are residential uses located approximately 600 feet east and southeast of the project site. The nearest sensitive receptors from the area, in which the proposed realignment of the golf cart path would take place, are residential uses located approximately 350 feet northeast of the project site.

Off-road equipment (which includes construction-related equipment) is a large contributor to DPM emissions in California, although since 2007, the ARB has found the emissions to be substantially lower than previously expected.[61] Newer and more refined emission inventories have substantially lowered the estimates of DPM emissions from off-road equipment such that off-road equipment is now considered the sixth largest source of DPM emissions in California.[62] This reduction in emissions is due, in part, to effects of the economic recession and refined emissions estimation methodologies. For example, revised particulate matter (PM) emission estimates for the year 2010, of which DPM is a major component of, have decreased by 83 percent from previous estimates for the SFBAAB.[63] Approximately half of the reduction can be attributed to the economic recession and approximately half can be attributed to updated assumptions independent of the economic recession (e.g., updated methodologies used to better assess construction emissions).[64]

Additionally, a number of federal and state regulations require cleaner off-road equipment. Specifically, both the USEPA and California have set emissions standards for new off-road equipment engines, ranging from Tier 1 to Tier 4. Tier 1 emission standards were phased in between 1996 and 2000 and Tier 4 Interim and Final emission standards for all new engines would be phased in between 2008 and 2015. To meet the Tier 4 emission standards, engine manufacturers will be required to produce new engines with advanced emission-control technologies. Although the full benefits of these regulations will not be realized for several years, the USEPA estimates that by implementing the federal Tier 4 standards, NO_x and PM emissions will be reduced by more than 90 percent.[65] Furthermore, California regulations limit maximum idling times to five minutes, which further reduces public exposure to DPM emissions.[66]

Moreover, construction activities do not lend themselves to analysis of long-term health risks because of their temporary and variable nature. As explained in the BAAQMD's *CEQA Air Quality Guidelines*:

> "Due to the variable nature of construction activity, the generation of TAC emissions in most cases would be temporary, especially considering the short amount of time such equipment is typically within an influential distance that would result in the exposure of sensitive receptors to substantial concentrations. Concentrations of mobile-source diesel PM emissions are typically reduced by 70 percent at a distance of approximately 500 feet (ARB 2005). In addition, current models and methodologies for conducting health risk assessments are

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61 ARB. *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* p.1 and p. 13 (Figure 4), October 2010.

62 ARB. *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* October 2010.

63 ARB. *In-Use Off-Road Equipment, 2011 Inventory Model,* Query accessed online, April 2, 2012, *http://www.arb.ca.gov/msei/categories.htm#inuse_or_category.*

64 ARB. *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* October 2010.

65 United State Environmental Protection Agency (USEPA). "Clean Air Nonroad Diesel Rule: Fact Sheet," May 2004.

66 California Code of Regulations, Title 13, Division 3, § 2485.

associated with longer-term exposure periods of 9, 40, and 70 years, which do not correlate well with the temporary and highly variable nature of construction activities. This results in difficulties with producing accurate estimates of health risk."[67]

In summary, project-level analyses of construction activities have a tendency to produce overestimated assessments of long-term health risks. As discussed above, DPM is a component of PM_{10}, which is often used as a surrogate for estimating DPM emissions. As shown above in Impact AQ-3, the proposed project's DPM emissions would be well below the criteria air pollutant significance thresholds; on-road heavy-duty diesel vehicles and off-road equipment would be used only temporarily during the approximate 60-day (over 18 months in accordance with the Biological Opinion) construction duration and would not expose sensitive receptors to substantial air pollutants. Furthermore, the proposed project's construction contractors would be required to comply with California regulations limiting idling to no more than five minutes, which would further reduce nearby sensitive receptor's exposure to temporary and variable DPM emissions. Therefore, construction period TAC emissions would result in a less-than-significant impact to nearby sensitive receptors.

Impact AQ-5: The proposed project would not create objectionable odors affecting a substantial number of people. (Less than Significant)

Organic material in soil can decompose through anaerobic processes[68] and generate methane and hydrogen sulfide gases, which can then be released into the environment once soil is exposed. Soil excavation and soil/vegetation removal associated with the proposed project would be minimal and temporary, and therefore would not generate odors that would affect a substantial number of people. Similarly, equipment exhaust could occasionally emit odors attributed to gasoline combustion, but any such odors would be temporary, limited only to the approximately 60-day (over 18 months in accordance with the Biological Opinion) construction period, and would cease upon completion of construction activities. Therefore, the proposed project's construction activities would not create objectionable odors affecting a substantial number of people and odor impacts would be less than significant.

Impact C-AQ: The proposed project, in combination with past, present, and reasonably foreseeable future development in the project area, would not make a considerable contribution to any cumulative significant air quality impacts. (Less than Significant with Mitigation)

As described in Impact AQ-3, regional air pollution is by its very nature largely a cumulative impact. Emissions from past, present and future projects contribute to the region's adverse air quality on a cumulative basis. No single project by itself would be sufficient in size to result in regional nonattainment of ambient air quality standards. Instead, a project's individual emissions contribute to existing cumulative adverse air quality impacts.[69] The project-level thresholds for criteria air pollutants are based on levels by which new sources are not anticipated to contribute to an air quality violation or result in a cumulatively considerable net increase in criteria air pollutants. Therefore, because the proposed project's construction criteria air pollutant impact (Impact AQ-3) would not exceed the project-level thresholds for criteria air pollutants, the

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67 BAAQMD, *CEQA Air Quality Guidelines*, May 2011, page 8-6.

68 Anaerobic process means a process which only occurs in the absence of molecular oxygen.

69 BAAQMD, *CEQA Air Quality Guidelines*, June 2010; and adopted Thresholds of Significance, June 2010, p. 2-1. Available online at: *http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES/Updated-CEQA Guidelines.aspx*. Accessed April 18, 2012.

proposed project would not result in a cumulatively considerable contribution to regional air quality impacts.

The project's temporary and incremental increase in DPM emissions resulting from construction activities would be minor and would not contribute substantially to cumulative concentrations of DPM or other toxic air contaminants that could affect nearby sensitive land uses.

With regard to fugitive dust emissions, these emissions result in a localized air quality impact as larger particulate matter particles tend to settle out of the atmosphere relatively close to dust generating activities. Construction of the proposed project is not anticipated to occur in proximity to other construction activities such that cumulative fugitive dust impacts would occur. However, should other construction activities occur concurrently and in close proximity to the project's construction activities, there is a potential, although a relatively low potential, for significant cumulative fugitive dust impacts. The proposed project would be required to comply with **Mitigation Measure M-AQ-2**, reducing the project's contribution to any potential cumulative fugitive dust impact to a less-than-significant level.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
8. GREENHOUSE GAS EMISSIONS— Would the project:					
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐	☐
b) Conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐	☐

Environmental Setting

Gases that trap heat in the atmosphere are referred to as greenhouse gases (GHGs) because they capture heat radiated from the sun as it is reflected back into the atmosphere, much like a greenhouse does. The accumulation of GHGs has been implicated as the driving force for global climate change. The primary GHGs are carbon dioxide, methane, nitrous oxide, ozone, and water vapor.

Individual projects contribute to the cumulative effects of climate change by emitting GHGs during demolition, construction, and operational phases. While the presence of the primary GHGs in the atmosphere is naturally occurring, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are largely emitted from human activities, accelerating the rate at which these compounds occur within earth's atmosphere. Emissions of carbon dioxide are largely by-products of fossil fuel combustion, whereas methane results from off-gassing associated with agricultural practices and landfills. Black carbon has recently emerged as a major contributor to global climate change, possibly second only to CO_2. Black carbon is produced naturally and by human activities as a result of the incomplete combustion of fossil fuels, biofuels and biomass.[70]

[70] Center for Climate and Energy Solutions. *What is Black Carbon?*, April 2010. Available online at: *http://www.c2es.org/docUploads/what-is-black-carbon.pdf*. Accessed September 27, 2012.

N_2O is a byproduct of various industrial processes and has a number of uses, including use as an anesthetic and as an aerosol propellant. Other GHGs include hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, and are generated in certain industrial processes. Greenhouse gases are typically reported in "carbon dioxide-equivalent" measures (CO_2E).[71]

There is international scientific consensus that human-caused increases in GHGs have and will continue to contribute to global warming. Many impacts resulting from climate change, including increased fires, floods, severe storms and heat waves, are occurring already and will only become more frequent and more costly.[72] Secondary effects of climate change are likely to include a global rise in sea level, impacts to agriculture, the state's electricity system, and native freshwater fish ecosystems, an increase in the vulnerability of levees in the Sacramento-San Joaquin Delta, changes in disease vectors, and changes in habitat and biodiversity.[73,74]

The California Air Resources Board (ARB) estimated that in 2009 California produced about 457 million gross metric tons of CO_2E ($MMTCO_2E$).[75] The ARB found that transportation is the source of 38 percent of the State's GHG emissions, followed by electricity generation (both in-state generation and imported electricity) at 23 percent and industrial sources at 18 percent. Commercial and residential fuel use (primarily for heating) accounted for nine percent of GHG emissions.[76] In the Bay Area, the transportation (on-road motor vehicles, off-highway mobile sources, and aircraft) and industrial/commercial sectors were the two largest sources of GHG emissions, each accounting for approximately 36 percent of the Bay Area's 95.8 $MMTCO_2E$ emitted in 2007.[77] Electricity generation accounts for approximately 16 percent of the Bay Area's GHG emissions followed by residential fuel usage at seven percent, off-road equipment at three percent and agriculture at one percent.[78]

Regulatory Setting

In 2005, in recognition of California's vulnerability to the effects of climate change, then-Governor Schwarzenegger established Executive Order S-3-05, which sets forth a series of target dates by which statewide emissions of GHGs would be progressively reduced, as follows: by 2010, reduce GHG emissions to 2000 levels (approximately 457 $MMTCO_2E$); by 2020, reduce emissions to 1990 levels (estimated at 427 $MMTCO_2E$); and by 2050 reduce statewide GHG emissions to 80 percent below 1990 levels (approximately 85 $MMTCO_2E$).

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71 Because of the differential heat absorption potential of various GHGs, GHG emissions are frequently measured in "carbon dioxide-equivalents," which present a weighted average based on each gas's heat absorption (or "global warming") potential.

72 California Climate Change Portal. Available online at: *http://www.climatechange.ca.gov*. Accessed September 25, 2012.

73 California Climate Change Portal. Available online at: *http://www.climatechange.ca.gov*. Accessed September 25, 2012.

74 California Energy Commission. California Climate Change Center. *Our Changing Climate 2012*. Available online at: *http://www.energy.ca.gov/2012publications/CEC-500-2012-007/CEC-500-2012-007.pdf*. Accessed August 21, 2012.

75 ARB. *California Greenhouse Gas Inventory for 2000-2009— by Category as Defined in the Scoping Plan*. Available online at: *http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_00-09_2011-10-26.pdf*. Accessed August 21, 2012.

76 ARB. *California Greenhouse Gas Inventory for 2000-2009— by Category as Defined in the Scoping Plan*. Available online at: *http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_00-09_2011-10-26.pdf*. Accessed August 21, 2012.

77 BAAQMD. *Source Inventory of Bay Area Greenhouse Gas Emissions: Base Year 2007*, February 2010. Available online at: *http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Emission%20Inventory/regionalinventory2007_2_10.ashx*. Accessed August 21, 2012.

78 BAAQMD. *Source Inventory of Bay Area Greenhouse Gas Emissions: Base Year 2007, Updated: February 2010*. Available online at: *http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Emission%20Inventory/regionalinventory2007_2_10.ashx*. Accessed August 21, 2012.

In response, the California legislature passed Assembly Bill No. 32 in 2006 (California Health and Safety Code Division 25.5, Sections 38500, et seq., or AB 32), also known as the Global Warming Solutions Act. AB 32 requires ARB to design and implement emission limits, regulations, and other measures, such that feasible and cost-effective statewide GHG emissions are reduced to 1990 levels by 2020 (representing a 25 percent reduction from forecast emission levels).[79]

Pursuant to AB 32, ARB adopted a Scoping Plan in December 2008, outlining measures to meet the 2020 GHG reduction limits. The Scoping Plan is the State's overarching plan for addressing climate change. In order to meet these goals, California must reduce its GHG emissions by 30 percent below projected 2020 business as usual emissions levels, or about 15 percent from 2008 levels.[80] The Scoping Plan estimates a reduction of 174 million metric tons of CO_2E ($MMTCO_2E$) (about 191 million U.S. tons) from the transportation, energy, agriculture, forestry, and high global warming potential sectors, see Table 3, below. ARB has identified an implementation timeline for the GHG reduction strategies in the Scoping Plan.[81]

Table 3. GHG Reductions from the AB 32 Scoping Plan Sectors[82,83]

GHG Reduction Measures By Sector	GHG Reductions (MMT CO_2E)
Transportation Sector	62.3
Electricity and Natural Gas	49.7
Industry	1.4
Landfill Methane Control Measure (Discrete Early Action)	1
Forestry	5
High Global Warming Potential GHGs	20.2
Additional Reductions Needed to Achieve the GHG Cap	34.4
Total	**174**
Other Recommended Measures	
Government Operations	1-2
Methane Capture at Large Dairies	1
Additional GHG Reduction Measures:	
Water	4.8
Green Buildings	26
High Recycling/ Zero Waste • Commercial Recycling • Composting • Anaerobic Digestion • Extended Producer Responsibility • Environmentally Preferable Purchasing	9
Total	**41.8-42.8**

[79] Governor's Office of Planning and Research (OPR). *Technical Advisory- CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review*, June 19, 2008. Available online at: *http://opr.ca.gov/docs/june08-ceqa.pdf*. Accessed August 21, 2012.

[80] ARB. *California's Climate Plan: Fact Sheet*. Available online at: *http://www.arb.ca.gov/cc/facts/scoping_plan_fs.pdf*. Accessed August 21, 2012.

[81] ARB. *Assembly Bill 32: Global Warming Solutions Act*. Available online at: *http://www.arb.ca.gov/cc/ab32/ab32.htm/*. Accessed August 21, 2012.

[82] ARB. *Climate Change Scoping Plan*, December 2008. Available online at: *http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf*. Accessed August 21, 2012.

[83] ARB. *California's Climate Plan: Fact Sheet*. Available online at: *http://www.arb.ca.gov/cc/facts/scoping_plan_fs.pdf*. Accessed August 21, 2012.

The AB 32 Scoping Plan recommendations are intended to curb projected business-as-usual growth in GHG emissions and reduce those emissions to 1990 levels. Therefore, meeting AB 32 GHG reduction goals would result in an overall annual net decrease in GHGs as compared to current levels and accounts for projected increases in emissions resulting from anticipated growth.

The Scoping Plan also relies on the requirements of Senate Bill 375 (SB 375) to implement the carbon emission reductions anticipated from land use decisions. SB 375 was enacted to align local land use and transportation planning to further achieve the State's GHG reduction goals. SB 375 requires regional transportation plans, developed by Metropolitan Planning Organizations (MPOs), to incorporate a "sustainable communities strategy" in their regional transportation plans (RTPs) that would achieve GHG emission reduction targets set by ARB. SB 375 also includes provisions for streamlined CEQA review for some infill projects such as transit-oriented development. SB 375 would be implemented over the next several years and the Bay Area Metropolitan Transportation Commission's 2013 RTP, Plan Bay Area, would be its first plan subject to SB 375.

AB 32 further anticipates that local government actions will result in reduced GHG emissions. ARB has identified a GHG reduction target of 15 percent from current levels for local governments themselves and noted that successful implementation of the Scoping Plan relies on local governments' land use planning and urban growth decisions because local governments have the primary authority to plan, zone, approve, and permit land development to accommodate population growth and the changing needs of their jurisdictions.[84] The BAAQMD has conducted an analysis of the effectiveness of the region in meeting AB 32 goals from the actions outlined in the Scoping Plan and determined that in order for the Bay Area to meet AB 32 GHG reduction goals, the Bay Area would need to achieve an additional 2.3 percent reduction in GHG emissions from the land use driven sector.[85]

At a local level, the City has developed a number of plans and programs to reduce the City's contribution to global climate change. San Francisco's GHG reduction goals, as outlined in the 2008 Greenhouse Gas Reduction ordinance are as follows: by 2008, determine the City's GHG emissions for the year 1990, the baseline level with reference to which target reductions are set; by 2017, reduce GHG emissions by 25 percent below 1990 levels; by 2025, reduce GHG emissions by 40 percent below 1990 levels; and finally by 2050, reduce GHG emissions by 80 percent below 1990 levels. San Francisco's Greenhouse Gas Reduction Strategy documents the City's actions to pursue cleaner energy, energy conservation, alternative transportation and solid waste policies. As identified in the Greenhouse Gas Reduction Strategy, the City has implemented a number of mandatory requirements and incentives that have measurably reduced GHG emissions including, but not limited to, increasing the energy efficiency of new and existing buildings, installation of solar panels on building roofs, implementation of a green building strategy, adoption of a zero waste strategy, a construction and demolition debris recovery ordinance, a solar energy generation subsidy, incorporation of alternative fuel vehicles in the City's transportation fleet (including buses), and a mandatory recycling and composting ordinance.

The Greenhouse Gas Reduction Strategy concludes that San Francisco's policies and programs have resulted in a reduction in GHG emissions below 1990 levels, exceeding statewide AB 32

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[84] ARB. *Climate Change Scoping Plan.* December 2008. Available online at: *http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf*. Accessed August 21, 2012.

[85] BAAQMD. *California Environmental Quality Act Guidelines Update, Proposed Thresholds of Significance,* December 2009. Available online at: *http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/Proposed%20Thresholds%20of%20Significance%20Dec%207%2009.ashx*. Accessed September 25, 2012.

GHG reduction goals. San Francisco's communitywide 1990 GHG emissions were approximately 6,201,949 $MTCO_2E$. As stated above, San Francisco GHG emissions in 2010 were 5,299,757 $MTCO_2E$, which is a 14.5 percent reduction in GHG emissions compared to 1990 levels. The reduction has largely come from the electricity sector, from 2,032,085 $MTCO_2E$ (year 1990) to 1,333,959 $MTCO_2E$ (year 2010), and waste sector, from 472,646 $MTCO_2E$ (year 1990) to 244,625 $MTCO_2E$ (year 2010).[86]

Impact C-GG: The proposed project would generate greenhouse gas emissions, but not in levels that would result in a significant impact on the environment or conflict with any policy, plan, or regulation adopted for the purpose of reducing greenhouse gas emissions. (Less than Significant)

The most common GHGs resulting from human activity associated with land use decisions are CO_2, CH_4, and N_2O.[87] Individual projects contribute to the cumulative effects of climate change by directly or indirectly emitting GHGs during construction and operational phases. As discussed in Section E.7, Air Quality, ongoing maintenance activities that result in operational GHG emissions (e.g., vehicle trips, etc.) are expected to be substantially similar to existing levels, and therefore operational GHG emissions would not measurably increase upon project completion. This analysis therefore focuses on GHG emissions that would be emitted during construction activities.

The project's construction activities would contribute to temporary increases in GHGs emissions. During construction, which is anticipated to occur for approximately 60 days over 18 months in the appropriate construction window in accordance with the Biological Opinion, GHGs would emitted from the combustion of fuel used for construction equipment, vehicles used for worker commuting, and trucks transporting materials to and from the project site.

CO_2E emissions from project construction activities were quantified using the CalEEMod modeling software (version CalEEMod.2011.1).[88] Results of this analysis indicate that the proposed project would emit 30 $MTCO_2E$ during construction. While neither the BAAQMD, nor any other jurisdiction, has identified quantifiable thresholds for construction period GHG emissions, the BAAQMD, in their 2011 CEQA Air Quality Guidelines, did identify an operational GHG threshold of 1,100 $MTCO_2E$ per year. Estimated construction emissions would be well below this level and would cease upon completion of construction activities. Thus, GHG emissions from the proposed project would result in a less-than-significant impact.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
9. WIND AND SHADOW—Would the project:					

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[86] San Francisco Department of Environment (SFDOE). *San Francisco Community -Wide Carbon Emissions by Category, Excel spreadsheet provided via email between Pansy Gee, SFDOE and Wade Wietgrefe, San Francisco Planning Department*, June 7, 2013.

[87] OPR. *Technical Advisory- CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review*, June 19, 2008. Available at the Office of Planning and Research's website at: *http://www.opr.ca.gov/ceqapdfs/june08-ceqa.pdf*. Accessed March 3, 2010.

[88] CalEEMod. Available online at: *http://www.caleemod.com/*. Accessed February 26, 2013.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
a) Alter wind in a manner that substantially affects public areas?	☐	☐	☐	☒	☐
b) Create new shadow in a manner that substantially affects outdoor recreation facilities or other public areas?	☐	☐	☐	☒	☐

Impact WS-1: The proposed project would not alter wind in a manner that substantially affects public areas. (No Impact)

The proposed project would not include construction of any above-ground structures that would alter wind patterns. The proposed project would not remove any structures or trees in a way that would result in substantial changes in wind patterns on the project site or in its vicinity. Therefore, the proposed project would not substantially alter wind patterns on the project site and in its vicinity, and no wind impact would result from the proposed project.

Impact WS-2: The proposed project would not create new shadow in a manner that could substantially affect outdoor recreation facilities or other public areas. (No Impact)

No new above-ground structures would be constructed except for the minor structures to be constructed around the pumphouse and realigned golf course path segment. Given the height and scale of these structures, no new shadow that would affect the use or enjoyment of Sharp Park would result from the proposed project. As a result, no shadow impact would result from the proposed project.

Impact C-WS: the proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant impacts related to wind or shadow. (Less than Significant)

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in cumulative wind or shadow impacts during the construction period of the proposed project. The Draft EIR prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, addressed potential ground-level wind hazards and windthrow risks resulting from tree removal and concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to wind. The Initial Study prepared for the proposed 2006 SNRAMP concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to shadow. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including wind and shadow impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[89] Therefore, no cumulative wind or shadow impact within the project vicinity exists to which this project could potentially contribute.

[89] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

The proposed project, as discussed above, would not substantially alter wind on the project site and in its vicinity and would have no impacts on shadow. Therefore, the proposed project would not contribute to a cumulative wind or shadow impact, even if one existed.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
10. RECREATION—Would the project:					
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated?	☐	☐	☒	☐	☐
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☐	☐	☒	☐
c) Physically degrade existing recreational resources?	☐	☐	☒	☐	☐

Impact RE-1: The proposed project would not physically degrade existing recreational resources or increase the use of existing neighborhood parks or other recreational facilities, such that substantial physical deterioration of the facilities would occur or be accelerated. (Less than Significant)

The proposed project would not close or substantially modify any portion of the Sharp Park Golf Course. The proposed project involves improvements to existing facilities and creation of habitat for CRLF and SFGS at Sharp Park. Most of the proposed activities, except for the realignment of the golf cart path segment, would occur in areas that are not used for recreation or are off limits to the public.

The realignment of the golf cart path segment would take approximately 5 days to complete. Given the small scale of this project and SFRPD's intent to provide continuous play during construction, the proposed project would not substantially affect recreational resources on the project site or in its vicinity, and therefore would not result in physical deterioration of Sharp Park or result in increased use of nearby parks.

In light of the above, this impact is less than significant.

Impact RE-2: The proposed project would not require construction or expansion of recreational facilities that would have an adverse physical effect on the environment. (No Impact)

The proposed project would not result in new uses that would increase the demand for parks or recreational facilities. Therefore, the proposed project would not require construction or expansion of recreational facilities, and would have no impact.

Impact C-RE: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant recreation impacts. (Less than Significant)

The Draft EIR prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP in combination with the GGNRA Dog Management Plan would result in a significant and unavoidable cumulative impact with respect to recreation as a result of closure of Dog Play Areas. However, dogs are not now, and will not under proposed project conditions, be allowed at Sharp Park, so none of the significant recreation impacts identified in the Draft EIR for the proposed 2006 SNRAMP would combine with any element of the proposed project to result in a cumulatively considerable recreation impact.

A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including recreation impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[90]

As discussed above, the proposed project would not generate additional demand for parks or recreational facilities. Therefore, the proposed project would not contribute to a cumulative impact with respect to recreation.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
11. UTILITIES AND SERVICE SYSTEMS—Would the project:					
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒	☐
d) Have sufficient water supply available to serve the project from existing entitlements and resources, or require new or expanded water supply resources or entitlements?	☐	☐	☒	☐	☐
e) Result in a determination by the wastewater treatment provider that would serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐	☐

90 San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒	☐

Impact UT-1: Implementation of the proposed project would not significantly affect wastewater collection and treatment facilities or exceed wastewater treatment requirements of the SFRWQCB, and would not require or result in the construction of new stormwater drainage facilities or expansion of existing facilities. (No Impact)

The project would not generate wastewater or stormwater, and therefore would not result in the construction of new wastewater or stormwater facilities or the expansions of existing facilities. Therefore, no impact would result from the proposed project with respect to wastewater collection or treatment facilities.

Impact UT-2: the proposed project would not require expansion or construction of new water supply or treatment facilities. (Less than Significant)

The project would likely require water for cleaning of construction equipment and may use water during construction to control fugitive dust as discussed in Section E.7, Air Quality. Additionally, the project could require water for irrigation of plants to ensure successful establishment (approximately once a month between June and September). Water would be provided by the existing golf course water source, which is municipal water provided by the North Coast County Water District.

The demand for such water use can be fully met by existing water supply capacity and would not require new or expanded water supply resources. Therefore, the proposed project's impacts on water supply would be less than significant.

Impact UT-3: The proposed project would be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs. (Less than Significant)

Minor quantities of solid waste and recyclable material would be generated during the construction of the proposed project. The sediment and vegetation removed from the site would be transported to the former rifle range site, on the east side of PCH, within Sharp Park. A small amount of construction debris would be generated from the demolition of the retaining wall and would be disposed of at a landfill with sufficient capacity that would be selected by the project contractor. As such, the project would not substantially impact landfill capacity.

Impact UT-4: The proposed project would follow all applicable statutes and regulations related to solid waste. (No Impact)

The proposed project would follow all applicable statutes and regulations related to solid waste, and therefore no impact would result from the proposed project.

Impact C-UT: the proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant impacts related to utilities or service systems. (Less than Significant)

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in cumulative impacts with respect to utilities and service systems. The Draft EIR prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to utilities or service systems.

The Final Draft Supplemental Initial Study/Mitigated Negative Declaration was prepared by the North Coast County Water District concerning the amended Sharp Park Recycled Water Project, which consists of construction of infrastructure necessary to provide tertiary treated water from Calera Creek Water Recycling Plant to irrigation sites in the Sharp Park area. The Final Draft Supplemental Initial Study/Mitigated Negative Declaration determined that with implementation of mitigation measures the amended Sharp Park Recycled Water Project would not result in any significant impacts.[91]

A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including utilities and service systems impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[92] Thus, no cumulative impact to utilities or service systems within the project vicinity exists to which this project could potentially contribute.

The proposed project would not require a substantial amount of water and would not result in any significant impacts on utilities or service systems in the project area. Existing service management plans address anticipated growth in the region. The proposed project would not contribute to a cumulative impact on utilities and service systems, even if one existed.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
12. PUBLIC SERVICES— Would the project:					

[91] North Coast County Water District. *Draft Supplemental Initial Study/Mitigated Negative Declaration, North Coast County Water District Water Recycling Storage Tank Location Project*, July 2007. This document is available online at: *http://www.nccwd.com/Draft%20Supplemental%20July%202007.pdf*. Accessed August 29, 2013.

[92] San Francisco Planning Department, *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
a) Result in substantial adverse physical impacts associated with the provision of, or the need for, new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any public services such as fire protection, police protection, schools, parks, or other services?	☐	☐	☐	☒	☐

Impact PS-1: The proposed project would not increase demand for fire protection or police service to an extent that would result substantial adverse impacts associated with the provision of such service. (No Impact)

The proposed project does not include any new habitable structures which would require fire protection and police services. Workers for the proposed project would consist of SFRPD employees and contractors, totaling approximately three to ten individuals. Potential increases in visitor use levels as a result of an improved Sharp Park, if any, would be adequately served by the existing capabilities of service providers. Therefore, no impact to fire protection or police service would result from the proposed project.

Impact PS-2: The proposed project would not indirectly generate new students, and would not require new or physically altered school facilities. (No Impact)

The project does not propose any new habitable structures, and therefore would not generate new students. Therefore, the project would not require a new school or expansion of school facilities and no impact to public schools would result from the proposed project.

Impact C-PS: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant effects related to public services. (No Impact)

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in impacts to public. The Initial Study prepared for the proposed 2006 SNRAMP concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to public services. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including public services impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[93] Thus, no cumulative impact to public services within the project vicinity exists to which this project could potentially contribute.

Public service providers accommodate growth within their service areas by responding to forecasted population growth and land use changes. The proposed project would have no

[93] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

impacts to public services. Therefore, the proposed project would not contribute to a cumulative impact on public services, even if one existed.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
13. BIOLOGICAL RESOURCES— Would the project:					
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☒	☐	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☒	☐	☐

Regulatory Setting

Endangered Species Act

The FESA (16 United States Code [USC], 1531-1543) 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 Section 1533[c]). The FESA is administered by both the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) and the USFWS. NOAA NMFS is responsible for the protection of FESA-listed marine species, including marine fish, most marine mammals, and anadromous fish. The USFWS has jurisdiction over listed wildlife, plant, and commercial fish species and proposed or candidate species.

Pursuant to the requirements of the FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any FESA-listed threatened or endangered species may be present in the project site and determine whether the proposed project would have a potentially-significant impact on such species. In addition, the agency is required to determine whether the proposed project is likely to jeopardize the continued existence of[94] any species listed or proposed to be listed under the FESA or result in the destruction or adverse modification of critical habitat designated or proposed to be designated for such species (16 USC Section 1536). If so, project-related impacts to these species or their habitats would be considered significant and would require mitigation.

Section 9 of the FESA lists those actions that are prohibited, including take[95] of listed species of fish and wildlife. "Take" of listed species can be authorized through either the Section 7 consultation process for actions undertaken by federal agencies, or through the Section 10 permit process for actions undertaken by non-federal agencies where a Section 404 permit or other federal approval is not required.

Federal actions include activities that are on federal land, conducted by a federal agency, funded by a federal agency, or authorized by a federal agency (including issuance of federal permits and licenses). Under Section 7, the federal agency conducting, funding, or permitting an action (the federal lead agency) must consult the NOAA NMFS or USFWS, as appropriate, to ensure that the proposed action will not jeopardize endangered or threatened species or destroy or adversely modify designated critical habitat. Regulations governing interagency cooperation under Section 7 are found at 50 Code of Federal Regulations (CFR), Part 402.

If a proposed project "may affect" a listed species or designated critical habitat, the project sponsor is required to prepare a Biological Assessment evaluating the nature and severity of the expected effect. In response, the NOAA NMFS or USFWS issues a Biological Opinion with a determination that the proposed action may either jeopardize the continued existence of one or more listed species (jeopardy finding), result in the destruction or adverse modification of critical habitat (adverse modification finding), not jeopardize the continued existence of any listed species (no jeopardy finding), or not result in adverse modification of critical habitat (no adverse modification finding). The Biological Opinion issued by the NOAA NMFS or USFWS may stipulate discretionary "reasonable and prudent" conservation measures, and if the project would not jeopardize a listed species, the NOAA NMFS or USFWS issues an incidental take statement to authorize the proposed activity. Projects that would result in a "take" of a federally-listed threatened or endangered species would be required to obtain authorization from NOAA NMFS or USFWS through an incidental take permit.

The proposed improvements to the existing pumphouse and sediment and emergent vegetation removal activities would require a Section 404 permit pursuant to the FCWA, as described below. The USACE is the federal agency that issues a permit under Section 404 of the FCWA and thus

[94] "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of the species. 50 Code of Federal Regulations (C.F.R) §402.02.

[95] FESA defines "take" as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, such as breeding, feeding, or sheltering. "Harass" is further defined as actions that create the likelihood of injury to listed species to an extent that significantly disrupts normal behavior patterns, which include breeding, feeding, and sheltering.

establishes a federal nexus with the FESA, requiring Section 7 consultation. The SFRPD has already consulted with the USFWS under the Section 7 consultation process, and the USFWS issued a Biological Opinion in October, 2012 concerning the proposed project.[96]

Clean Water Act

The FCWA (33 USC, 1251-1376) was enacted as an amendment to the Federal Water Pollution Control Act of 1972, which outlined the basic structure for regulating discharges of pollutants into waters of the U.S. The FCWA serves as the primary federal law protecting the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands.

Waters of the U.S. are areas subject to federal jurisdiction pursuant to Section 404 of the FCWA. In order to be protected under the FCWA Sections 404 and 401, wetlands and other waters of the U.S. must be classified as one of the following:[97]

- Traditional navigable waters;
- Wetlands next to traditional navigable waters;
- Nonnavigable tributaries of traditional navigable waters that are relatively permanent, where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); or
- Wetlands that directly abut the tributaries described in the previous bullet.

The USACE would decide jurisdiction over the following waters, based on a fact-specific analysis, to determine whether they have a significant nexus with a traditional navigable water:[98]

- Nonnavigable tributaries that are not relatively permanent;
- Wetlands next to nonnavigable tributaries that are not relatively permanent; or
- Wetlands next to but that do not directly abut a relatively permanent nonnavigable tributary.

Waters of the U.S. are typically divided into two types: 1) wetlands and 2) other waters of the U.S. Wetlands are "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR Section 328.3[b], 40 CFR Section 230.3). To be considered subject to federal jurisdiction, a wetland must normally support hydrophytic vegetation (plants growing in water or wet soils), hydric soils, and wetland hydrology.[99] Other waters of the U.S. are seasonal or perennial water bodies, including lakes, stream channels, drainages, ponds, and other surface water features, that exhibit an ordinary high-water mark but lack positive indicators for the three wetland parameters (33 CFR Section 328.4).

Under FCWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the U.S. must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water

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[96] USFWS. *Biological Opinion*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[97] U.S. Amy Corps of Engineers (USACE). *Revised Guidance on Clean Water Act Jurisdiction Following the Supreme Court Decision in Rapanos v. U.S. and Carabell v. U.S.*, December 2, 2008. Available online at: *http://www.usace.army.mil/missions/civilworks/regulatoryprogramandpermits/relatedresources/cwaguidance.aspx*. Accessed May 17, 2013.

[98] Ibid.

[99] USACE. *Corps of Engineers Wetland Delineation Manual*, January 1987. Available online at: *http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf*. Accessed May 17, 2013.

pollution control agency with jurisdiction over affected water at the point where the discharge would originate. The California Regional Water Quality Control Boards (RWQCBs) administer this certification. Therefore, all projects that have a federal component and that may affect state water quality (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with FCWA Section 401.

FCWA Section 402 authorizes the USEPA to regulate water quality in California by controlling the discharge of pollutants to water bodies from point sources (a municipal or industrial discharge at a specific location or pipe) and nonpoint sources (diffuse runoff of water from adjacent land uses) through the NPDES. Federal regulations issued in November 1990 and revised in 2003 expanded the authority of the California State Water Resources Control Board to permit stormwater discharges from municipal storm sewer systems, industrial processes, and construction sites that disturb areas larger than one acre. Within the San Francisco limits, NPDES permits are administered by the SFBRWQCB.

FCWA Section 404 regulates the discharge of dredged and fill materials into waters of the U.S. Applicants must obtain a permit from the USACE for discharges of dredged or fill material into waters of the U.S., including wetlands, before proceeding with a proposed activity. The USACE may issue either an individual permit evaluated on a case-by-case basis or a general permit evaluated at a program level for a series of related activities. General permits are preauthorized and are issued to cover multiple instances of similar activities expected to cause only minimal adverse environmental effects. Nationwide permits (NWPs) are a type of general permit issued to cover particular activities that would result in the deposition of fill material into waters of the U.S. Each NWP specifies particular conditions that must be met for the NWP to apply to a particular project. Waters of the U.S. in the project area are under the jurisdiction of the San Francisco District of the USACE.

Implementing regulations by the USACE are found at 33 CFR, Parts 320-330. Guidelines for implementation are referred to as the Section 404(b)(1) Guidelines and were developed by the USEPA in conjunction with the USACE (40 CFR, Part 230). The guidelines allow the discharge of dredged or fill material into the aquatic system only if there is no practicable alternative that would have less adverse impacts.

The proposed project would require a Section 404 CWA NWP for the proposed work within the jurisdictional wetlands.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC, 703-711) implements a treaty signed by the United States, Canada, Mexico, and Japan that makes it unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, or kill migratory birds. The law also applies to the removal of nests (such as swallow nests on bridges) occupied by migratory birds during the breeding season. The MBTA states that it is unlawful to take these species, their nests, their eggs, or their young anywhere in the United States.

California Endangered Species Act (CESA)

CESA (Fish & Game Code Section 2050, et seq.), which is administered by the CDFW,[100] prohibits the take[101] of plant and animal species designated by the Fish and Game Commission as either threatened or endangered in the State of California. Section 2081 of CESA allows the CDFW to

[100] Formally known as the CDFG

[101] "Take" in the context of CESA means to hunt, pursue, kill, or capture a listed species, as well as any other actions that may result in adverse impacts when attempting to take individuals of a listed species. The take prohibitions also apply to candidates for listing under CESA.

authorize exceptions to the state's prohibition against take of a listed species, such as for educational, scientific, or management purposes. Private developers whose projects do not involve a state lead agency under CEQA may not take a listed species without formally consulting with the CDFW and agreeing to strict measures and standards for protection of listed species.

Species in the project area, CRLF, WPT, salt marsh common yellowthroat, and San Francisco dusky-footed woodrat are not formally designated as threatened or endangered under the CESA, but are considered a California SSC. No formal consultation with the CDFW under the CESA is required for this project.

California Fish and Game Code

Sections 1600-1616

Under these sections of the Fish and Game Code, CDFW jurisdiction is determined to occur within the water body of any natural river, stream, or lake. The term stream, which includes creeks and rivers, is defined in Title 14, CCR, Section 1.72. The applicant is required to notify CDFW before constructing any project that would divert, obstruct, or change the natural flow, bed, channel, or bank of any river, stream, or lake. Preliminary notification and project review generally occur during the environmental review process. When a fish or wildlife resource may be substantially adversely affected, CDFW is required to propose reasonable project changes to protect the resource. These modifications are formalized in a Streambed Alteration Agreement that becomes part of the plans, specifications, and bid documents for the project. The proposed project would require a Streambed Alteration Agreement from the CDFW.

Sections 3511, 4700, 5515, and 5050

The classification of fully protected species was the state's initial effort to identify and provide additional protection to those animals that were rare or that faced possible extinction. Lists were created for fish, amphibians and reptiles, birds, and mammals. Most of the species on these lists have subsequently been listed under either the state or federal endangered species act or both, although there are several exceptions, including the golden eagle. The Fish and Game Code sections dealing with fully protected species state that these species "...may not be taken or possessed at any time and no provision of this code or any other law would be construed to authorize the issuance of permits or licenses to take any fully protected" species, although take may be authorized for necessary scientific research. This language arguably makes the "fully protected" designation the strongest and most restrictive regarding the take of these species. In 2003, the code sections dealing with fully protected species were amended to allow the CDFW to authorize the taking of those species for necessary scientific research, including efforts to recover fully protected, threatened, or endangered species.

SFGS is a fully protected species under the CESA and the proposed project, which is designed to enhance habitat for this species and its primary food source, CRLF, constitutes a recovery action pursuant to the Fish and Game Code. The SFRPD is required to consult with the CDFW prior to implementation of the proposed project.

Sections 3503 and 3513

Section 3503 prohibits the take and possession of any bird egg or nest, except as otherwise provided by the Fish and Game Code or subsequent regulations. Further, Section 3513 provides for the adoption of the MBTA's provisions. As with the MBTA, this state code offers no statutory or regulatory mechanism for obtaining an incidental take permit for the loss of nongame migratory birds. The administering agency for these sections is the CDFW.

Environmental Setting

The proposed project would be implemented entirely within Sharp Park (see Figure 3). Sharp Park provides habitat which supports several special-status species and high natural resource and recreational values that include Sanchez Creek, a free-flowing creek, LS, a large brackish lake, and associated wetlands including HSP and the connecting channel. It is situated between two regionally significant open spaces, Milagra and Sweeney Ridges. Sharp Park also provides: regionally important wildlife habitat and connections between habitat, attractive habitat for resident and migratory birds, and significant stands of coastal scrub habitat.

The information contained in this section is based on the information contained in the Biological Assessment[102] prepared by the SFRPD for this project, the Biological Opinion issued by the USFWS in October 2012 for this project, and two wetland delineation reports[103,104] prepared in November 2008 and May 2013.

Special-Status Species

The analysis of special-status species in this Initial Study addresses all special-status species anticipated to occur within the project area. For the purposes of this Initial Study, the term "special-status species" includes species that are: 1) legally protected by the FESA, CESA, or MBTA; or 2) locally significant sensitive species, including species on the National Audubon Society's Watch List or those under threat of local extirpation, as determined by the Yerba Buena chapter of the California Native Plant Society (CNPS) or the Golden Gate chapter of the National Audubon Society. State and federally listed species known to occur or that have been recorded historically in the project vicinity are presented in Table 4, below.

Legally protected species include species that are federally listed as endangered, threatened, or candidate species,[105] that are state listed as endangered, rare, threatened, California fully protected, or SSC, or that are listed in the MBTA. Protected species also include those listed as 1A or 1B on the CNPS plant list; that is, the 1A list is for plants presumed extirpated in California, and the 1B list is for plants that are rare, threatened, or endangered in California and elsewhere. No special-status plant species that are required to be addressed under CEQA Guidelines 15380[106] are known to occur within the project area.

[102] SFRPD. *Biological Assessment*. This Biological Assessment was amended on August 16, 2012. These documents are available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[103] Tetra Tech, Inc. *LS Wetland Determination Report*. This report is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[104] SFRPD. *Single Parameter Wetland Delineation Report*. This document is available for as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[105] "Candidate species" are plants and animals for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the FESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities.

[106] CEQA Guidelines Section 15380 provides that a plant or animal species may be treated as rare or endangered even if it is not on one of the official lists but otherwise meets the criteria for an endangered or rare species (e.g., it is likely to become endangered in the foreseeable future). For this reason, this Initial Study also addresses locally significant species, which include species on CNPS List 2A (plants presumed extirpated in California, but more common elsewhere), CNPS List 2B (plants rare, threatened, or endangered in California, but more common elsewhere), CNPS List 3 (plants about which more information is needed), and CNPS List 4 (plants of limited distribution).

The species from all lists are important for local conservation efforts and thus are analyzed in this Initial Study. However, impacts to federal, state, and CNPS 1A and 1B listed species are given additional consideration because of their protected status by federal and/or state laws.

The Biological Opinion issued by the USFWS for the proposed project concluded that the proposed project would not be likely to adversely affect the mission blue butterfly (*Icaricia icarioides missionensis*) given that the project site is located at least 0.5 miles away from mission blue butterfly habitat and the mission blue butterfly is not expected to occur in the intervening areas.[107] The former rifle range site, to which the removed sediment and debris would be transported, is located approximately 0.4 miles from the closest known potential habitat for the mission blue butterfly.[108] Therefore, this Initial Study concludes that no impact would result from the proposed project. Thus, this species is not addressed further in this Initial Study.

The CNDDB reports the occurrence of the bumblebee scarab beetle (*Lichnanthe ursina*) within Sharp Park. This species is not federally listed, but was a candidate for listing in the early 1990s. According to the CNDDB, specimens were collected from dunes near LS and although the collection date is unknown, the population is presumed to be extant. The larval stage of this species lives in sand layers, while the adult phase prefers coastal dunes. As the proposed project would affect a very limited extent of coastal dune areas of Sharp Park and would not occur in the beach areas, it would not have a substantial impact on this species.

In addition to those species listed in Table 4, a number of bird species breed or occur at Sharp Park. Some of these bird species are designated as Species of Local Concern by the Golden Gate Audubon Society including: American goldfinch; American kestrel; band-tailed pigeon; black-crowned night heron; clark's grebe; gadwall; great horned owl; hairy woodpecker; hutton's vireo; pacific-slope flycatcher; pied-billed grebe; purple finch; red-shouldered hawk; red-tailed hawk; say's phoebe; steller's jay; swainson's thrush; tree swallow; and violet-green swallow.[109] Some of these bird species inhabit primarily forests or woodlands, which are a substantial distance away from the project area. Others may nest in the wetland and coastal scrub habitats present in the project area.

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[107] USFWS. *Biological Opinion.* This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[108] Lisa Wayne, SFRPD. *Email to Kei Zushi, San Francisco Planning Department, MBB: Sharp Park,* July 16, 2013. This email is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[109] EIP Associates (EIP). *Final Draft 2006 SNRAMP, Sharp Park, February 2006.* Available online at: *http://sfrecpark.org/parks-open-spaces/natural-areas-program/significant-natural-resource-areas-management-plan/snramp/.* Accessed September 11, 2013.

Table 4. Listed species that could potentially occur in the Project Area[110,111,112]

Common Name	*Scientific Name*	Federal/State/ CNPS Status	Habitat	Likelihood of Occurrence/Notes on Occurrence
Reptiles and Amphibians				
California red-legged frog	*Rana aurora draytonii*	FT/SSC/--	Lowlands and foothills in or near permanent sources of deep water, with dense, shrubby, or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development.	C/ Recently observed at Sharp Park.
San Francisco garter snake	*Thamnophis sirtalis elegans*	FE/SE, SFP/--	Freshwater marshes, ponds, and slow-moving streams. Prefers dense cover and water depths of at least one foot.	C/ Reported near HSP in 2008.
Western pond turtle	*Clemmys marmorata*	--/SSC/--	Ponds, marshes, rivers, streams, and irrigation ditches with aquatic vegetation. Needs basking sites and upland habitat for egg-laying.[113]	C/ Presumed to occur at Sharp Park.
Birds				
Salt marsh common yellowthroat	*Geothlypis trichas sinuosa*	--/SSC/--	Saltwater and freshwater marshes. Requires thick cover for foraging and dense vegetation for nesting.[114]	C/ Presently occurs at Sharp Park.

110 USFWS. *Biological Opinion*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

111 USFWS. *Species*. Available online at: *http://www.fws.gov/species/*. Accessed July 11, 2013.

112 CDFG. *California Natural Diversity Database, Special Animals (898 Taxa)*, January 2011. Available online at: *http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/spanimals.pdf*. Accessed July 11, 2013.

113 Swaim Biological Incorporated. *Sharp Park Wildlife Surveys and Special Status Reptile and Amphibian Restoration Recommendations*, December 4, 2008 ("Sharp Park Wildlife Surveys"). This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

114 Shuford, W. D., and Gardali, T., editors, Western Field Ornithologists and CDFG. *California Bird 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 No. 1*, February 2008. Available online at: *https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=19854*. Accessed July 12, 2013.

Black-crowned night heron	*Nycticorax nycticoraz*	--/SA/--	Foothills and lowlands. Nesting takes place in thick-foliaged trees, dense fresh or brackish emergent wetlands, or dense shrubbery or vines near aquatic feeding areas.[115]	P/ Presently occurs at Sharp Park.
Mammals				
San Francisco dusky-footed woodrat	*Neotoma fuscipes annectens*	--/SSC/--	Riparian and oak woodland forests with dense understory cover or thick chaparral habitat.[116]	U/ Observed in Sharp Park, only on the east side of PCH.
Insects				
Myrtle's silverspot butterfly	*Speyeria zerene myrtleae*	FE/--/--	Coastal dunes, coastal prairie, and coastal scrub at elevations ranging from sea level to 1,000 feet, and as far as three miles inland. The adult butterflies prefer areas protected from onshore winds. Critical factors in the distribution of this species include presence of the presumed larval host plant, western dog violet (*Viola adunca*), and availability of nectar sources for adults.[117]	U/ The CDFW's Natural Diversity Database indicates that this species was extirpated. By the late 1970s populations of this species south of the Golden Gate Bridge were believed to be extinct and extant populations were known only from Marin County at the Point Reyes National Seashore.[118]
San Bruno elfin butterfly	*Callophrys mossii bayensis*	FE/--/--	Coastal chaparral, on steep north facing slopes, and in the fog-belt of the mountains near San Francisco Bay. This species closely follows the narrow, fragmented distribution of its larval host	U/ There are no rocky substrates or grassland habitats that contain the host plant for this species in the project area or its vicinity.

115 CDFW. *Stanislaus River Report, Black-crowned Night Heron*. Available online at: *http://www.dfg.ca.gov/delta/reports/stanriver/sr437.asp*. Accessed July 11, 2013.

116 H. T. Harvey & Associates. *Junipero Serra Traffic Calming Project Biological Resources Project, Project No. 3283-01*, September 26, 2011. This document is available for review as part of Case File No. 2012.1247E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

117 USFWS. *Recovery Plan for Seven Coastal Plants and the Myrtle's Silverspot Butterfly*, September 29, 1998. Available online at: *http://ecos.fws.gov/docs/recovery_plan/980930d.pdf*. Accessed July 11, 2013.

118 Ibid.

			plant, broadleaf stonecrop *(Sedum spathulifolium)*.[119]	
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT/--/--	Native grasslands on very large serpentine outcrops; secondary or "satellite" habitat islands of smaller serpentine outcrops with native grassland; and "tertiary" habitat areas, where both larval food plants occur on soils not derived from serpentine, but which have similarities to serpentine-derived soils.[120]	U/ There is no serpentine grassland habitat or grasslands supporting larval food plants of the bay checkerspot butterfly in the project area or its vicinity.
Plants				
San Francisco Bay spineflower	*Chorizanthe cuspidata var. cuspidata*	--/--/CNPS List 1B	Barren, disturbed sites on loose mineral soils. This species has been found in coastal prairie, coastal dune, coastal scrub, and coastal bluff scrub habitats. It occurs in Sonoma, Marin, San Francisco, San Mateo, and possibly Santa Clara counties; it is believed to have been extirpated in Alameda County.[121]	U/ Last observed in 1925 in Sharp Park. Presumed extirpated from Sharp Park.[122]

119 USFWS. *San Bruno Elfin Butterfly and Mission Blue Butterfly, 5-year Review: Summary and Evaluation*, February 2010. Available online at: *http://ecos.fws.gov/docs/five_year_review/doc3216.pdf*. Accessed July 11, 2013.

120 USFWS. *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area*, September 30, 1998. Available online at: *http://ecos.fws.gov/docs/recovery_plan/980930c_v2.pdf*. Accessed July 11, 2013.

121 Michael Wood, California Native Plant Society (CNPS), Yerba Buena Chapter. *Focus on Rarities (from the quarterly Yerba Buena Chapter Newsletter), San Francisco Bay spineflower*, September 1997. Available online at: *http://www.cnps-yerbabuena.org/experience/focus_on_rarities.html#pageTop*. Accessed July 11, 2013.

122 CDFG. *Natural Diversity Database. Chorizanthe cuspidata var. cuspidate, San Francisco Bay spineflower*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

Federal Status

FE = Endangered. Species in danger of extinction throughout all or a significant portion of its range.

FT = Threatened. Species likely to become endangered within foreseeable future throughout all or a significant portion of its range.

California State Status

SE = Endangered. Species whose continued existence in California is jeopardized.

SSC = Species of Special Concern

SFP = State Fully Protected under Sections 3511 and 4700 of the Fish and Game Code.

SA = Special Animal

California Native Plant Society

1A = Plants presumed extirpated in California

1B = Plants that are rare, threatened, or endangered in California and elsewhere

2A = Plants presumed extirpated in California, but more common elsewhere

2B = Plants rare, threatened, or endangered in California, but more common elsewhere

3 = Plants about which more information is needed

4 = Plants of limited distribution (a watch list)

LS = Locally Significant

Occurrence

P = Potential

C = Confirmed

U = Unlikely

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The following provides a description of the biology of special-status species that are known to occur on the project site or in its vicinity.

San Francisco Garter Snake

SFGS was listed as an endangered species under the FESA on March 11, 1967 and was listed as endangered by the State of California in 1971. SFGS is a fully protected species under California law. Historically, SFGSs occurred in scattered wetland areas on the San Francisco Peninsula from approximately the San Francisco County line south along the eastern and western bases of the Santa Cruz Mountains, at least to the Upper Crystal Springs Reservoir, and along the coast south to Año Nuevo Point in San Mateo County, and Waddell Creek in Santa Cruz County, California. Currently, the species has been reduced to only six significant populations in San Mateo County and northern Santa Cruz County. These sites include Pescadero Marsh, Año Nuevo, the San Francisco State Fish and Game Refuge, San Francisco Airport/Milbrae, Sharp Park Golf Course at Laguna Salada, and Cascade Ranch. There are two significant components to SFGS habitat, which include: 1) ponds that support CRLF and Pacific tree frogs; and 2) surrounding upland habitat that supports burrowing mammals such as Botta's pocket gopher and California vole. The preferred habitat of SFGS is vegetated ponds with an open water component near open hillsides where they can sun themselves, feed, and find cover in rodent burrows. SFGS avoids brackish marsh areas because their preferred prey base, primarily CRLF and Pacific tree frogs, have low tolerance to saline conditions. Adult SFGS sometimes overwinters and aestivates (passes the summer in a state of torpor) in rodent burrows during summer months when the ponds are dry. Mating occurs during both the spring and fall, but principally during the first few warm days of March.[123]

California Red-legged Frog

CRLF is a federally listed threatened species and California SSC. CRLF was listed as a threatened species on May 23, 1996. A Recovery Plan was published for CRLF on September 12, 2002. The historic range of CRLF extended from the vicinity of Elk Creek in Mendocino County, California, along the coast inland to the vicinity of Redding in Shasta County, California, and southward to northwestern Baja California, Mexico. CRLF predominately inhabits permanent water sources such as streams, lakes, marshes, natural and manmade ponds, and ephemeral drainages in valley bottoms and foothills up to 4,921 feet in elevation. They also inhabit ephemeral creeks, drainages, and ponds with minimal riparian and emergent vegetation. CRLF breeds from November to April, although earlier breeding records have been reported in southern localities. Breeding generally occurs in still or slow-moving water often associated with emergent vegetation, such as cattails, tules or overhanging willows. Sheltering habitat for CRLF potentially includes all aquatic, riparian, and upland areas within the range of the species and includes any landscape feature that provides cover, such as animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. CRLF does not have a distinct breeding migration. Dispersal distances are typically less than 0.5 miles, with a few individuals moving up to 1 to 2 miles.[124,125]

Western Pond Turtle

While the federal government does not list WPT, WPT is a California SSC. Historically, this species was relatively continuously distributed in most Pacific slope drainages, from Klickitat County, Washington, along the Columbia River to northern Baja California, Mexico. In

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[123] USFWS. *Biological Opinion*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[124] CDFG. *Amphibian and Reptile Species of Special Concern in California*, 1994. Available online at: *http://www.dfg.ca.gov/wildlife/nongame/publications/docs/herp_ssc.pdf*. Accessed April 9, 2013.

[125] USFWS. *Biological Opinion*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

California, it was historically present in most Pacific slope drainages between the Oregon and Mexican borders. WPT requires still or slow water. This aquatic turtle usually leaves the aquatic site to reproduce and aestivates, and overwinters. WPT may overwinter on land or in water, or they may remain active in water during the winter. Mating typically occurs in late April or early May, but may occur year-round.[126]

Salt Marsh Common Yellowthroat

The salt marsh common yellowthroat is one of 12 subspecies of the common yellowthroat recognized north of Mexico, and is listed as a California SSC. This subspecies is in decline due to loss of wetlands. The salt marsh common yellowthroat feeds on invertebrates and seeds, and is known as one of the three most frequent hosts of the cowbird, which lays its own eggs in the nests of other bird species.[127]

Black-crowned Night Heron

The black-crowned night heron is designated as a Special Animal by the CDFW. This bird species is a fairly common year-long resident of the foothills and lowlands throughout most of California. Nesting takes place in thick-foliaged trees, dense fresh or brackish emergent wetlands, or dense shrubbery or vines near aquatic feeding areas. The black-crowned night heron feeds primarily at night. Foraging is conducted largely along the margins of lacustrine, riverine, and fresh and saline emergent wetlands.[128]

San Francisco Dusky-footed Woodrat

The San Francisco dusky-footed woodrat occurs in a variety of woodland and scrub habitats throughout the South Bay and the adjacent central coast range, south to the Pajaro River in Monterey County. Woodrats prefer riparian and oak woodland forests with dense understory cover or thick chaparral habitat. Dusky-footed woodrats build large, complex nests of sticks and other woody debris, which may be maintained by a series of occupants for several years. Woodrats are also very adept at making use of human-made structures and can nest in electrical boxes, pipes, wooden pallets, and even portable storage containers. While the San Francisco dusky-footed woodrat is described as a generalist omnivore, individuals may specialize on local plants that are available for forage. The breeding season for dusky-footed woodrats begins in February and sometimes continues through September, with females bearing a single brood of one to four young per year.[129]

Migratory Fish and Birds

Some small fish species, such as sculpin, have been observed in LS and HSP. Other species such as mosquitofish may also occur. Many migratory birds use some areas of Sharp Park for foraging, nesting, and perching habitat.

Wildlife Corridors

Sharp Park is bordered in part by undeveloped areas, including Sweeney and Milagra Ridges, which allows it to serve as a relatively undisturbed corridor for wildlife, particularly birds. Sharp Park's connectivity to high-quality natural habitats also allows it to support medium size and

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[126] Swaim Biological Incorporated. *Sharp Park Wildlife Surveys*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[127] Ibid.

[128] CDFW. *Stanislaus River Report, Black-crowned Night Heron*. Available online at: *http://www.dfg.ca.gov/delta/reports/stanriver/sr437.asp*. Accessed July 11, 2013.

[129] H. T. Harvey & Associates. *Junipero Serra Traffic Calming Project Biological Resources Project, Project No. 3283-01*, September 26, 2011. This document is available for review as part of Case File No. 2012.1247E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

large mammals, including numerous general wildlife species, such as the black-tailed deer, bobcat, common porcupine, coyote, and mountain lion.

Native Wildlife Nursery Sites

Many areas in Sharp Park support potential or confirmed native bird nesting habitat and potential breeding habitat for other wildlife species. Native birds that may nest within this portion of Sharp Park include waterbirds, songbirds, and raptors and include such habitats as wetlands, grasslands, riparian scrub, and coastal scrub.

Habitat Types

Several different types of wetlands are present within Sharp Park, such as free-flowing creeks, open water, wet meadow, willow scrub, and fresh-to-brackish water marsh. Habitat types within or adjacent to the project area include coastal scrub, non-native grasslands, and wetlands. The area in which the proposed pond would be constructed is generally characterized as coastal scrub. The areas near the former rifle range site on the east side of PCH are generally covered with non-native grasslands.

Areas that meet the USACE criteria for wetlands or other waters of the U.S. may be protected under Section 1600 of the California Fish and Game Code and thus may be regulated by the CDFW. In addition, these areas are considered wetlands and thus are protected under the CCA. The USEPA and USACE assert jurisdiction over the following waters:[130]

- Traditional navigable waters;
- Wetlands next to traditional navigable waters;
- Nonnavigable tributaries of traditional navigable waters that are relatively permanent, where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); or
- Wetlands that directly abut the tributaries described in the previous bullet.

Under the CCA, an area is classified as a wetland if it meets only one of the three parameters required by Section 404 of the FCWA definition of a wetland: hydric soils, hydrophytic vegetation, or wetland hydrology.[131] Some wetlands may also meet criteria as "waters of the state" and be regulated by the SFBRWQCB.

In November 2008 a wetland delineation report was prepared for the LS wetland complex. Most of the wetlands delineated were characterized as freshwater marsh (19.56 acres), followed by wet meadow (2.44 acres) and willow scrub (0.93 acres).[132] These areas meet the USACE criteria for classification as wetlands. The unvegetated open water (4.49 acres) meets the USACE criteria for "other waters of the U.S.," due to the presence of an ordinary high water mark. In March 2009, the USACE confirmed this wetland delineation report.[133] All of these wetlands also meet the CCA criteria.

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130 USACE. *Revised Guidance on Clean Water Act Jurisdiction Following the Supreme Court Decision in Rapanos v. U.S. and Carabell v. U.S.*, December 2, 2008. Available online at: *http://www.usace.army.mil/missions/civilworks/regulatoryprogramandpermits/relatedresources/cwaguidance.aspx*. Accessed May 17, 2013.

131 USACE. *Corps of Engineers Wetland Delineation Manual*, January 1987. Available online at: *http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf*. Accessed May 17, 2013.

132 Tetra Tech, Inc. *LS Wetland Determination Report*. This report is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

133 USACE. *Letter to Ms. Kelly Bayer, Tetra Tech, Inc., Subject: File Number 2009-00044S*, March 9, 2009. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

Another wetland delineation report was prepared in May 2013 that evaluated wetlands located within the proposed project area that meet the CCA-only criteria.[134] The May 2013 wetland delineation report found that the proposed project would not affect any CCA-only wetlands. The acreage of each jurisdictional habitat type within the LS wetland complex is shown in Table 5, below.

Table 5. Wetland Habitat Types in LS Wetland Complex[135,136]

Habitat Type	Determination	Jurisdiction	Area (Acres)
Freshwater marsh	Wetlands	USACE/CCA	19.56
Willow scrub	Wetlands	USACE/CCA	0.93
Wet meadow	Wetlands	USACE/CCA	2.44
Unvegetated pond	Other Waters of the U.S.	USACE/CCA	4.49
Total wetlands/waters			**27.46**

Project Impacts

USFWS's Biological Opinion

A Biological Assessment was prepared by the SFRPD for the proposed project to facilitate a consultation, pursuant to Section 7 of the FESA.[137] Based on this Biological Assessment, the USACE's October 25, 2011 request for the initiation of formal consultation with the USFWS, numerous phone calls and emails between the SFRPD and USFWS, and other information available to the USFWS, the USFWS prepared and issued a Biological Opinion regarding this project under the authority of the FESA.[138] The Biological Opinion describes the proposed project,[139] evaluates the potential effect of the proposed project on CRLF and SFGS, and identifies Conservation Measures that would reduce impacts to federally-listed species.[140] The Biological

[134] SFRPD. *Single Parameter Wetland Delineation Report.* This document is available for as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[135] Tetra Tech, Inc. *LS Wetland Determination Report.* This report is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[136] SFRPD. *Single Parameter Wetland Delineation Report.* This document is available for as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[137] SFRPD. *Biological Assessment.* This Biological Assessment was amended on August 16, 2012. These documents are available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[138] USFWS. *Biological Opinion.* This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[139] The proposed project is part of the project for which the Biological Opinion was issued by the USFWS. The proposed project, except for the construction of a 1,600-sf pond, is outlined under "Construction Action" on pages 5 and 6 of the Biological Opinion. The proposed construction of a 1,600-sf pond is outlined under "Conservation Measures for Golf Course Maintenance and Operations" on page 19 of the Biological Opinion.

[140] The Biological Opinion issued by the USFWS included the proposed project, as well as the ongoing operations and maintenance of the golf course. Although ongoing golf course operations and maintenance activities, such as pump

Opinion concluded that the proposed project would not be likely to jeopardize the continued existence of the CRLF or SFGS based on the Conservation Measures to be implemented as part of the project. These Conservation Measures are intended to minimize the likelihood or potential for take of individual CRLF and SFGS.

An Incidental Take Statement is also included in the Biological Opinion.[141] The Incidental Take Statement provides the maximum amount of incidental take of CRLF and SFGS anticipated for the proposed project, effects of the take, and terms and conditions related to the Incidental Take Statement. The proposed project is subject to these Terms and Conditions. According to the Incidental Take Statement, the USFWS anticipates, even with implementation of the Conservation Measures as outlined on pages 11 through 13 of the Biological Opinion, that:

1) All CRLF in the 0.624-acre area[142] within the HSP construction site will be subject to incidental take in the form of harassment and capture;
2) In total one CRLF adult will be subject to incidental take in the form of death or injury as a result of construction activities;[143]
3) All SFGS in the 0.624-acre construction area will potentially be harassed as a result of ground disturbing activities, and take of this species is expected to be in the form of harassment and no SFGS is expected to be killed or injured as a result of construction activities; and
4) All SFGS and CRLF in the restoration[144] area footprint will be subject to incidental take in the form of harassment as a result of the direct effects of removal of plants, revegetation activities, and other activities associated with pond construction.

Impact BIO-1: The proposed project would not conflict with an adopted habitat conservation plan or natural community plan. (Less than Significant)

The only adopted conservation or management plan applicable to Sharp Park is the 1995 SNRAMP. The proposed 2006 SNRAMP is currently under environmental review and has not yet been adopted. As discussed in Section C, Compatibility with Existing Zoning and Plans, the project would not conflict with the 1995 or the proposed 2006 SNRAMP. Therefore, this impact is less than significant.

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management and operation, mowing, and golf cart use, are discussed in the Biological Opinion, these ongoing operations and maintenance activities are not considered part of the proposed project for purposes of this CEQA analysis, but rather are considered part of the existing, or baseline, conditions.

[141] "Incidental Take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the FESA provided that such taking is in compliance with the Incidental Take Statement.

[142] The 0.624-acre area includes the areas where the "Construction Activities" would take place. "Construction Activities" in the Biological Opinion include all of the elements of the proposed improvements to the pumphouse (construction of steps and a maintenance walkway and replacement of the existing wooden retaining wall), removal of sediment and emergent vegetation in HSP and the connecting channel, and realignment of the existing golf cart paths.

[143] "Construction Activities" in the Biological Opinion include all of the elements of the proposed improvements to the pumphouse (construction of steps and a maintenance walkway and replacement of the existing wooden retaining wall), removal of sediment and emergent vegetation in HSP and the connecting channel, realignment of the existing golf cart paths.

[144] "Restoration" includes the proposed creation of a perennial pond per Conservation Measure 32 of the Biological Opinion and the restoration of one half acre of upland habitat per Conservation Measure 29 of the Biological Opinion. See page 37 of the Biological Opinion for more information. A Categorical Exemption (Planning Case No. 2013.1008E) was issued on August 5, 2013 concerning the restoration of one half acre of upland habitat.

Impact BIO-2: The proposed project could have a substantial adverse effect, either directly or through habitat modifications, on special-status species. (Less than Significant with Mitigation)

The proposed project includes improvements to existing facilities and enhancement and creation of habitat for CRLF and SFGS. The project's potential impacts to each of the special-status species that are known or have the potential to occur at the project site are addressed below.

California Red-legged Frog and San Francisco Garter Snake

Potential effects of the proposed project to CRLF and SFGS are addressed in the Biological Opinion prepared by the USFWS.[145] The jeopardy analysis in the Biological Opinion relies on four components: 1) the status of the species, which evaluates CRLF's and SFGS's range-wide conditions, the factors responsible for that condition, and their survival and recovery needs; 2) the environmental baseline, which evaluates the condition of these species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of these species; 3) the effects and action, which determines the direct and indirect effects of the proposed federal action and the effects of any interrelated or interdependent activities on these species; and 4) cumulative effects, which evaluate the effects of future, non-federal activities in the action area on them.

The Biological Opinion noted that because CRLF and SFGS have been observed throughout the project site, the effects of the construction activities to wetland and upland habitat and to individual CRLF and SFGS will be throughout the 0.624-acre construction footprint. Injury, exposure disorientation and disruption of normal behaviors will likely result from: 1) excavation of sediments and vegetation as part of the golf cart path realignments; 2) the removal and/or disturbance of vegetation, sediments, and cover sites including animal burrows, boulders ofr rocks, organic debris such as downed trees or logs in HSP and the connecting channel; 3) construction of a maintenance walkway around the pumphouse at HSP; and 4) soil disturbance and fill associated with replacement of the wooden retaining wall with a concrete retaining wall at HSP. Construction noise, vibration, and increased human activity during the construction may interfere with normal behaviors such as feeding, sheltering, movement between refugia and foraging grounds, and other essential behaviors. This can result in avoidance of areas that have suitable habitat and can cause disturbance to the species. Direct effects may include injury or mortality from being crushed by earth moving equipment, construction debris, and worker foot traffic. Work activities, including noise and vibration, may result in adverse effects to CRLF and SFGS by causing them to leave the work area. This disturbance may increase the potential for predation and desiccation.

The Biological Opinion further states that, as demonstrated at Mori Point, the proposed creation of a pond can benefit CRLF and SFGS and that the proposed removal of emergent vegetation (cattails and bulrush) would improve breeding habitat for CRLF. Although ultimately serving as a long-term conservation measure for CRLF and SFGS, these activities may also result in adverse effects to both species during construction. Short-term direct and indirect adverse effects to CRLF and SFGS are likely to be minimized, provided that the SFRPD constructs the pond following the scope and design of the existing GGNRA ponds at Mori Point.

The Biological Opinion concluded that the proposed project would not be likely to jeopardize the continued existence of the CRLF or SFGS with implementation of conservation measures

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[145] USFWS. *Biological Opinion*, Pages 30 through 32, 37, and 38. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

included in the Biological Opinion. These conservation measures, along with the applicable Terms and Conditions included in the Incidental Take Statement, would minimize the likelihood of potential for take of individual CRLF and SFGS and are included in **Mitigation Measure M-BIO-2a**, as outlined below.[146]

The proposed project would also be subject to the Terms and Conditions related to the Incidental Take Statement issued by the USFWS for this project. To be exempt from the prohibitions of Section 9 of the FESA, the USACE and the SFRPD shall ensure compliance with these Terms and Conditions. The Terms and Conditions include measures intended to minimize the impact of incidental take on CRLF and SFGS.

The measures included in the Terms and Conditions in the Biological Opinion that are applicable to the proposed project are incorporated in **Mitigation Measure M-BIO-2a**, as outlined below.

Mitigation Measure M-BIO-2a - Protection of CRLF, SFGS, and WPT

1. All sensitive habitats outside the construction site shall be avoided during and following project implementation. All biologists working on the project and their roles shall be approved by the USFWS and CDFW[147] based on their qualifications. All approved biologists shall be part of the Project Implementation Team. The SFRPD shall designate one of the USFWS/CDFW-approved biologists to oversee and coordinate all avoidance and survey tasks of the Project Implementation Team. Prior to the commencement of any project-related construction activity, an approved biological monitor shall flag the sensitive areas and/or the limits of the construction site with suitable markers that are easily discernible by construction equipment operators. No construction equipment or personnel shall enter the sensitive areas designated for avoidance by the project;

2. The lead USFWS/CDFW-approved biological monitor shall be present at all planning meetings prior to project implementation. A USFWS/CDFW-approved biological monitor shall present an educational program at one or more such meetings regarding the listed species and their habitats. Every person who works on project implementation shall receive this education program and sign a form indicating they have attended and agree to abide by the terms and conditions being implemented to avoid take of listed species and/or habitat. A USFWS/CDFW-approved biological monitor shall be present at the site during all construction activities including, but not limited to, vegetation and sediment removal, placement of concrete support structures for the walkway, replacement of the retaining wall and pathway repair. The biological monitor shall have the authority to stop work temporarily in order to protect the listed species or the flagged sensitive areas;

3. Prior to commencement of any construction activities and daily prior to construction each day, a USFWS/CDFW-approved biological monitor shall survey the site for listed species. A USFWS/CDFW-approved biologist shall also oversee the installation of exclusion fencing in segments or fully enclosing components of the construction site as appropriate. The biological monitor shall inspect the integrity of the exclusion fencing on a daily basis;

4. During the proposed sediment and vegetation removal activities, if required, up to three biological monitors shall be present to: 1) monitor the area of vegetation or sediment

[146] The conservation measures in the Biological Opinion have been modified to include measures to protect WPT and included in Mitigation Measure M-BIO-2a.

[147] Formally known as CDFG

removal; 2) observe the material as it is transferred to the shoreline; and 3) inspect material as it is loaded into a container/dump bed that will allow the water in the excavated sediment to drain out before removal from the site;

5. Biological monitors shall complete a daily monitoring log that records information on compliance and construction activities as well as avoidance measures implemented each day during the project. Each monitor shall submit a daily monitoring report from to the lead biologist before the start of the next construction day. Photographic documentation of project activities shall accompany each daily monitoring log. Within 60 days of completion of the project, the SFRPD shall submit a report to the USFWS and CDFW documenting compliance with the terms and conditions and avoidance of unauthorized take of species or habitat;

6. No earthmoving or soil disturbing work shall occur starting October 31 and ending June 1, the breeding season for CRLF and the season when SFGS are less active on the site;

7. Terrestrial vegetation in undisturbed areas around HSP and the connecting channel shall be cleared by manual means to a height of four inches (or a height that allows visibility of the ground) under the supervision of an approved biological monitor and checked for the presence of CRLF, SFGS, and WPT;

8. Prior to ground disturbing activities associated with construction, including the use of staging or vehicle access areas or the removal or placement of fill or construction materials, rodent burrows in the construction site shall be hand excavated by a USFWS/CDFW-approved biologist until the burrow terminates or until a maximum depth of 30 centimeters;

9. Vehicle speeds in the project area shall not exceed 10 miles an hour. The USFWS/CDFW-approved biological monitor shall inspect for CRLF, SFGS, and WPT underneath any vehicle that is parked for 30 minutes or more prior to moving the vehicle. All construction personnel shall inspect under their tires and vehicle if it is in idle for more than five minutes and has not been inspected by the on-site monitor. Vehicles accessing the construction site shall be limited to the minimum necessary to complete the project. Project personnel shall park personal vehicles at a staging area located away from all aquatic habitats or areas of sensitive upland habitat;

10. Any workers on the site that observe any frog, snake, or turtle shall immediately report their findings to the on-site biological monitor and immediately suspend work that may be harmful to the individual. The monitor shall identify the animal if it has not left the area. If a CRLF, SFGS, or WPT is observed in the work area, it shall be relocated by a USFWS/CDFW-approved biological monitor to the nearest suitable aquatic habitat out of harm's way. Work may only recommence if CRLF, SFGS, and WPT move out of harm's way or the animal is relocated by the biological monitor. Work may not recommence until the biological monitor has returned to the work area and gives approval;

11. Only USFWS/CDFW-approved personnel shall be allowed to capture or attempt to capture and move CRLF, SFGS, WPT, or other non-listed wildlife (e.g., treefrogs, small rodents) in the work area;

12. Erosion control best management practices (silt fences, coir rolls, straw bales) shall be employed as part of the dewatering of sediments after removal and while soils are exposed. The erosion control measures shall not include netting, plastic or natural monofilament netting or other materials that may entrap CRLF, SFGS, or WPT;

13. After completion of the project, the access routes in the wetland shall be revegetated with appropriate native plants and erosion control measures, as described in Measure 12, as outlined above, shall be installed on exposed soils with slopes of 3:1 or greater;

14. All construction activities shall occur in uplands and on the golf course. Stockpiling and staging areas shall be located in the uplands and in areas cleared for species and the golf course. Construction materials (bricks, boards, shoring, concrete forms, etc.) shall be elevated approximately four to six inches above ground to minimize the potential for species to take cover under these items. If feasible, materials shall be staged on a trailer/truck bed to avoid contact with the ground. Construction materials shall be brought to on-site staging areas as close to the time they are needed as possible;

15. The SFRPD shall minimize the potential for harm, harassment, injury, and death of federally listed wildlife species resulting from project-related activities including implementation of the Conservation Measures in the Biological Opinion;

16. If requested, during or upon completion of construction activities, the SFRPD shall ensure the USFWS, CDFW, or their authorized agents have immediate access to the project area. The on-site biologist and/or a representative from the USACE/SFRPD shall accompany USFWS personnel on an on-site inspection of the project area(s) to review project effects to CRLF and SFGS and their habitat;

17. The SFRPD shall ensure compliance with the Reporting Requirements of the Biological Opinion;

18. During the course of construction activities, biological monitors may determine that relocation of a CRLF or SFGS is necessary for the safety of individual animals. If it is determined that a SFGS needs to be moved, the USFWS shall be contacted for further guidance. Individuals shall be relocated to appropriate sites away from disturbance on Sharp Park property;

19. Within nine months of issuance of the Biological Opinion, the SFRPD shall develop, for the USFWS review and approval, a monitoring plan for the new perennial pond. The plan shall include monitoring of: 1) the use of the pond by all life stages of CRLF and SFGS, 2) the amount of emergent vegetation and open water available, and 3) how effective barriers are at preventing entry by people and off-leash dogs. If predators become established in the pond they shall be immediately removed and the USFWS shall be notified; and

20. Implementation of the pond monitoring plan shall begin immediately following the construction of the new pond.

In response to the Neighborhood Notice circulated on January 15, 2013, some of the commenters raised concerns related to impacts to CRLF and SFGS and their habitat resulting from acid sulfate soils being disturbed in the water during the proposed removal of sediment and emergent vegetation in HSP and the connecting channel and culverts that link HSP and LS. During implementation of sediment and vegetation removal work, sediment present at the bottom of the water would be disturbed, resulting in a temporary suspension of sediment in the water column. Although unlikely, these sediments may contain sulfides and other components which, once disturbed or suspended in the water column, could have adverse impacts to special-status species, their habitat, or water quality.

When exposed to dissolved or atmospheric oxygen, sulfides transform to sulfuric acid, which in turn results in the formation of acid sulfate soils. An increase in the amount of exposed acid sulfate soils in water bodies generally causes a decrease of the pH of water (an increase in acidity of the water) and a decrease in the amount of dissolved oxygen in the water, causing anoxic conditions[148] in which resuspension of anoxic hydrogen sulfide sediments may result in pulses of low oxygen conditions in HSP. This could cause mortality of CRLF larvae and juveniles.[149]

Anoxic sediments containing sulfides have associated bacteria like *Thiobacillus* sp. that reduce sulfur. Bacterial respiration near the bottom of a waterbody can modify oxygen concentrations in overlying water causing some level of anoxia. When this condition occurs, the pH of the water begins to decline resulting in an acidic environment. Depletion of oxygen in the water column is mediated by the rate of photosynthesis during peak portions of a day. The degree to which water becomes acidified depends on the length of time that sulfides are suspended in the water column and the amount of sulfides in the water column. In general, the longer that sulfidic soils are suspended in the water column, the more chance there is for acidic conditions to occur. Even if acid sulfate soils are present, the suction hydraulic equipment could be used to minimize suspension of sediments relative to other sediment removal methods, and sulfides will settle out of the water column quickly. Therefore, anoxic conditions are expected to be localized and short-term. CRLF larvae and juveniles are likely to escape these small, short-lived anoxic zones as they dissipate with settling of the sediment and dilution by the pond.[150,151]

The Biological Opinion[152] issued by the USFWS concluded that the proposed project would not jeopardize the continued existence of the CRLF or SFGS with the implementation of the Conservation Measures included in the Biological Opinion, which limit the construction to June 1 through October 31 and include measures to protect species, such as pre-construction avoidance and survey tasks, site monitoring by USFWS/CDFW-approved biologists during construction activities, limitations on vehicle speeds in the project area, erosion control measures, and others. The Biological Opinion concluded that the Conservation Measures, which limit the construction period to June 1 through October 31, would minimize the likelihood that adult or juvenile CRLF would be present and would reduce potential adverse effects on CRLF.

A literature search indicates that very little research has been done on acid sulfate soils in the San Francisco Bay Area. One case in which acid sulfate soils have arisen as a concern is at the Bair Island tidal marsh restoration area, in Redwood City, California. In that case, the main concern was that sediments that had been excavated and stockpiled for re-use at the site contained

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148 "Anoxic condition" means a condition in which hydrogen ion availability increases and binds with sulfides mobilized from sediments.

149 Harry Gibbons and Robert Plotnikoff, Tetra Tech, Inc. *Technical Memorandum, Revised Review of Acid Sulfate Soils, Potential Release Mechanism, and Risk of Release in the Horse Stable Pond and Connecting Channel Sediment Removal Project.* August 27, 2013 ("Acid Sulfate Soils Technical Memorandum"). This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

150 Robert Plotnikoff, Tetra Tech, Inc. *Email to Stacy Bradley, SFRPD, Suggested Change to the MND,* December 3, 2013. This email is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

151 Robert Plotnikoff, Tetra Tech, Inc. *Email to Alexis Ward, SFRPD and David Munro, Tetra Tech, Inc., Sharp Park,* December 30, 2013. This email is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

152 USFWS. *Biological Opinion.* This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

sulfides that converted to sulfates as the sediments dried out. Re-use of these materials could result in acidic and hypoxic conditions. Since materials excavated at the LS wetlands complex would not be re-used as part of the project, hypoxic conditions would not result from re-use of dried sediments as part of the proposed project. Specific case studies of instances where acid sulfate soils effects have occurred in Bay Area restoration sites have not been identified.[153]

Removal of sediment in the connecting channel between HSP and LS, similar to the proposed sediment removal, was reported to have occurred more than 10 years ago. At that time, no effects that would normally be associated with acid sulfate soils, including acidification of waters and sediment surfaces, were identified. At the time of the previous removal, it was reported that the bottom of HSP was lined with gravel. The previous sediment removal activity removed sediments that had accumulated after the seawall, which eliminated saline water input into the wetland complex, was constructed. Because the sediment to be removed as part of the proposed project is likely to have only accumulated since the last removal activity, it is unlikely that acid sulfate soils would exist in the excavated sediments. The construction of the seawall eliminated saline water input into the wetland complex. Sources of these sediments include input from the watershed during storms, as well as accumulated organic matter from dead and decaying vegetation in the watershed complex. This means that these sediments accumulated without the saline conditions that allow acid sulfate soils to form, and can be eliminated as a contributor to acid sulfate soils conditions.[154] This supports the conclusion that the proposed sediment and vegetation removal would not likely result in substantial disturbance of acid sulfate soils in the water column, which may in turn result in a significant impact to special-status species.

Environmental effects that may occur from excavating sediments in the presence of acid sulfate soils may include one or more of the following: 1) increase in sulfuric acid; 2) decline in pH; 3) increase in dissolved metal concentrations (aluminum, iron, and arsenic); and 4) increased incidence of hypoxia.[155] Any of the above effects could result in significant impacts (e.g., effects that could jeopardize the continued existence of a population of special-status species or effects to water quality beyond thresholds indicated in state or federal water quality standards) to special-status species or water quality. In order to ensure that hypoxic conditions do not materialize and to mitigate such conditions in the unlikely event that they do occur, **Mitigation Measure M-BIO-2b** as outlined below would be implemented by the SFRPD during construction to reduce the potential for adverse impacts to special-status species as a result of acid sulfate soils and other components. **Mitigation Measure M-BIO-2b** requires that sediment core sampling tests be conducted and specific remediation measures be implemented by the SFRPD if results of the sediment core sampling tests reveal the need for such remediation measures prior to commencement of any on-site work related to the removal of sediment and emergent vegetation in HSP or the connecting channel and culverts that link HSP and LS. **Mitigation Measure M-BIO-2b** requires that a toxics pathway analysis be conducted for potential risks and toxicities to species that may be affected by localized increases in acidity, hypoxia, or dissolved metals concentration should the potential for acid sulfate soils and anoxic conditions be present. This method for analyzing potential for bioaccumulation of toxics in the environment is a recommended approach for determining risk to wildlife and plants.[156] Pathway analysis is used to

[153] Harry Gibbons and Robert Plotnikoff, Tetra Tech, Inc. *Acid Sulfate Soils Technical Memorandum.* This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[154] Harry Gibbons and Robert Plotnikoff, Tetra Tech, Inc. *Acid Sulfate Soils Technical Memorandum.* This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[155] Ibid.

[156] USEPA. *Framework for Metals Risk Assessment, EPA 120/R-07/001,* March 2007. Available online at: *http://www.epa.gov/raf/metalsframework/pdfs/metals-risk-assessment-final.pdf.* Accessed July 17, 2013.

determine environmental conditions that would mobilize toxics and increase exposure that could have chronic or acute effects.

Mitigation Measure M-BIO-2b - Protection of Special-Status Species and Water Quality from Acid Sulfate Soils and Other Components

Prior to commencement of any on-site work related to the proposed removal of sediment and emergent vegetation in HSP or the connecting channel and culverts that link HSP and LS, sediment core sampling tests shall be conducted in the manner specified in this mitigation measure.

The result of the sediment core sampling tests and remediation measures recommended by a qualified SFRPD biological/hydrological consultant, if any, shall be submitted to the USFWS and CDFW for review and approval prior to commencement of any on-site remediation work or sediment/vegetation removal work at HSP or the connecting channel and culverts. If the USFWS or CDFW determines, based on the results of the sediment core sampling tests, that remediation measures are required, the SFRPD shall submit a remediation and monitoring plan to all applicable resource agencies for review and approval prior to implementation of the remediation measures. Copies of all correspondence with the resource agencies shall be submitted to the ERO for review. The sediment core sampling tests shall include the following elements:

1. Work Plan

   A Work Plan for sediment core sampling tests shall be prepared by a qualified SFRPD biological/hydrological consultant and submitted to the USFWS and CDFW for review and comment prior to commencement of any on-site work related to the sampling tests. The Work Plan shall describe, at a minimum, compliance with ~~Item~~Tasks 2 through 6 of this mitigation measure. Copies of all correspondence with the ~~resource~~responsible agencies shall be submitted to the ERO for review.

2. Sampling of Sediment Cores

   The sampling test shall include collection of, at minimum, one sediment core from HSP, two from the connecting channel, and one from LS. The exact locations of sampling shall be determined pursuant to the work plan developed in accordance with ~~Item~~Task 1, above. Sample sediment cores shall include the soils between the current surface sediment level and approximately two to three feet below the current surface. This depth shall be at least one foot below the proposed depth of the future sediment-water interface.

3. Analysis of Sediment Cores and Estimation of the Potential for Formation of Acid Sulfate Soils

   The sediment cores shall be analyzed every five centimeters over the first 20 centimeters of core depth and then every 10 centimeters for the remainder of the core length for the following components: Total Organic Carbon (TOC), carbonate/bicarbonate, sulfate, sulfide, sulfites, pH, calcium, sodium, iron, aluminum, chloride, conductivity, redox potential, refractory organics, organic nitrogen, total phosphorus, ammonia, nitrate+nitrite nitrogen, soluble reactive phosphorus, organic phosphorus, loosely-sorbed phosphorus, iron-phosphorus, iron-phosphorus, aluminum-phosphorus, and calcium-phosphorus. Sediment core chemistry shall be analyzed to assess the potential reduction of sulfate to form hydrogen sulfate, iron sulfides, and reduction buffering capacity relative to acid-neutralizing capacity.

In addition, sediment oxygen demand (SOD) in the sediment cores shall be measured. Results shall be compared to the total oxidizable organic material, which would be estimated from the difference of TOC and refractory organic carbon (labile carbon). These results shall be used in the analysis of potential for formation of anoxic conditions within the newly restored HSP and connecting channel.

Sediment cores shall be analyzed based on Toxicity Reference Values (TRVs) from the USEPA and Screening Quick Reference Tables (SQuiRT) from the NOAA.[157] A draft summary of potential toxics shall be provided to the USFW, CDFW, and ERO for review and, if needed, revision will be made to the toxicity ranges appropriate for use in analyzing the sediment cores.

The potential for formation of acid sulfate soils and anoxic conditions in the water column shall be estimated based on this analysis and in coordination with the USFWS and CDFW. If this analysis determines that acid sulfate soils could be present in this location, the SFRPD shall perform a toxic pathway analysis[158] to determine the appropriate remediation measures. The analysis results and determination shall be submitted to the USFWS, CDFW, and ERO for review.

4. Toxics Pathway Analysis

Should the potential for acid sulfate soils and anoxic conditions be present, a toxics pathway analysis shall be conducted for potential risks and toxicities to species that may be affected by localized increases in acidity, hypoxia, or dissolved metals concentration. During this Task, toxicity standards shall be established by the USFWS, CDFW, and ERO based on the results of ~~Item~~Tasks 2 and 3 above, site-specific hydrologic conditions including water exchange and dissolved oxygen levels, the species that are known to be present, and literature review. The results of this task shall be submitted to the USFWS and CDFW and any applicable ~~resource~~responsible agencies for review and approval. Copies of all correspondence with the ~~resource~~responsible agencies shall be submitted to the ERO for review.

Should the results of the sediment core tests reveal that there has been an appreciable increase in the amount of nitrogen and related compounds in the sediment cores, any necessary measures to remediate such compounds shall be undertaken in accordance with Task 5, below. The SFRPD shall hire a qualified biological/hydrological consultant to prepare a remediation and monitoring plan which shall be submitted to the USFWS and CDFW for review and approval. Copies of all correspondence with the resource agencies shall be submitted to the ERO for review.

5. Remediation

If results of the sediment core chemistry analysis reveal the potential for reduction of sulfate to form hydrogen sulfate, iron sulfides, and its reduction in buffering capacity relative to acid-neutralizing capacity, or if the toxics pathway analysis indicates that their

[157] The National Oceanic and Atmospheric Administration (NOAA), Office of Response and Restoration. *SQuiRT Cards.* Available online at: *http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html.* Accessed July 17, 2013.

[158] A toxics pathway analysis identifies potential risks and toxicities to species that may be affected by localized increases in acidity, hypoxia, or dissolved metals concentration.

presence could potentially result in substantial stress to special-status species, the SFRPD shall implement remediation measures, as approved by the USFWS and CDFW.

Remediation measures could include, but are not limited to:

a. Addition of lime to neutralize any acid that exists or which may form during the sediment removal process;

b. Injection of sodium nitrate to oxidize the sediments, thereby satisfying the sediment oxygen demand; or

c. Use of suction hydraulic sediment removal that reduces re-suspension of any form of sediments.

Depending on the severity of the condition (e.g., hypoxia), the remediation measure selected for implementation would be the least intensive beginning with Item a, when signs of hypoxia are present, to the most intensive with Item c, when hypoxia is persistent and/or widespread. The SFRPD shall select the remediation measure in consultation with the USFWS and CDFW. The remediation measure shall be selected based on immediate threats to species and sensitive life stages present during occurrence of the hypoxic condition.

6. Monitoring

During sediment and vegetation removal in HSP and the connecting channel and culverts, pH levels immediately above the sediment shall be monitored by the SFRPD to ensure that implementation of the proposed project would not adversely affect special-status species.[159] To ensure that residual acid sulfates in the water column would not adversely impact special-status species, pH levels in HSP and the connecting channel shall be monitored by the SFRPD for a period of six weeks after the proposed sediment and vegetation removal is completed. A remediation measure, such as addition of lime or injection of sodium nitrate, shall be implemented if the monitoring warrants such a remediation measure to protect special-status species based on the toxicity standards that are established in accordance with Task 4 above.[160]

To facilitate the proposed sediment and emergent vegetation removal and to reduce potential impacts to CRLF, the water level of HSP and the connecting channel may be lowered through the use of the existing pumps in consultation with the USFWS and CDFW. If water levels in HSP or LS fall below sea level and beach groundwater levels, then saline groundwater may flow into the lagoon from the beach.[161] CRLF cannot breed when salinity levels exceed approximately four

[159] pH is an indicator of anoxic conditions at the sediment-surface water interface. Under anoxic conditions, hydrogen ion availability increases and binds with sulfides mobilized from sediments. Rates of transformation of sulfur are mediated by microorganisms in both the sediments and surface water. Suspension of hydrogen sulfide (H_2S) in the water column is oxidized in surface water to form sulfuric acid (H_2SO_4).

[160] David Munro, Tetra Tech, Inc. *Email to Stacy Bradley, SFRPD, Sharp Park Appeal: M-BIO-2b - Post Construction Monitoring*, January 7, 2014. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[161] USFWS. *Biological Opinion*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

parts per thousand (ppt).[162] Although salinity levels may increase in HSP, the construction period would be short and would not correspond to the breeding season of CRLF. After construction is complete, winter storm runoff would result in substantial freshwater inputs to the wetland complex, causing any increased salinity levels to return to baseline levels. Therefore, the potential impacts to CRLF associated with increased salinity levels would be temporary and would occur outside the breeding season for CRLF, and would not be considered significant.

To facilitate the proposed sediment and emergent vegetation removal and to reduce potential impacts to CRLF, suction hydraulic equipment may be used in consultation with the USFWS and CDFW to minimize the disturbance of sediments in the water. While generally resulting in a higher percentage of water in the excavated materials than a clamshell dredge, the use of suction hydraulic equipment generally results in less turbidity and overall disturbance at the point of use than a clamshell. In sensitive environments, the use of suction hydraulic equipment is often preferred provided that the excavated materials and residual water are properly handled so they do not result in a significant impact on the environment. If suction hydraulic equipment is to be used as part of this project, the slurry that is created by suction hydraulic equipment would go into a settling area until the sediments settle out and the decant water can be tested for its acidity. If the result of such testing indicates that the water is pH neutral, it would either be released into HSP or pumped into the Pacific Ocean.[163,164] Should any permit be required by the SFBRWQCB for the discharge of the water into the Pacific Ocean as part of this project, the SFRPD will seek such a permit and comply with any conditions that may be attached to the permit. In light of the above, the use of suction hydraulic equipment as part of the proposed sediment and vegetation removal would not result in any significant impacts on the environment.

The Biological Opinion discusses the possibility of CRLF mortality through entrainment (individuals being pulled along with water and trapped against screening or pulled into the pumps) of egg masses and individual larvae at the pumps (see pages 33 and 34 in the Biological Opinion). The Biological Opinion further discusses the restoration actions and conservation measures that the SFRPD is committing to in order to reduce these effects and protect the species. The Biological Opinion concludes that this project, including the conservation measures, the uplands restoration work, and the continued operations and maintenance of the golf course, is not likely to jeopardize the continued existence of CRLF or SFGS. The conservation measures set forth in the Biological Opinion and incorporated into the project description and mitigation measures would reduce the adverse effects of the proposed construction and operations and maintenance activities on the survival and recovery of CRLF and SFGS. As a result, the proposed installation of secondary screen would not result in significant impacts to CRLF or SFGS.

Although construction activities could result in temporary impacts to CRLF and SFGS that are considered significant as discussed above, implementation of **Mitigation Measures M-BIO-2a** and **M-BIO-2b** would reduce the project's impacts to CRLF and SFGS to a less-than-significant level.

Western Pond Turtle

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162 Swaim Biological Incorporated. *Sharp Park Wildlife Surveys*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

163 David Munro, Tetra Tech. *Email to Stacy Bradley, SFRPD, Feedback on MND Appeal*, November 26, 2013. This email is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

164 David Munro, Tetra Tech. *Email to Stacy Bradley, SFRPD, Revised Text*, November 26, 2013. This email is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

Impacts to WPT from the proposed project would be similar to those described above for CRLF. However, because the restoration activities would occur during the WPT nesting season, the magnitude of those impacts would be potentially greater for this species. Temporary impacts from construction activities would result in the disturbance of feeding, breeding, aestivation sites and dispersal behaviors. The removal of nonnative vegetation may disturb western pond turtles sheltering within the plants as well as remove basking sites along the wetland banks. Increased sedimentation could adversely affect shallow water habitat for hatchlings as well as basking sites along the banks. These effects of the proposed project would result in significant impacts to WPT.

Implementation of **Mitigation Measures M-BIO-2a** and **M-BIO-2b**, as outlined above, would reduce short-term impacts to WPT resulting from the proposed project to a less-than-significant level.

San Francisco Dusky-footed Woodrat

The San Francisco dusky-footed woodrat, which inhabits forests with moderate canopy and moderate to dense understory, is known to occur in the Upper Canyon at Sharp Park. As part of the proposed project, the sediment and vegetation removed from HSP and the connecting channel would be transported by trucks to a remediated former rifle range site on the east side of PCH. Habitat for the San Francisco dusky-footed woodrat occurs in the non-native forest and riparian areas surrounding the former rifle range site. Although habitat exists in the surrounding area, disposal of the sediment and vegetation would occur in the non-native grassland area, which is located well away from the San Francisco dusky-footed woodrat habitat. Therefore, there would be no impact to this species or its habitat. While additional truck trips would occur in the area, potentially resulting in greater noise, the area currently receives intermittent vehicular traffic and the level of additional noise and disturbance along with the distance between the disposal site and habitat for the San Francisco dusky-footed woodrat would not result in a significant impact on this species. Therefore, the proposed project would result in less-than-significant impacts to the San Francisco dusky-footed woodrat.

Salt Marsh Common Yellowthroat and Black-Crowned Night Heron

Construction activities associated with the proposed project could also result in the temporary disturbance to the salt marsh common yellowthroat from an increase in noise, vehicle traffic, and human presence. The salt marsh common yellowthroat uses saltwater or freshwater marsh habitat with dense vegetation for nesting, cover, and foraging. The proposed project may result in temporary impacts to this species through the disturbance and loss of nesting habitat from sediment and emergent vegetation removal activities. These impacts would be considered a significant impact. Similar temporary impacts to the black-crowned night heron could occur as a result of the proposed project. Implementing **Mitigation Measure M-BIO-2c** as outlined below, requires that all vegetation removal activities be conducted outside the breeding season for bird species (February 1 through August 31, as designated by the CDFW), unless a breeding bird survey is conducted prior to vegetation removal activities and determines that no nesting birds are present. If active nests (or large abandoned stick nests) are discovered as part of the breeding bird survey, a 150-foot-radius avoidance buffer would be centered on the nest sites to prevent the nesting birds from being disturbed by construction activities.

In addition, there would be permanent loss of some nesting habitat as vegetated areas are converted to open water. However, the overall area of fresh-to-brackish water marsh habitat that would be removed represents approximately one percent[165] of the total habitat present in the LS wetland complex for these bird species. Furthermore, the fresh-to-brackish water marsh would likely re-establish through natural succession over time. Because the impact area represents a small portion of the total habitat in the LS wetland complex and ample habitat would remain in adjacent areas at Sharp Park, the proposed project would not result in a significant permanent impact to nesting and other habitat of the salt marsh common yellowthroat or black-crowned night heron.

With implementation of **Mitigation Measure M-BIO-2c**, the proposed project would result in less-than-significant impacts to the salt marsh common yellowthroat and black-crowned night heron.

Mitigation Measure M-BIO-2c - Protection of Bird Species

Vegetation removal activities shall be conducted outside the breeding season (February 1 to August 31), unless the following specific conditions are met: a breeding bird survey by a qualified biologist has been conducted prior to any vegetation removal activities. If active nests (or large abandoned stick nests) of a sensitive species are discovered, a 150-foot-radius avoidance buffer shall be centered on the nest site(s) to prevent nesting birds from being disturbed by power tools or other equipment. Weeds may be pulled by hand no closer than 50 feet from the nest.

Locally Significant Bird Species

As discussed above, a number of bird species, considered Species of Local Concern by the Golden Gate Audubon Society, breed or occur at Sharp Park. These bird species include: American goldfinch; American kestrel; band-tailed pigeon; black-crowned night heron; clark's grebe; gadwall; great horned owl; hairy woodpecker; hutton's vireo; pacific-slope flycatcher; pied-billed grebe; purple finch; red-shouldered hawk; red-tailed hawk; say's phoebe; steller's jay; swainson's thrush; tree swallow; and violet-green swallow. Some of these species primarily inhabit forests or woodlands. Nonetheless, all of these species or their nests could potentially be present in the project area.

Locally significant bird species including those listed above may occur in the project area or their habitat may be affected by the proposed project as a result of vegetation removal and an increase in noise, vehicle traffic, and human presence during construction activities. Impacts to locally significant bird species would be similar to those described above for the salt marsh common yellowthroat and black-crowned night heron. If nesting of locally significant bird species is present, in compliance with the MBTA, the SFRPD would be required to avoid damaging or removing the nests of any migratory bird species. Implementation of **Mitigation Measure M-BIO-2c** as outlined above, and compliance with the MBTA, would reduce the project's impacts on such bird species to a less-than-significant level.

Impact BIO-3: The project could interfere with the movement of native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites. (Less than Significant with Mitigation)

165 Based on the wetland delineation report prepared by Tetra Tech in November 2008, a total of approximately 19.56 acres (approximately 852,033 sf) of freshwater marsh were delineated in the LS wetland complex. Based on the wetland delineation report prepared by the SFRPD in May 2013, a total of approximately 8,612 sf of freshwater marsh would be permanently impacted by the proposed project. Therefore, the proposed project would permanently impact approximately one percent of the total freshwater marsh present in the LS wetland complex.

Migratory Corridors and Nursery Sites

Sharp Park is bordered in part by undeveloped areas, including Sweeney Ridge, Mori Point, and Milagra Ridge, which allows it to serve as a relatively undisturbed corridor for wildlife, particularly birds. No special-status fish are known to occur in LS, HSP, or the connecting channel. Many migratory birds use some areas of Sharp Park for foraging, nesting, and perching habitat.

The potential impacts on wildlife movement, migratory corridors, and nursery sites as a result of the proposed project would include the temporary disturbance from human presence as well as the disturbance of foraging and nesting habitat from vegetation removal and construction of the proposed pond. These activities may result in localized and temporary impacts to wildlife movement due to equipment and human presence and the amount of disturbance from earthmoving activities and removal of sediment and vegetation, which could be considered a significant impact. However, the proposed project would ultimately result in long-term beneficial impacts on wildlife movement by improving habitat quality for native species and allowing for greater habitat connectivity between Sharp Park and contiguous areas.

Implementation of **Mitigation Measures M-BIO-2a, M-BIO-2b, and M-BIO-2c** as outlined above and **M-BIO-4a** and **M-BIO-4b** as outlined below would minimize the potential temporary impacts to wildlife movement within the LS wetland complex by implementing protection measures to avoid and minimize impacts to special-status species as well as wetland and riparian areas. These measures require pre-construction surveys, worker education programs, biological monitoring, exclusion fencing, and consultation with the USFWS and CDFW. With implementation of **Mitigation Measures M-BIO-2a, M-BIO-2b, M-BIO-2c, M-BIO-4a,** and **M-BIO-4b**, the project's impacts on fish and wildlife movement, migratory corridors, and nursery sites would be less than significant.

Impact BIO-4: The proposed project would not have a substantial adverse effect on sensitive natural communities. (Less than Significant with Mitigation)

The sensitive natural communities present within the project site include coastal scrub, non-native grasslands, and wetland habitats.[166]

Coastal Scrub and Non-native Grasslands

The proposed creation of a perennial pond would convert some of the areas currently characterized as coastal scrub with native and invasive species to open water wetland habitat for CRLF and SFGS. The areas surrounding the perennial pond would be replanted with native coastal scrub vegetation where appropriate. Removal of invasive vegetation is expected to result in an overall benefit to native coastal scrub habitat. As a result, this impact to the coastal scrub community would be less than significant.

No native grasslands would be affected by the proposed project. Sediment and emergent vegetation removed from HSP and the connecting channel would be transported to and spread at the former rifle range site on the east side of PCH. The former rifle range site is characterized by non-native grasslands, and therefore disposal of sediment and vegetation at this site would not affect native grasslands.

Wetlands and Waters of the U.S.

[166] Tetra Tech, Inc. *LS Wetland Determination Report*. This report is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

The project would result in a permanent impact to wetland habitat as a result of the construction of a maintenance walkway at the HSP pumphouse and replacement of the retaining wall. The support structures for the proposed maintenance walkway and replaced retaining wall would result in 1.2 CYs and 0.4 CYs, respectively, of permanent fill in wetlands and waters of the U.S.[167]

As previously mentioned, a wetland delineation report was prepared in 2008 to delineate the USACE/CCC jurisdictional wetlands[168] in the LS wetland complex. In addition, the May 2013 wetland delineation report evaluates the proposed project's impacts to CCC-only wetlands located in the proposed project area as part of the requirements for the Coastal Development Permit required by the CCC for this project (see Figure 7).[169] Elements of the proposed project that may affect either the USACE/CCC jurisdictional wetlands and/or waters of the U.S. include:[170]

- Removal of sediment and emergent vegetation (cattails and bulrush) within HSP and the connecting channel that links HSP and LS;
- Construction of a maintenance walkway; and
- Replacement of a wooden retaining wall with a concrete retaining wall at the pumphouse.

The May 2013 wetland delineation report concluded that no wetlands would be affected by the proposed construction of steps at the HSP pumphouse, construction of a 1,600-sf perennial pond, or realignment of a segment of the golf cart path segment.[171] The area of each type of wetland or waters of the U.S. that would be permanently affected and created as part of the proposed project, and the area of each type of wetland that would be temporarily affected by the proposed project are shown in Tables 6 and 7, respectively, and discussed below.

The May 2013 wetland delineation report found that a total of 8,612 sf of freshwater marsh (USACE/CCA jurisdictional wetlands) would be permanently affected by the proposed sediment and emergent vegetation removal in HSP and the connecting channel, construction of a maintenance walkway at the pumphouse, and replacement of a retaining wall at the pumphouse. Of the 8,612 sf of affected freshwater marsh, 8,600 sf would be converted to open water wetlands as part of this project and 12 sf represents a permanent loss of wetlands that would result from the construction of the footings for the proposed walkway and replacement of the existing retaining wall at the pumphouse.

The proposed emergent vegetation (cattails and bulrush) removal would result in conversion of a portion of the existing vegetated wetland to open water habitat, consistent with historical conditions of the wetland complex which previously provided productive CRLF and SFGS habitat. Over the years, cattails and bulrush have encroached into the historically open water habitat, converting this habitat to freshwater marsh and/or wet meadow and limiting its value as breeding habitat for CRLF. Removing accumulated sediment and encroaching vegetation would reverse the effects of a trend that would eventually result in the conversion of the remaining open

167 USFWS. *Biological Opinion.* This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

168 See pages 59 and 60 of this Initial Study for the definitions of USACE/CCC jurisdictional wetlands.

169 SFRPD. *Single Parameter Wetland Delineation Report.* This document is available for as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

170 Ibid.

171 The May 2013 wetland delineation report included realignment of two golf cart path segments. The project has since been modified to realign only one golf cart path segment (north segment) and maintain the other golf cart path segment (south segment) at its current location. The May 2013 wetland delineation report identified that no wetlands would be affected by the proposed alignment of the north golf cart path segment.

water to vegetated wetland and ultimately conversion of those wetlands to upland. The proposed conversion of wetland to open water habitat would not result in a loss of waters of the U.S., and would be consistent with the historical conditions of wetland complex.

The proposed project includes construction of a new 1,600-sf perennial pond and would result in 8,600 sf of open water habitat in HSP. This means that a total of 10,200 sf of wetlands and/or waters of the U.S. would be created as part of this project. Therefore, the proposed project would result in a net increase of 1,588 sf of wetlands and/or waters of the U.S. within the project site, and would not result in a significant permanent impact to wetlands.

The proposed project would also temporarily affect a total of 3,700 sf of USACE/CCA jurisdictional wetlands and/or waters of the U.S. The 3,700 sf includes 3,000 sf of open water habitat, which would remain as open water habitat upon the completion of the proposed sediment and emergent vegetation removal in HSP, and 700 sf of freshwater marsh, which would be affected by the access areas required for the sediment and emergent removal activities in HSP. Most of these areas temporarily affected during construction would be protected by all applicable BMPs during construction and revegetated with native plant species upon the project completion. Nevertheless, these temporary impacts to wetlands could be considered significant. Implementation of **Mitigation Measures M-BIO-4a** and **M-BIO-4b**, as outlined below, would ensure that these temporary impacts would be reduced to a less-than-significant level.

As discussed in Impact BIO-2, temporary impacts to wetlands resulting from the proposed sediment and emergent vegetation removal in HSP and the connecting channel could include impacts due to the potential presence of acid sulfate soils or other components in HSP and the connecting channel or anoxic conditions potentially caused by the sediment removal activities. Implementation of **Mitigation Measure M-BIO-2b** would reduce these temporary impacts to a less-than-significant level.

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Sharp Park, Pacifica, CA
Figure 2: Elements related to construction

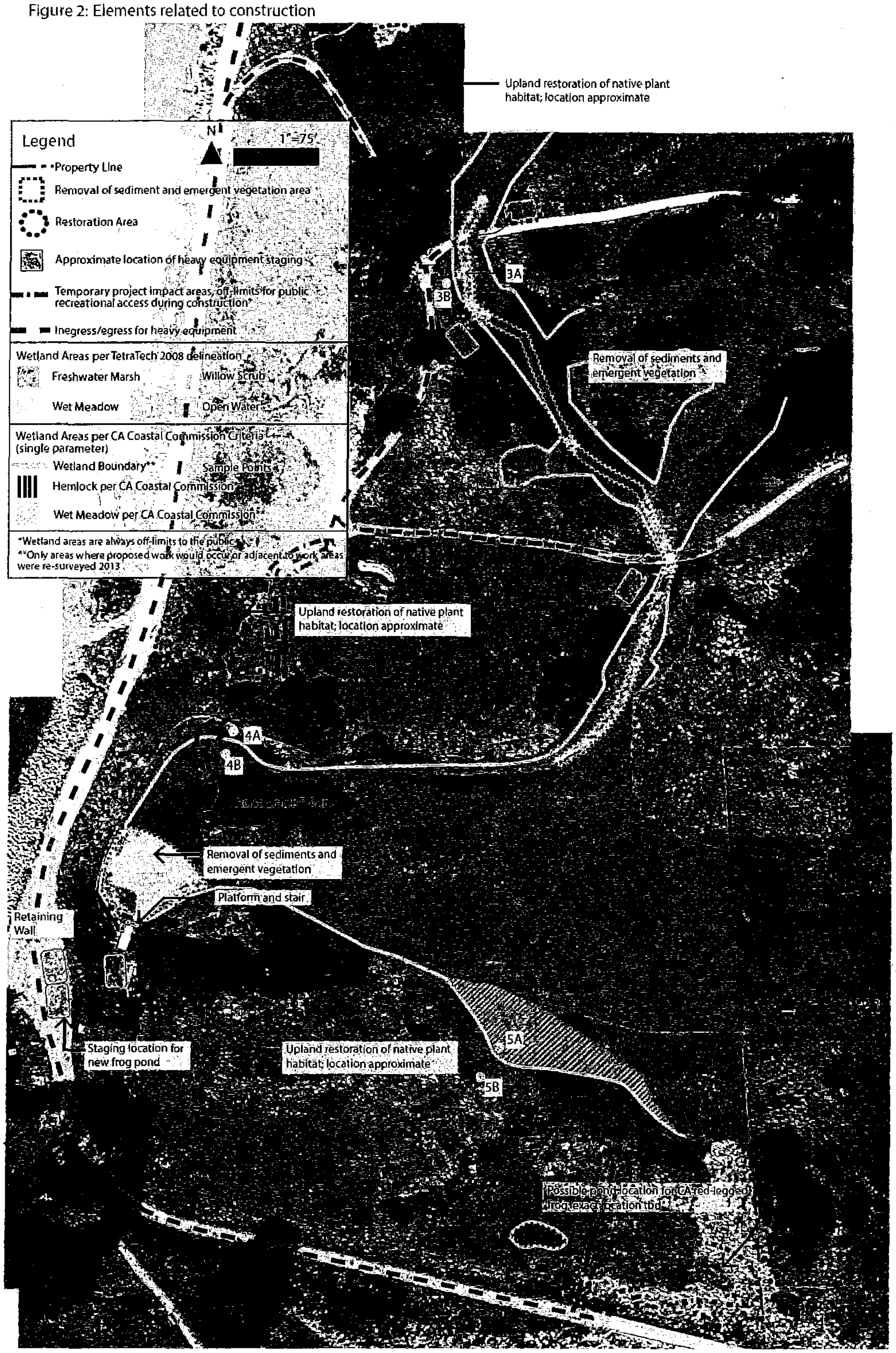

Figure 7. Affected Wetlands and Waters of the U.S. near HSP[172]

Source: San Francisco Recreation and Park Department

[172] SFRPD. *Single Parameter Wetland Delineation Report.* This document is available for as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

Table 6. Permanently Affected Wetlands and Waters of the U.S.[173]

Affected Area - Permanent		Created (Post Construction) - Permanent	
Habitat Type	**Area (square feet)**	**Habitat Type**	**Area (square feet)**
Freshwater marsh	8,612	Open water	8,600
Total	**8,612**	Freshwater marsh / Open Water (new pond)	1,600
		Total	**10,200**
		Net Increase	**1,588**

Table 7. Temporarily Affected Wetlands and Waters of the U.S.[174]

Affected Area - Temporary	
Habitat Type	**Area (square feet)**
Freshwater marsh	700
Open water	3,000
Total	**3,700**

173 SFRPD. *Single Parameter Wetland Delineation Report*. This document is available for as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

174 Ibid.

As discussed above, implementation of the project would result in temporary impacts to wetlands, which could be considered a significant impact. Implementation of **Mitigation Measures M-BIO-2b, M-BIO-4a,** and **M-BIO-4b** as outlined below would reduce these temporary impacts to a less-than-significant level. Prior to implementing the proposed project, the SFRPD would be required to obtain a Section 404 permit from the USACE, a Section 401 water quality certification from SFBRWQCB, a coastal development permit from the CCC, and a lake or streambed alteration agreement from the CDFW. These resource agencies may require measures to protect wetlands in addition to **Mitigation Measures M-BIO-4a** and **M-BIO-4b.**

Mitigation Measure M-BIO-4a - Protection of Wetlands and Natural Habitat

The SFRPD shall obtain all applicable permits from the SFBRWQCB, CCC, USACE, and CDFW to protect wetlands and natural habitat. Measures identified in these permits shall be applied, in addition to the following measures, unless otherwise specified by resource agencies:

1. In areas where work is not directly taking place, a minimum 100-foot buffer surrounding all wetlands, ponds, streams, drainages, and other aquatic habitats located on or within 100 feet of the project site shall be clearly designated on the final project construction plans and marked on the site with wildlife-friendly orange construction fencing or silt fencing. If the area is on a slope, silt fencing or other comparable management measures will be installed to prevent polluted runoff, as well as equipment, from entering the buffer area. Signs shall be installed every 100 feet on or adjacent to the buffer fence that read, "Environmentally Sensitive Area – Keep Out." Fencing and management measures shall be installed and inspected prior to project implementation and maintained throughout the restoration period. No equipment mobilization, grading, clearing, storage of equipment or machinery, vehicle or equipment washing, or similar activity, may occur until a representative of the SFRPD has inspected and approved the fencing and/or management measures installed around these features;

2. Vehicle and equipment operators shall use existing access roads and shall remain outside of wetlands and riparian areas that are not directly associated with the proposed project. Project construction and staging areas shall be delineated with construction fencing and shall avoid wetland habitat to the maximum extent feasible; and

3. All vehicles shall be brought in clean and free of weeds to prevent the spread or introduction of invasive plant species. Vehicles and equipment shall be fueled, maintained, and parked at least 100 feet from wetlands. Each morning, operators shall inspect all equipment that requires the use of fuel or fluids for leaks.

Mitigation Measure M-BIO-4b - Wetland Mitigation Plan for Temporarily Affected Areas

Consistent with the requirements for a Section 401 water quality certification permit, the SFRPD shall prepare a wetland mitigation plan for temporarily effected wetlands. Additionally, because the proposed project includes habitat restoration (i.e., construction of a perennial pond), the CCC may require an objective performance evaluation to determine project success which would include a monitoring program and methods for evaluating performance, which could be accomplished through implementation of the wetland mitigation plan. The wetland mitigation plan shall include, at a minimum, a description of the following:

- Proposed project's physical and biological impacts;
- Mitigation goals;

- Mitigation work plan;
- Management and maintenance plan;
- Success criteria and performance indicators;
- Monitoring plan; and
- Site protection measures.

The components of the above mitigation plan may be altered, supplemented, or deleted during the SFBRWQCB's review process, as the SFBRWQCB has final authority over the terms of the water quality certification.

Impact C-BIO: The proposed project, combined with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant biological resources impacts. (Less than Significant with Mitigation)

The Draft EIR prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP in combination with the GGNRA Dog Management Plan would result in a significant and unavoidable cumulative impact related to special-status plant and wildlife species. The Draft EIR for the proposed 2006 SNRAMP concluded that with mitigation measures the proposed 2006 SNRAMP would not result in any significant biological impacts. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including biological resources impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[175]

As discussed above, the proposed project with identified mitigation would not result in any significant biological impacts. Therefore, the proposed project's contribution to cumulative biological resources impacts would be reduced to less than significant with incorporation of **Mitigation Measures M-BIO-2a, M-BIO-2b, M-BIO-2c, M-BIO-4a**, and **M-BIO-4b**.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
14. GEOLOGY AND SOILS— Would the project:					
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:					

[175] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to Division of Mines and Geology Special Publication 42.)	☐	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒	☐
iv) Landslides?	☐	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐	☐
c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☒	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code, creating substantial risks to life or property?	☐	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☐	☒
f) Change substantially the topography or any unique geologic or physical features of the site?	☐	☐	☒	☐	☐

Question 14e would not be applicable because the project does not involve the use of any septic systems.

Impact GE-1: The proposed project would not result in exposure of people and structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, expansive soils, seismic ground-shaking, liquefaction, lateral spreading, or landslides. (No Impact)

The proposed project does not involve the construction of any residences or inhabitable structures. The proposed project would involve construction of minor structures such as steps and a maintenance walkway and replacement of an existing retaining wall near the existing pumphouse at HSP. All of these structures would be constructed in compliance with the California Uniform Building Code. The topography of the project site is relatively flat. The proposed project would not expose people or structures to substantial adverse effects involving the rupture of a known earthquake fault or strong seismic shaking. Ground rupture most commonly occurs along preexisting faults. No known active faults cross Sharp Park, and the project site is not within an Alquist-Priolo Earthquake Hazard Zone. While there is a potential for strong ground shaking at the project site due to a nearby earthquake fault line, the proposed project would not increase the likelihood that people or structures would experience adverse effects from strong ground shaking. Therefore, no impact would result from the proposed project.

Impact GE-2: The proposed project would not result in substantial loss of topsoil or erosion. (Less than Significant)

The proposed project includes minor improvements to existing facilities and the creation of habitat in Sharp Park. Ground disturbance resulting from these construction activities can expose soils to erosion, resulting in a loss of topsoil. However, the magnitude of loss of topsoil or erosion is not expected to be substantial given the minor scope and nature of the proposed project. Therefore, this impact is less than significant. BMPs for erosion control would be implemented for all elements of the proposed project, such as installation of fiber rolls, silt fences, straw blankets, hydroseeding, and straw mulch/wood chips, and these measures would further ensure that the project would not result in a substantial loss of topsoil or erosion.

Impact GE-3: The proposed project would not result in substantial impacts to site topographical features. (Less than Significant)

The proposed project would not substantially change the topography of the project site. Unique geologic features generally include picturesque rock outcrops and some of the last remaining sand dune systems. While the proposed project includes construction of an approximately 1,600-sf pond, this would not be considered a significant change in the topography of the site given the size and depth (approximately 5 feet) of the pond. Therefore, the proposed project would not result in substantial impacts with respect to changes in topographical features at the project site. Therefore, this impact is less than significant.

Impact C-GE: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the site vicinity, would not make a considerable contribution to any cumulative significant impacts related to geology and soils. (Less than Significant)

Geology impacts are generally site-specific and do not have cumulative effects with other projects. There are no known past, present, or future projects that in combination with the proposed project could result in cumulatively significant impacts to geology or soil resources. Thus, the project would not contribute to a cumulative impact on geology or soils.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
15. HYDROLOGY AND WATER QUALITY—Would the project:					
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐	☐

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion of siltation on- or off-site?	☐	☐	☒	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?	☐	☐	☒	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☒	☐	☐
f) Otherwise substantially degrade water quality?	☐	☒	☐	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other authoritative flood hazard delineation map?	☐	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☐	☒	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☒	☐	☐
j) Expose people or structures to a significant risk of loss, injury or death involving inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒	☐

Question 15g is not applicable to the proposed project because the project would not involve the construction of any residences or inhabitable structures.

Setting

Climate

The climate in the San Francisco Bay Area is generally characterized as a Mediterranean pattern of cool and mild temperatures along the coast, with higher temperatures inland, cool wet winters, and relatively warm dry summers. Pacifica receives an average of approximately 29.5 inches of precipitation a year, mostly between October and April. Average monthly temperatures range from 50.5 degrees Fahrenheit in January to 62.0 degrees in September.[176]

Regional Hydrology

Pacifica is in the San Francisco Bay watershed, U.S. Geological Survey (USGS) hydrologic unit code 18050004. The California State Water Resources Control Board and the nine RWQCBs manage water quality in California and administer federal water pollution control laws. The state board administers water rights and water pollution control, while the RWQCBs conduct planning, permitting, and enforcement. Within this context, Pacifica is in the San Francisco Bay Basin, which is administered by the SFBRWQCB. The SFBRWQCB has developed a water quality control plan (Basin Plan) for the San Francisco Bay region, dividing the basin into several hydrologic planning areas. Most of San Francisco and Pacifica are in the San Mateo Coastal Hydrologic Planning Area.[177]

Laguna Salada and Horse Stable Pond

The Sharp Park Golf Course is located within an 845-acre watershed.[178] HSP is located south of LS and consists of an open water pond and a freshwater wetland. It is connected to LS via an approximately 1,000-foot-long channel that was constructed to drain water from the lagoon to HSP, and together these three features form a wetland complex. In addition to water from LS, HSP receives water from Sanchez Creek from the east (see Figure 4). HSP is shallower and smaller than LS, and typical water depths range from one to three feet. Flood waters in the wetland complex are ~~drained~~removed by pumps at HSP, which pump water into the Pacific Ocean during the winter, when water levels in HSP become too high.

The LS wetland system is naturally maintained by groundwater during periods of low surface water inflow, such as during the summer. At these times, the water elevation in HSP and LS represents the groundwater table. Groundwater flow from the watershed to the ocean maintains the pond elevations above sea level. Over the course of the year, surface inflows to LS exceed groundwater inflows to LS by 600 percent. Some of the excess surface water inflow is lost to evaporation and uptake by plants, some flows as groundwater to the sea, and some is pumped to the ocean during periods of high inflow.[179]

A hydrologic assessment report was prepared in 2009 for the SFRPD to improve the understanding of the hydrologic processes that affect the distribution of ecological habitats in the LS wetland system and flooding of the adjacent golf course.[180] The assessment characterized the variability of water level functions from year to year in the LS wetland system. Results from a water budget investigation reveal that the system is supplied with adequate water to fill HSP

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[176] U.S. Climate Data, *Climate, Pacifica, California*. Available online at: *http://www.usclimatedata.com/climate.php?location=USCA0822*. Accessed July 11, 2013.

[177] SFBRWQCB. *Basin Planning*. Available online at: *http://www.waterboards.ca.gov/rwqcb2/basin_planning.shtml*. Accessed July 22, 2013.

[178] USFWS. *Biological Opinion*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[179] Kamman Hydrology & Engineering, Inc. *Hydrologic Assessment*. This report is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[180] Ibid.

even in dry years. Variability of water levels in the wetlands from year to year is low due to the operation of the pumping station. Early spring water levels in the ponds are consistent among dry, normal, and wet water years because the water level is controlled by the pumping station. Dry season losses due to evapotranspiration and seepage do not likely vary much year to year. Surface water flows associated with winter storms provide the primary source of water into the wetland system. Groundwater inflow exceeds groundwater outflow (seepage); as a result, groundwater inflows contribute to the overall water budget of the system, and dry season water level recession occurs at a slightly slower rate than would be expected due to evapotranspiration losses alone.[181]

As part of the hydrological assessment, the seasonal variation of salinity in the wetland system was also monitored to characterize conditions and to assess potential impacts of saltwater encroachment. Salinity is a concern because of its potential to affect the survival of sensitive species that use this wetland habitat. During the monitoring period, salinity in HSP ranged between 0.7 and 2.5 ppt. Salinity in LS appears uniform and well mixed.[182]

Flood Hazard Zones

Flood hazard zones in Sharp Park are identified in the Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA) in 2012.[183,184] The FIRMs identify LS, HSP, and the lower reach of Sanchez Creek (labeled as Sharp Park Creek in the FIRMs) as Zone A (areas with a 1-percent annual chance of flooding). A larger area that includes a portion of the golf course southeast of LS is identified as Zone X (areas of 0.2-percent annual chance flood; areas of 1-percent annual chance flood with average depth of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1-percent annual chance flood).

Sharp Park is subject to the CCSF Floodplain Management Program as outlined in San Francisco Administrative Code Sections 2A.280 through 2A.285.

Sea Level Rise

In 2006, the California Climate Change Center reported a historic sea-level rise of seven inches in the last century and projected an additional rise of 22–35 inches by the end of this century. Since that time numerous other studies have published projected ranges of 7–23 inches, 20–55 inches, and 32–79 inches of sea-level rise for this same period, with the differences in these projections attributable to different methodologies used and how well or whether glacier ice melt is included in the calculations.[185] Sea level rise could increase flooding potential in coastal areas. Sea level rise and climate change may also alter seasonal and long-term ocean levels and wave energy,

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181 Ibid.

182 Ibid.

183 Federal Emergency Management Agency (FEMA). *Flood Insurance Rate Map (FIRM), San Mateo County, California, and Incorporated Areas, Panel 38 of 510, Map Number 06081C0038E*, Effective Date October 16, 2012. This map is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

184 FEMA. *Flood Insurance Rate Map (FIRM), San Mateo County, California, and Incorporated Areas, Panel 126 of 510, Map Number 06081C0126E*, Effective Date October 16, 2012. This map is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

185 California Natural Resources Agency. *2009 California Climate Adaptation Strategy, A Report to the Governor of the State of California in Responses to Executive Order S-13-2008*. Available online at: *http://resources.ca.gov/climate_adaptation/*. Accessed July 13, 2013.

potentially reversing shallow groundwater gradients between the lagoon and ocean and allowing more sea water to migrate into the LS wetland complex.[186]

Impact HY-1: The proposed project would not violate water quality standards or otherwise substantially degrade water quality. (Less than Significant with Mitigation)

The proposed construction activities would involve excavation up to five feet bgs. Excavation could release sediment and other constituents of soil into local water bodies, if uncontrolled, would result in significant water quality impacts. Best Management Practices (BMPs) for erosion control would be implemented for all elements of the proposed project, such as installation of fiber rolls, silt fences, straw blankets, hydroseeding, and straw mulch/wood chips. These BMPs would ensure that ground-disturbing activities associated with the proposed project would not result in a substantial increase in the amount of sediment in runoff from the site which may ultimately discharge to surface water bodies.

As discussed in Section E.13, Biological Resources, **Mitigation Measure M-BIO-4**a requires that the SFRPD obtain all applicable permits from the SFBRWQCB, CCC, USACE, and CDFW to protect wetlands and natural habitat. This would further ensure that impacts to wetland habitat and water quality would be reduced to a less-than-significant level. A post-construction monitoring program would also be designed and implemented, as described in **Mitigation Measure M-BIO-4b**, which would ensure that erosion control measures and revegetation efforts meet standards and success criteria as determined in consultation with the SFBRWQCB.

To facilitate the proposed sediment and emergent vegetation removal activities in HSP and the connecting channel and to reduce potential impacts to CRLF, the water level in HSP or the connecting channel may be lowered through the use of the existing pumps in consultation with the USFWS, CDFW, and/or SFBRQWCB. This would result in a temporary increase in the amount of water discharged to the Pacific Ocean during the project construction. ~~Discharge at Sharp Park is authorized under an existing NPDES permit issued to CCSF. The SFRPD would seek modification to the NPDES permit in consultation with the SFBRWQCB so that activities associated with the proposed project are reflected in the NPDES permit, if necessary. In addition, the SFRPD would seek an amendment to an existing Section 401 permit issued by the SFBRWQCB to reflect the proposed project, if required by the SFBRWQCB.~~ No permit is required for discharges from Sharp Park's pumphouse into the Pacific Ocean because both the LS wetlands complex and the Pacific Ocean are considered "waters of the United States" under the FCWA. As such, as long as nothing is added to the water, no permit is required to discharge from one water of the U.S. to another. Should any permit be required by the SFBRWQCB for the proposed project, SFRPD will seek such a permit and comply with any conditions that may be attached to the permit.

During the implementation of the sediment and emergent vegetation removal activities, sediment present at the bottom of HSP and the connecting channel would be disturbed, resulting in a temporary suspension of sediment to the water column. Although unlikely, these sediments may contain sulfides and other components which, once disturbed or suspended in the water column, could have adverse impacts to special-status species, their habitat, or water quality. When exposed to dissolved or atmospheric oxygen, sulfides transform to sulfuric acid, which in turn results in the formation of acid sulfate soils. An increase in the amount of exposed acid sulfate soils in water bodies generally causes a decrease in the pH of water (an increase in acidity of the water) and a decrease in the amount of dissolved oxygen in the water, causing anoxic conditions

[186] Kamman Hydrology & Engineering, Inc. *Hydrologic Assessment*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

in which resuspension of anoxic hydrogen sulfide sediments may result in pulses of low oxygen conditions in HSP which could cause mortality of CRLF larvae and juveniles.[187] With implementation of **Mitigation Measure M-BIO-2b**, potential impacts to water quality resulting from acid sulfate soils, other chemical components, or anoxic conditions would be reduce to a less-than-significant level.

The proposed perennial pond, approximately 1,600 sf in area, would be constructed in consultation with USFWS, and all necessary permits from the CCC would be obtained. As of writing of this Initial Study, there are two potential locations for this pond. Both of them are located within Sharp Park, approximately 400 to 500 feet southeast of the existing pumphouse at HSP (see Figure 5). The water in the proposed pond would be supplied through surface water runoff and, depending on the location of the pond, through groundwater. Given the above, the proposed construction of the pond would result in a less-than-significant impact with respect to water quality.
In summary, with identified mitigation, the proposed project would not result in any significant water quality impacts.

Impact HY-2: The proposed project would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. (Less than Significant)

No groundwater would be used for the proposed project, except that the proposed 1,600-sf pond may be designed to be fed by groundwater. The pond would be constructed by excavating up to five feet bgs. The pond would occupy a small area and the overall topography and drainage patterns surrounding the pond site, which gently slopes toward HSP, would not be altered. The amount of water retained in the pond would not be substantial compared with the total amount of water present in the area watershed at a given moment. In addition, the proposed pond would capture some of the surface runoff water or groundwater that would otherwise flow into HSP as it would be constructed in an area located higher in elevation than HSP.

In light of the above, the project would not result in substantial depletion of groundwater supplies or interference with groundwater recharge, and this impact is less than significant.

Impact HY-3: The proposed project would not result in altered drainage patterns that would cause substantial erosion or flooding or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff. (Less than Significant)

None of the proposed project activities would substantially increase impervious surfaces or would contribute runoff water that would exceed the capacity of an existing or planned stormwater drainage system. Therefore, the proposed project would have a less-than-significant impact with respect to the creation of, or the contribution to, runoff water.

The proposed project would not substantially alter drainage patterns on the project site or in its vicinity. As part of the proposed project, a 1,600-sf pond would be constructed to establish habitat for CRLF. This pond would be constructed by excavating upland habitat, and is expected to retain surface water runoff, which would reduce the potential for flooding. Given the above, the proposed pond would result in a less-than-significant impact with respect to altered drainage patterns or flooding.

[187] Harry Gibbons and Robert Plotnikoff, Tetra Tech, Inc. *Acid Sulfate Soils Technical Memorandum*. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

Impact HY-4: The proposed project would not expose people, housing, or structures, to substantial risk of loss due to flooding. (Less than Significant)

The golf course floods whenever the pumps at HSP are not able to keep up with the inflow from the watershed. Because the watershed east of PCH is much larger than the golf course, most of the runoff from the watershed drains via Sanchez Creek to HSP. As water levels rise in HSP, water flows through the connecting channel into LS.

The capacity of HSP and the connecting channel would be slightly increased as a result of the proposed sediment and emergent vegetation removal activities, but the increase in capacity would be small compared to the amount of runoff generated by a moderate to large storm. Therefore, changes to HSP and the connecting channel would not substantially alter the frequency of flooding, which is regulated primarily by the rate at which the pumps at HSP are able to discharge water to the ocean and by the intensity of rainfall in the watershed that governs the rate at which water is delivered to HSP via Sanchez Creek.

As part of the proposed project, steps and a maintenance walkway would be constructed and the existing retaining wall would be replaced at the HSP pumphouse. While these proposed structures would not be subject to building permit requirements of the City of Pacifica, San Francisco Department of Building Inspection (DBI), or any other agencies, the SFRPD would design and construct these structures in accordance with the California Uniform Building Code.

The existing pumphouse is located outside the Special Flood Hazard Areas (SFHAs), which are the areas subject to inundation by the 1-percent annual chance flood. The 1-percent annual chance flood (100-year flood), also known as the base flood, is a flood that has a one percent chance of being equaled or exceeded in any given year.[188] The water level at the pumphouse and to a lesser extent throughout the entire wetland system is determined by rainfall and management of the pumps. Water levels are managed in the rainy season to ensure the protection of the CRLF egg masses. Typically, water levels in the wetland complex rise throughout the winter as egg masses are deposited and the pumps are adjusted upwards. Sometimes large storm events exceed the capacity of the pumps and water backs up on the golf course, however, it is very unlikely that the pumphouse itself would become inundated by flooding.[189] Furthermore, the proposed structures would not impede the flow of floodwater in a way that increases the elevation of floodwaters upstream. Therefore, the proposed project would result in a less-than-significant impact with respect to flooding.

In light of the above, the proposed project would not expose people, housing, or structures, to substantial risk of loss due to flooding, and this impact is less than significant.

Impact HY-5: The proposed project would not expose people or structures to a significant risk of loss, injury or death involving inundation by seiche, tsunami, or mudflow. (No Impact)

The proposed project would not attract a significant number of visitors to Sharp Park or result in construction of dwelling units. The proposed project would have a less-than-significant impact

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[188] FEMA. *Flood Insurance Rate Map (FIRM), San Mateo County, California, and Incorporated Areas, Panel 126 of 510, Map Number 06081C0126E*, Effective Date October 16, 2012. This map is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[189] Lisa Wayne, SFRPD. *Email to Kei Zushi, San Francisco Planning Department, FEMA 100-year flood map*, April 29, 2013. This email is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

with regard to exposing people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow.

The San Francisco General Plan Community Safety Elements describes tsunamis as follows:[190]

> "Tsunamis are large waves in the ocean generated by earthquakes, coastal or submarine landslides, or volcanoes. Damaging tsunamis are not common on the California coast. Most California tsunamis are associated with distant earthquakes (most likely those in Alaska or South America and recently in Japan), not with local earthquakes. Devastating tsunamis have not occurred in historic times in the Bay Area. Because of the lack of reliable information about the kind of tsunami runups that have occurred in the prehistoric past, there is considerable uncertainty over the extent of tsunami run-up that could occur. There is ongoing research into the potential tsunami run-up in California"

Sharp Park is within a tsunami inundation area.[191] Overtopping of the seawall can be expected should a tsunami occur simultaneously with a severe storm event during high tide.[192] None of the proposed project activities would increase the likelihood that people or structures would be exposed to a significant risk of loss, injury, or death due to inundation by seiche, tsunami, or mudflow. Therefore, the proposed project would have a less-than-significant impact with regard to this criterion.

Impact C-HY: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant effects related to hydrology or water quality. (Less than Significant with Mitigation)

As discussed above, in 2006, the California Climate Change Center reported a historic sea-level rise of seven inches in the last century and projected an additional rise of 22–35 inches by the end of this century. Since that time numerous other studies have published projected ranges of sea-level rise for this same period, with the differences in these projections attributable to different methodologies used and how well or whether glacier ice melt is included in the calculations.[193] The exact magnitude of sea level rise near the project site is unknown. Among the cumulative effects on water resources resulting from sea level rise are increased frequency of flooding of low-lying areas, increased salt water intrusion in coastal wetlands, increased coastal erosion, and increased potential for contamination of receiving waters because of inundation of areas containing hazardous substances. One approach to mitigating these and similar long-term cumulative effects is to move vulnerable development and activities out of low-lying coastal areas and to encourage coastal and shoreline uses, such as open space, that can accommodate sea level rise. The proposed project would not substantially affect existing uses on the project site and the project site would remain as open space. None of the proposed project activities would be

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190 City and County of San Francisco. *General Plan, Community Safety Element*, October, 2012. Available online at: *http://www.sf-planning.org/ftp/General_Plan/Community_Safety_Element_2012.pdf*. Accessed June 6, 2013.

191 California Department of Conservation. *San Mateo County Tsunami Inundation Maps*. Available online at: *http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/Inundation_Maps/SanMateo/Documents/Tsunami_Inundation_SouthSanFrancisco_PacificCoast_Quad_SanMateo.pdf*. Accessed July 19, 2013.

192 Arup North America. *Sharp Park Sea Wall Evaluation*, February 5, 2010. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

193 California Natural Resources Agency. *2009 California Climate Adaptation Strategy, A Report to the Governor of the State of California in Responses to Executive Order S-13-2008*. Available online at: *http://resources.ca.gov/climate_adaptation/*. Accessed July 13, 2013.

anticipated to contribute to the effects of sea level rise. Therefore, the proposed project would not contribute considerably to any cumulative impact associated with sea level rise.

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in cumulative hydrology or water quality impacts. The Draft EIR prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to hydrology or water quality. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including hydrology and water quality impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[194] Thus, no cumulative impact to hydrology or water quality within the project vicinity exists to which this project could potentially contribute.

The proposed project would not have a significant impact on hydrology or water quality with the implementation of **Mitigation Measures M-BIO-2b**, **M-BIO-4a**, and **M-BIO-4b**. Thus, the project would not contribute considerably to a cumulative impact to hydrology or water quality, even if one existed.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
16. HAZARDS AND HAZARDOUS MATERIALS Would the project:					
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒	☐

[194] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐	☐
h) Expose people or structures to a significant risk of loss, injury or death involving fires?	☐	☐	☒	☐	☐

Question 16c is not applicable because the project site is not within one-quarter mile of an existing or proposed school. The project site is not located near a public or private airport or within an airport land use plan area. Therefore, Questions 16e and 16f do not apply to the proposed project.

Impact HZ-1: The proposed project would not create a significant hazard through routine transport, use, disposal, handling or emission of hazardous materials. (No Impact)

The proposed project includes improvements to existing facilities and creation of habitat and would not involve routine transport, use, disposal, handling or emission of hazardous materials.[195] Therefore, no impact would result from the proposed project with respect to the routine transport, use, disposal, handling or emission of hazardous materials.

Impact HZ-2: Implementation of the proposed project activities would not result in a significant increase in the mosquito or tick population. (Less than Significant)

San Mateo County Mosquito and Vector Control District (SMCMVCD) provides mosquito and insect control at Sharp Park. The SMCMVCD has programs for the control of mosquitoes and ticks, including mosquito-borne diseases such as the West Nile virus. The SMCMVCD's integrated pest management for mosquito control includes a preventive approach, underground source control, and mosquito control within pools, ponds, fountains, marshes, and creeks. The SMCMVCD's integrated management includes controlling mosquitoes in their immature stages before emerging as biting adults. Further the SMCMVCD programs include a Lyme disease program, a tick prevention and removal program, and a tick-borne diseases program.[196]

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[195] Section 25501(h) of the California Health and Safety Code defines "Hazardous materials" as materials that, because of their quantity, concentration, or physical or chemical characteristics, pose a substantial present or potential hazard to human health and safety or to the environment if released to the workplace or environment.

[196] San Mateo County Mosquito and Vector Control District (SMCMVCD). Available online at: *http://www.smcmad.org/index.htm*. Accessed July 11, 2013.

The SMCMVCD mainly uses the following mosquito larva treatments:[197]

- BVA-2 Oil: A refined petroleum distillate that breaks down in a few days. It is applied to the surface of standing water and causes mosquito larvae to drown.
- Methoprene: A juvenile growth hormone that is targeted specific to mosquito larvae. It mimics the growth hormone produced in a developing larva. They stop producing the hormone when they pupate. When methoprene is applied to the water, it keeps the larvae in a juvenile stage.
- *Bacillus thuringensis israelis* (Bti): A bacteria that is toxic to mosquito larvae. The bacteria cause the stomach lining of mosquito larvae to rupture and ultimately killing the mosquito larvae.
- Mosquito fish (*Gambusia affinis*): These fish eat mosquito larvae. This is known to be a reliable biological control method.

The proposed improvements to the existing pumphouse would not change the depth or shape of water bodies. Therefore, these improvements would not create new areas of standing water that could lead to an increase the mosquito or tick population. As such, the proposed improvements to the pumphouse would have no impact on public health relative to mosquitoes and ticks.

Increased depths of HSP and the connecting channel as a result of the proposed sediment removal activities and a new perennial pond constructed as part of this project could increase the mosquito population in that area. The SMCMVCD would continue to control mosquitoes at the project site. The SFRPD would coordinate with the SMCMVCD in the implementation of the proposed sediment and emergent vegetation removal activities and the construction of the pond to minimize the potential for developing mosquito breeding habitat.

Over the past several years, sediments have accumulated in HSP and the connecting channel and enhanced the growth of cattails; cattail and tule stands provide ideal habitat for tule mosquitoes. The proposed project activities include removal of cattails and bulrush, which would reduce the habitat of tule mosquitoes. In addition, the SMCMVCD would continue to implement the Integrated Pest Management (IPM) program to control Lyme disease and tick-borne diseases.

The SFRPD proposes to implement the following BMPs to control the spread of mosquito-borne disease as part of this project.

1. Educate staff about the most effective ways to avoid being bitten by mosquitoes;
2. Remove small water features that contain standing water or treat those features with *Bacillus thuringiensis israelis* a biological control agent for mosquito larvae, if the features were to remain and Public Health Services were to identify a potential health hazard; and
3. Encourage staff to drain any standing water in stored equipment or temporary depressions.

In light of the above, the proposed project would result in a less-than-significant impact from mosquitoes or ticks.

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[197] SMCMVCD. *Preventative Approach.* Available online at: *http://www.smcmad.org/preventative_control.htm.* Accessed July 11, 2013.

Impact HZ-3: Implementation of the proposed project would not create a significant hazard through the use of pesticides for vegetation control. (No Impact)

No herbicides or pesticides would be used as part of this project. Therefore, no impact would result from the proposed project.

Impact HZ-4: The proposed project would create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. (Less than Significant)

The proposed project could result in accidental release of hazardous materials into the environment. The proposed project would require the use of motor vehicles and motorized equipment for the project activities around HSP and the connecting channel. Hazardous materials likely to be used during the project construction activities include fuel, oil, solvents, and lubricants for equipment and equipment maintenance. Similar motor vehicles and motorized equipment are regularly used at Sharp Park for the ongoing maintenance work and there have been no known incidents at Sharp Park that resulted in release of a substantial amount of hazardous materials from motor vehicles and motorized equipment. Hazardous materials would be used in marginal quantities as part of this project and would be stored outside the project site. Any activities involving hazardous materials and hazardous waste[198] would be conducted in accordance with strict health and safety standards mandated by the Occupational Safety and Health Administration (OSHA). Therefore, the proposed project would result in less-than-significant impacts from accidental releases of hazardous materials.

Impact HZ-5: Implementation of the proposed project activities would not result in substantial fire hazard impacts. (Less than Significant)

Motorized equipment used during construction would increase the risk of fire. Workers involved in the proposed project activities would carry fire extinguishers in their trucks and would use appropriate fire prevention and suppression measures during construction. Therefore, the proposed project would result in less-than-significant impacts from fire hazards.

Impact C-HZ: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the vicinity, would not make a considerable contribution to any cumulative significant impacts related to hazardous materials. (Less than Significant with Mitigation)

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in cumulative hazardous materials impacts during the construction period of the proposed project. The Draft EIR prepared for the proposed 2006 SNRAMP, a reasonably foreseeable future project in the proposed project's vicinity, concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to hazardous materials. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed

[198] "Hazardous waste" is defined as any material that is relinquished, recycled, or inherently waste-like and falls under Title 22 of the California Code of Regulations. Division 4.5, Chapter 11, contains regulations for classifying hazardous wastes. A waste is considered hazardous if it causes human health effects, has the ability to burn, causes severe burns or damages materials, or causes explosions or generates toxic gases, in accordance with the criteria established in Article 3. Article 4 lists specific hazardous wastes, and Article 5 identifies specific waste categories, including hazardous wastes, as defined by the Resource Conservation and Recovery Act, non-Resource Conservation and Recovery Act hazardous wastes, extremely hazardous wastes, and special wastes.

restoration would not result in any significant effects on the environment, including hazards and hazardous materials impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[199] Thus, no cumulative impact to hazardous materials within the project vicinity exists to which this project could potentially contribute.

Impacts from hazards are generally site-specific, and typically do not result in cumulative impacts. The proposed project would not have a significant impact with respect to hazardous materials on the project site or in its vicinity. Thus, the proposed project would not contribute considerably to a cumulative hazardous materials impact, even if one existed.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
17. MINERAL AND ENERGY RESOURCES—Would the project:					
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☐	☒
c) Encourage activities which result in the use of large amounts of fuel, water, or energy, or use these in a wasteful manner?	☐	☐	☒	☐	☐

The project site is designated Mineral Resource Zone 1 (MRZ-1) by the California Division of Mines and Geology (CDMG) under the Surface Mining and Reclamation Act of 1975.[200] This designation indicates the area where there is adequate geologic information which indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence. This zone is applied where well developed lines of reasoning, based on economic-geologic principles and adequate data, indicate that the likelihood for occurrence of significant mineral deposits is nil or slight.[201]

There are no operational mineral resource recovery sites in the project site or its immediate vicinity whose operations or accessibility would be affected by the construction or operation of the proposed project. Therefore, questions 16a and 16b are not applicable to this project.

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[199] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

[200] California Division of Mines and Geology (CDMG). *Mineral Land Classification Map, San Mateo and San Francisco Counties by Melvin C. Stinson, Michael W. Manson, and John J. Pioppert*, 1982. This map is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

[201] CDMG. *Guideline for Classification and Designation of Mineral Lands.* Available online at: *http://www.conservation.ca.gov/smgb/Guidelines/Documents/ClassDesig.pdf*. Accessed April 8, 2013.

Impact ME-1: Implementation of the proposed project would not encourage activities which would result in the use of large amounts of fuel, water, or energy, or use these in a wasteful manner. (Less than Significant)

During the project construction, fuel (diesel and gasoline) would be consumed by motorized equipment and by trucks and other construction equipment including a backhoe, Aquamog, and long-arm excavator. Use of these fuels by the project work crews are expected to be minor in amount. Given the minor scope of the proposed project, use of energy and fuels by the proposed project is expected to be less than significant.

Impact C-ME: The proposed project, in combination with past, present, and reasonably foreseeable future projects in the site vicinity, would not make a considerable contribution to any cumulative significant impacts related to energy or minerals. (Less than Significant)

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in energy or mineral impacts. The Initial Study prepared for the proposed 2006 SNRAMP concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to energy or minerals. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment, including mineral and energy resources impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[202] Thus, no cumulative impact to energy or minerals within the project vicinity exists to which this project could potentially contribute.

The project-generated demand for electricity would be negligible in the context of overall demand within Sharp Park and its vicinity. Therefore, the proposed project would not contribute to a cumulative energy or minerals impact, even if one existed.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
18. AGRICULTURE AND FOREST RESOURCES—Would the project					
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☐	☒

202 San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

Topics:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact	Not Applicable
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)) or timberland (as defined by Public Resources Code Section 4526)?	☐	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or forest land to non-forest use?	☐	☐	☐	☐	☒

Because no farmland or forest land is present within the project site, Questions relevant to impacts to agricultural resources and forest land are not applicable to the proposed project.

The project site is located entirely within Sharp Park within the City of Pacifica. The California Department of Conservation's Farmland Mapping and Monitoring Program identifies the project site as either "Urban and Built-up Land" or "Other Land."[203]

"Urban and Built-up Land" is defined as "land occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel and commonly include residential, industrial, commercial, institutional facilities, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, and water control structures.

"Other Land" is defined as "land not included in any other mapping category; commonly include low density rural developments, brush, timber, wetland, and riparian areas; not suitable for livestock grazing, confined livestock, poultry, or aquaculture facilities, strip mines, borrow pits, and water bodies smaller than 40 acres; and include vacant and nonagricultural land surrounded on all sides by urban development and greater than 40 acres."

Because the project site does not contain agricultural uses and is not zoned for such uses, the proposed project would not convert any prime farmland, unique farmland, or Farmland of Statewide Importance to non-agricultural use, and it would not conflict with existing zoning for agricultural land use or a Williamson Act contract, nor would it involve any changes to the environment that could result in the conversion of farmland. There is likewise no forest land on the project site.

As of September 2013, there are no known past or present projects in the project vicinity that would, in combination of the proposed project, result in agriculture or forest resources impacts during the construction period of the proposed project. The Draft EIR prepared for the proposed 2006 SNRAMP concluded that the proposed 2006 SNRAMP would not result in any significant impacts with respect to agriculture or forest resources. A Categorical Exemption prepared for the Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E) concluded that the proposed restoration would not result in any significant effects on the environment,

[203] California Department of Conservation, *San Mateo County Important Farmland 2010*, October 2011. Available online at: *ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/pdf/2010/smt10.pdf*. Accessed March 29, 2013.

including agriculture and forest resources impacts, and, thus, that project was appropriately exempt from CEQA under Section 15333 of the CEQA Guidelines.[204] Thus, no cumulative impact to agriculture or forest resources within the project vicinity exists to which this project could potentially contribute.

The proposed project would have no impacts to agricultural or forest resources, and would not contribute to cumulative agriculture or forest resources impact, even if one existed.

Topics:	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*	*Not Applicable*
19. MANDATORY FINDINGS OF SIGNIFICANCE—Would the project:					
a) Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐	☐
b) Have impacts that would be individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☒	☐	☐	☐
c) Have environmental effects that would cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐	☐

As discussed above, with the implementation of the mitigation measures the proposed project is anticipated to have only less-than-significant impacts in the environmental topics discussed. The foregoing analysis identifies potentially significant impacts to archeological resources, paleontological resources, human remains, air quality, biological resources, and hydrology and water quality. These potentially significant impacts would be mitigated though implementation of mitigation measures as described below and more fully within Section F of this Initial Study.

As discussed in Section E.4, Cultural and Paleontological Resources, it is possible that below-ground archeological and paleontological resources and human remains may be present within the project site. Any potential significant impacts to archeological and paleontological resources and human remains resulting from soil-disturbing activities would be reduced to a less-than-

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[204] San Francisco Planning Department. *Categorical Exemption, Sharp Park Upland Habitat Restoration (Planning Department Case No. 2013.1008E)*, August 5, 2013. Available online at: *http://www.sf-planning.org/index.aspx?page=3447*. Accessed December 17, 2013.

significant level with the implementation of **Mitigation Measures M-CP-2, M-CP-3,** and **M-CP-4,** which include measures to address accidental discovery of archeological and paleontological resources and human remains.

As discussed in Section E.7, Air Quality, construction associated with the proposed project activities could generate fugitive dust during soil-disturbing activities including sediment and emergent vegetation removal activities, excavation, site grading, installation of proposed structures, and realignment of golf cart path. Although the proposed project would involve mostly wet soils, unmitigated, fugitive dust generated by the proposed project could result in significant air quality impacts. Any potential significant impacts with respect to fugitive dust would be reduced to a less-than-significant level with the implementation of **Mitigation Measure M-AQ-2,** which addresses the control and suppression of fugitive dust.

Additionally, as discussed in Section E.13, Biological Resources, it is possible that the proposed project could result in a significant impact to special-status species including, but not limited to, CRLF, SFGS, WPT, salt marsh common yellowthroat, and black-crowned night heron. **Mitigation Measures M-BIO-2a, M-BIO-2b,** and **M-BIO-2c** would reduce the impacts to a less-than-significant level. It is also possible that the proposed project would result in significant impacts to the wetlands in the project area or its vicinity. With the implementation of **Mitigation Measures M-BIO-4a** and **M-BIO-4b,** such potential significant impacts would be reduced to a less-than-significant level. Accordingly, the proposed project would not result in a significant impact to biological resources.

Furthermore, as discussed in Section E. 15, Hydrology and Water Quality, the proposed project could result in significant impacts to water quality resulting from acid sulfate soils, other chemical components, or anoxic conditions. With the implementation of **Mitigation Measure M-BIO-2b,** this impact would be reduced to a less-than-significant level.

Cumulative projects in the project site vicinity primarily include the proposed 2006 SNRAMP as discussed in Section E of this Initial Study. With incorporation of identified mitigation measures, the proposed project would not result in a considerable contribution to any cumulatively significant impacts.

In light of the above, the proposed project would not result in any significant impacts.

F. MITIGATION MEASURES AND IMPROVEMENT MEASURES

Mitigation Measure M-CP-2 - ~~Accidental Discovery~~ Archeological Testing

~~The following mitigation measure is required to avoid any potential adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in *CEQA Guidelines* Section 15064.5(a)(c). The project sponsor shall distribute the Planning Department archeological resource "ALERT" sheet to the project prime contractor; or to any project subcontractor (including demolition, excavation, grading, etc. firms) involved in soils disturbing activities within the project site. Prior to any soils disturbing activities being undertaken each contractor is responsible for ensuring that the "ALERT" sheet is circulated to all field personnel including, machine operators, field crew, supervisory personnel, etc. The project sponsor shall provide the Environmental Review Officer (ERO) with a signed affidavit from the responsible parties (prime contractor and subcontractor(s)) to the ERO confirming that all field personnel have received copies of the Alert Sheet.~~

~~Should any indication of an archeological resource be encountered during any soils disturbing activity of the project, the project Head Foreman and/or project sponsor shall immediately notify the ERO and shall immediately suspend any soils disturbing activities in the vicinity of the discovery until the ERO has determined what additional measures should be undertaken.~~

~~If the ERO determines that an archeological resource may be present within the project site, the project sponsor shall retain the services of an archaeological consultant from the pool of qualified archaeological consultants maintained by the Planning Department archaeologist. The archeological consultant shall advise the ERO as to whether the discovery is an archeological resource, retains sufficient integrity, and is of potential scientific/historical/cultural significance. If an archeological resource is present, the archeological consultant shall identify and evaluate the archeological resource. The archeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by the project sponsor.~~

~~Measures might include: preservation in situ of the archeological resource; an archaeological monitoring program; or an archeological testing program. If an archeological monitoring program or archeological testing program is required, it shall be consistent with the Environmental Planning (EP) division guidelines for such programs. The ERO may also require that the project sponsor immediately implement a site security program if the archeological resource is at risk from vandalism, looting, or other damaging actions.~~

~~The project archeological consultant shall submit a Final Archeological Resources Report (FARR) to the ERO that evaluates the historical significance of any discovered archeological resource and describes the archeological and historical research methods employed in the archeological monitoring/data recovery program(s) undertaken. Information that may put at risk any archeological resource shall be provided in a separate removable insert within the final report.~~

~~Copies of the Draft FARR shall be sent to the ERO for review and approval. Once approved by the ERO, copies of the FARR shall be distributed as follows: California Archaeological Site Survey Northwest Information Center (NWIC) shall receive one (1) copy and the ERO shall receive a copy of the transmittal of the FARR to the NWIC. The EP division of the Planning Department shall receive one bound copy, one unbound copy and one unlocked, searchable PDF copy on CD of the FARR along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. In instances of high public interest or~~

interpretive value, the ERO may require a different final report content, format, and distribution than that presented above.

Based on a reasonable presumption that archeological resources may be present within the project site, the following measures shall be undertaken to avoid any potentially significant adverse effect from the proposed project on buried or submerged historical resources. The project sponsor shall retain the services of an archaeological consultant from the rotational Department Qualified Archaeological Consultants List (QACL) maintained by the Planning Department archaeologist. The project sponsor shall contact the Department archeologist to obtain the names and contact information for the next three archeological consultants on the QACL. The archeological consultant shall undertake an archeological testing program as specified herein. In addition, the consultant shall be available to conduct an archeological monitoring and/or data recovery program if required pursuant to this measure. The archeological consultant's work shall be conducted in accordance with this measure at the direction of the Environmental Review Officer (ERO). All plans and reports prepared by the consultant as specified herein shall be submitted first and directly to the ERO for review and comment, and shall be considered draft reports subject to revision until final approval by the ERO. Archeological monitoring and/or data recovery programs required by this measure could suspend construction of the project for up to a maximum of four weeks. At the direction of the ERO, the suspension of construction can be extended beyond four weeks only if such a suspension is the only feasible means to reduce to a less than significant level potential effects on a significant archeological resource as defined in CEQA Guidelines Sect. 15064.5 (a)(c).

Consultation with Descendant Communities: On discovery of an archeological site[205] associated with descendant Native Americans, the Overseas Chinese, or other descendant group an appropriate representative[206] of the descendant group and the ERO shall be contacted. The representative of the descendant group shall be given the opportunity to monitor archeological field investigations of the site and to consult with ERO regarding appropriate archeological treatment of the site, of recovered data from the site, and, if applicable, any interpretative treatment of the associated archeological site. A copy of the Final Archaeological Resources Report shall be provided to the representative of the descendant group.

Archeological Testing Program. The archeological consultant shall prepare and submit to the ERO for review and approval an archeological testing plan (ATP). The archeological testing program shall be conducted in accordance with the approved ATP. The ATP shall identify the property types of the expected archeological resource(s) that potentially could be adversely affected by the proposed project, the testing method to be used, and the locations recommended for testing. The purpose of the archeological testing program will be to determine to the extent possible the presence or absence of archeological resources and to identify and to evaluate whether any archeological resource encountered on the site constitutes an historical resource under CEQA.

At the completion of the archeological testing program, the archeological consultant shall submit a written report of the findings to the ERO. If based on the archeological testing program the archeological consultant finds that significant archeological resources may be present, the ERO in consultation with the archeological consultant shall determine if additional measures are warranted. Additional measures that may be undertaken include additional archeological testing,

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205 By the term "archeological site" is intended here to minimally included any archeological deposit, feature, burial, or evidence of burial.

206 An "appropriate representative" of the descendant group is here defined to mean, in the case of Native Americans, any individual listed in the current Native American Contact List for the City and County of San Francisco maintained by the California Native American Heritage Commission and in the case of the Overseas Chinese, the Chinese Historical Society of America. An appropriate representative of other descendant groups should be determined in consultation with the Department archeologist.

archeological monitoring, and/or an archeological data recovery program. No archeological data recovery shall be undertaken without the prior approval of the ERO or the Planning Department archeologist. If the ERO determines that a significant archeological resource is present and that the resource could be adversely affected by the proposed project, at the discretion of the project sponsor either:

A) The proposed project shall be re-designed so as to avoid any adverse effect on the significant archeological resource; or

B) A data recovery program shall be implemented, unless the ERO determines that the archeological resource is of greater interpretive than research significance and that interpretive use of the resource is feasible.

Archeological Monitoring Program. If the ERO in consultation with the archeological consultant determines that an archeological monitoring program shall be implemented the archeological monitoring program shall minimally include the following provisions:

- The archeological consultant, project sponsor, and ERO shall meet and consult on the scope of the AMP reasonably prior to any project-related soils disturbing activities commencing. The ERO in consultation with the archeological consultant shall determine what project activities shall be archeologically monitored. In most cases, any soils- disturbing activities, such as demolition, foundation removal, excavation, grading, utilities installation, foundation work, driving of piles (foundation, shoring, etc.), site remediation, etc., shall require archeological monitoring because of the risk these activities pose to potential archaeological resources and to their depositional context;
- The archeological consultant shall advise all project contractors to be on the alert for evidence of the presence of the expected resource(s), of how to identify the evidence of the expected resource(s), and of the appropriate protocol in the event of apparent discovery of an archeological resource;
- The archeological monitor(s) shall be present on the project site according to a schedule agreed upon by the archeological consultant and the ERO until the ERO has, in consultation with project archeological consultant, determined that project construction activities could have no effects on significant archeological deposits;
- The archeological monitor shall record and be authorized to collect soil samples and artifactual/ecofactual material as warranted for analysis;
- If an intact archeological deposit is encountered, all soils-disturbing activities in the vicinity of the deposit shall cease. The archeological monitor shall be empowered to temporarily redirect demolition/excavation/pile driving/construction activities and equipment until the deposit is evaluated. If in the case of pile driving activity (foundation, shoring, etc.), the archeological monitor has cause to believe that the pile driving activity may affect an archeological resource, the pile driving activity shall be terminated until an appropriate evaluation of the resource has been made in consultation with the ERO. The archeological consultant shall immediately notify the ERO of the encountered archeological deposit. The archeological consultant shall make a reasonable effort to assess the identity, integrity, and significance of the encountered archeological deposit, and present the findings of this assessment to the ERO.

Whether or not significant archeological resources are encountered, the archeological consultant shall submit a written report of the findings of the monitoring program to the ERO.

Archeological Data Recovery Program. The archeological data recovery program shall be conducted in accord with an archeological data recovery plan (ADRP). The archeological consultant, project sponsor, and ERO shall meet and consult on the scope of the ADRP prior to preparation of a draft ADRP. The archeological consultant shall submit a draft ADRP to the ERO. The ADRP shall identify how the proposed data recovery program will preserve the significant information the archeological resource is expected to contain. That is, the ADRP will identify what scientific/historical research questions are applicable to the expected resource, what data classes the resource is expected to possess, and how the expected data classes would address the applicable research questions. Data recovery, in general, should be limited to the portions of the historical property that could be adversely affected by the proposed project. Destructive data recovery methods shall not be applied to portions of the archeological resources if nondestructive methods are practical.

The scope of the ADRP shall include the following elements:

- *Field Methods and Procedures.* Descriptions of proposed field strategies, procedures, and operations.
- *Cataloguing and Laboratory Analysis.* Description of selected cataloguing system and artifact analysis procedures.
- *Discard and Deaccession Policy.* Description of and rationale for field and post-field discard and deaccession policies.
- *Interpretive Program.* Consideration of an on-site/off-site public interpretive program during the course of the archeological data recovery program.
- *Security Measures.* Recommended security measures to protect the archeological resource from vandalism, looting, and non-intentionally damaging activities.
- *Final Report.* Description of proposed report format and distribution of results.
- *Curation.* Description of the procedures and recommendations for the curation of any recovered data having potential research value, identification of appropriate curation facilities, and a summary of the accession policies of the curation facilities.

Human Remains and Associated or Unassociated Funerary Objects. The treatment of human remains and of associated or unassociated funerary objects discovered during any soils disturbing activity shall comply with applicable State and Federal laws. This shall include immediate notification of the Coroner of the City and County of San Francisco and in the event of the Coroner's determination that the human remains are Native American remains, notification of the California State Native American Heritage Commission (NAHC) who shall appoint a Most Likely Descendant (MLD) (Pub. Res. Code Sec. 5097.98). The archeological consultant, project sponsor, and MLD shall make all reasonable efforts to develop an agreement for the treatment of, with appropriate dignity, human remains and associated or unassociated funerary objects (CEQA Guidelines. Sec. 15064.5(d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects.

Final Archeological Resources Report. The archeological consultant shall submit a Draft Final Archeological Resources Report (FARR) to the ERO that evaluates the historical significance of any discovered archeological resource and describes the archeological and historical research methods employed in the archeological testing/monitoring/data recovery program(s) undertaken. Information that may put at risk any archeological resource shall be provided in a separate removable insert within the final report.

Once approved by the ERO, copies of the FARR shall be distributed as follows: California Archaeological Site Survey Northwest Information Center (NWIC) shall receive one (1) copy and the ERO shall receive a copy of the transmittal of the FARR to the NWIC. The Environmental Planning division of the Planning Department shall receive one bound, one unbound and one unlocked, searchable PDF copy on CD of the FARR along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. In instances of high public interest in or the high interpretive value of the resource, the ERO may require a different final report content, format, and distribution than that presented above.

Mitigation Measure M-CP-3 - Paleontological Training Program and Alert Sheet

To reduce the potential for the proposed project to result in a significant impact on paleontological resources, the SFRPD shall arrange for a paleontological training by a qualified paleontologist regarding the potential for such resources to exist in the project site and how to identify such resources. The training shall also include a review of penalties for looting and disturbance of these resources. An alert sheet shall be issued and shall include the following:

1. A discussion of the potential to encounter paleontological resources;

2. Instructions for reporting observed looting of a paleontological resource; and instruct that if a paleontological deposit is encountered within a project area, all soil-disturbing activities in the vicinity of the deposit shall cease and the ERO shall be notified immediately.

3. If an unanticipated paleontological resource is encountered during project activities, all project activities shall stop, and a professional paleontologist shall be hired to assess the potential paleontological resource and its significance. The findings shall be presented to the ERO, who shall determine the additional steps to be taken before work in the vicinity of the deposit is authorized to continue.

Mitigation Measure M-CP-4 - Human Remains, Associated or Unassociated Funerary Objects

The treatment of human remains and of associated or unassociated funerary objects discovered during any ground-disturbing activity shall comply with applicable State and Federal Laws, including immediate notification to the San Mateo County Coroner and in the event of the Coroner's determination that the human remains are Native American remains, notification to the Native American Heritage Commission (NAHC) who shall appoint a Most Likely Descendant (MLD) (Pub. Res. Code Sec. 5097.98). The project archaeological consultant, SFRPD, and MLD shall make all reasonable efforts to develop an agreement for the treatment of, with appropriate dignity, human remains and associated or unassociated funerary objects (CEQA Guidelines. Sec. 15064.5(d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, curation, possession, and final disposition of the human remains and associated or unassociated funerary objects.

Mitigation Measure M-AQ-2 - Preparation and Implementation of a Dust Control Plan

The SFRPD shall comply with the following requirements to control fugitive dust:

- The SFRPD shall designate an individual to monitor compliance with dust control requirements identified in this mitigation measure;
- Water all active construction areas sufficiently to prevent dust from becoming airborne (without creating runoff) in any area of land clearing, earth movement, excavation, and other dust-generating activity. Watering shall occur as needed, and whenever wind speeds exceed 15 miles per hour. Reclaimed water shall be used whenever possible;
- Establish shutdown conditions based on wind, soil migration, and other factors;
- Limit the area subject to construction activities at any one time;
- During excavation and dirt-moving activities, wet sweep or vacuum the routes and paths where work is in progress at the end of the workday;
- Cover any inactive (no disturbance for more than seven days) stockpiles greater than ten cubic yards or 500 square feet of excavated materials, backfill material, import material, gravel, sand, road base, and soil with a 10 mil (0.01 inch), wildlife-friendly polyethylene plastic or equivalent tarp and brace it down or use other equivalent soil stabilization techniques;
- Limit the amount of soil in hauling trucks to the size of the truck bed, and secure the load with a tarpaulin;
- Enforce a 10-mile per hour (mph) speed limit for vehicles entering and exiting construction areas;
- All soil stockpiles, if any, shall be protected against wind and rainfall erosion at all times. Wildlife-friendly plastic sheeting or other similar material shall be used to cover soils and shall be securely anchored by sandbags or other suitable means. At no time shall any stockpiled materials be allowed to erode into any water body or drainage facility or onto any roadway; and
- Install and use wheel washers to clean truck tires.

The SFRPD shall prepare and submit a site-specific Dust Control Plan to the ERO for records. The Plan shall detail a protocol for project compliance with the above requirements.

Mitigation Measure M-BIO-2a - Protection of CRLF, SFGS, and WPT

1. All sensitive habitats outside the construction site shall be avoided during and following project implementation. All biologists working on the project and their roles shall be approved by the USFWS and CDFW[207] based on their qualifications. All approved biologists shall be part of the Project Implementation Team. The SFRPD shall designate one of the USFWS/CDFW-approved biologists to oversee and coordinate all avoidance and survey tasks of the Project Implementation Team. Prior to the commencement of any project-related construction activity, an approved biological monitor shall flag the sensitive areas and/or the limits of the construction site with suitable markers that are easily discernible by construction equipment operators. No construction equipment or personnel shall enter the sensitive areas designated for avoidance by the project;

2. The lead USFWS/CDFW-approved biological monitor shall be present at all planning meetings prior to project implementation. A USFWS/CDFW-approved biological monitor shall present an educational program at one or more such meetings regarding the listed species and their habitats. Every person who works on project implementation shall receive this education program and sign a form indicating they have attended and agree

[207] Formally known as CDFG

to abide by the terms and conditions being implemented to avoid take of listed species and/or habitat. A USFWS/CDFW-approved biological monitor shall be present at the site during all construction activities including, but not limited to, vegetation and sediment removal, placement of concrete support structures for the walkway, replacement of the retaining wall and pathway repair. The biological monitor shall have the authority to stop work temporarily in order to protect the listed species or the flagged sensitive areas;

3. Prior to commencement of any construction activities and daily prior to construction each day, a USFWS/CDFW-approved biological monitor shall survey the site for listed species. A USFWS/CDFW-approved biologist shall also oversee the installation of exclusion fencing in segments or fully enclosing components of the construction site as appropriate. The biological monitor shall inspect the integrity of the exclusion fencing on a daily basis;

4. During the proposed sediment and vegetation removal activities, if required, up to three biological monitors shall be present to: 1) monitor the area of vegetation or sediment removal; 2) observe the material as it is transferred to the shoreline; and 3) inspect material as it is loaded into a container/dump bed that will allow the water in the excavated sediment to drain out before removal from the site;

5. Biological monitors shall complete a daily monitoring log that records information on compliance and construction activities as well as avoidance measures implemented each day during the project. Each monitor shall submit a daily monitoring report from to the lead biologist before the start of the next construction day. Photographic documentation of project activities shall accompany each daily monitoring log. Within 60 days of completion of the project, the SFRPD shall submit a report to the USFWS and CDFW documenting compliance with the terms and conditions and avoidance of unauthorized take of species or habitat;

6. No earthmoving or soil disturbing work shall occur starting October 31 and ending June 1, the breeding season for CRLF and the season when SFGS are less active on the site;

7. Terrestrial vegetation in undisturbed areas around HSP and the connecting channel shall be cleared by manual means to a height of four inches (or a height that allows visibility of the ground) under the supervision of an approved biological monitor and checked for the presence of CRLF, SFGS, and WPT;

8. Prior to ground disturbing activities associated with construction, including the use of staging or vehicle access areas or the removal or placement of fill or construction materials, rodent burrows in the construction site shall be hand excavated by a USFWS/CDFW-approved biologist until the burrow terminates or until a maximum depth of 30 centimeters;

9. Vehicle speeds in the project area shall not exceed 10 miles an hour. The USFWS/CDFW-approved biological monitor shall inspect for CRLF, SFGS, and WPT underneath any vehicle that is parked for 30 minutes or more prior to moving the vehicle. All construction personnel shall inspect under their tires and vehicle if it is in idle for more than five minutes and has not been inspected by the on-site monitor. Vehicles accessing the construction site shall be limited to the minimum necessary to complete the project. Project personnel shall park personal vehicles at a staging area located away from all aquatic habitats or areas of sensitive upland habitat;

10. Any workers on the site that observe any frog, snake, or turtle shall immediately report their findings to the on-site biological monitor and immediately suspend work that may be harmful to the individual. The monitor shall identify the animal if it has not left the area. If a CRLF, SFGS, or WPT is observed in the work area, it shall be relocated by a USFWS/CDFW-approved biological monitor to the nearest suitable aquatic habitat out of harm's way. Work may only recommence if CRLF, SFGS, and WPT move out of harm's way or the animal is relocated by the biological monitor. Work may not recommence until the biological monitor has returned to the work area and gives approval;

11. Only USFWS/CDFW-approved personnel shall be allowed to capture or attempt to capture and move CRLF, SFGS, WPT, or other non-listed wildlife (e.g., treefrogs, small rodents) in the work area;

12. Erosion control best management practices (silt fences, coir rolls, straw bales) shall be employed as part of the dewatering of sediments after removal and while soils are exposed. The erosion control measures shall not include netting, plastic or natural monofilament netting or other materials that may entrap CRLF, SFGS, or WPT;

13. After completion of the project, the access routes in the wetland shall be revegetated with appropriate native plants and erosion control measures, as described in Measure 12, as outlined above, shall be installed on exposed soils with slopes of 3:1 or greater;

14. All construction activities shall occur in uplands and on the golf course. Stockpiling and staging areas shall be located in the uplands and in areas cleared for species and the golf course. Construction materials (bricks, boards, shoring, concrete forms, etc.) shall be elevated approximately four to six inches above ground to minimize the potential for species to take cover under these items. If feasible, materials shall be staged on a trailer/truck bed to avoid contact with the ground. Construction materials shall be brought to on-site staging areas as close to the time they are needed as possible;

15. The SFRPD shall minimize the potential for harm, harassment, injury, and death of federally listed wildlife species resulting from project-related activities including implementation of the Conservation Measures in the Biological Opinion;

16. If requested, during or upon completion of construction activities, the SFRPD shall ensure the USFWS, CDFW, or their authorized agents have immediate access to the project area. The on-site biologist and/or a representative from the USACE/SFRPD shall accompany USFWS personnel on an on-site inspection of the project area(s) to review project effects to CRLF and SFGS and their habitat;

17. The SFRPD shall ensure compliance with the Reporting Requirements of the Biological Opinion;

18. During the course of construction activities, biological monitors may determine that relocation of a CRLF or SFGS is necessary for the safety of individual animals. If it is determined that a SFGS needs to be moved, the USFWS shall be contacted for further guidance. Individuals shall be relocated to appropriate sites away from disturbance on Sharp Park property;

19. Within nine months of issuance of the Biological Opinion, the SFRPD shall develop, for the USFWS review and approval, a monitoring plan for the new perennial pond. The plan shall include monitoring of: 1) the use of the pond by all life stages of CRLF and SFGS, 2) the amount of emergent vegetation and open water available, and 3) how

effective barriers are at preventing entry by people and off-leash dogs. If predators become established in the pond they shall be immediately removed and the USFWS shall be notified; and

20. Implementation of the pond monitoring plan shall begin immediately following the construction of the new pond.

Mitigation Measure M-BIO-2b - Protection of Special-Status Species and Water Quality from Acid Sulfate Soils and Other Components

Prior to commencement of any on-site work related to the proposed removal of sediment and emergent vegetation in HSP or the connecting channel and culverts that link HSP and LS, sediment core sampling tests shall be conducted in the manner specified in this mitigation measure.

The result of the sediment core sampling tests and remediation measures recommended by a qualified SFRPD biological/hydrological consultant, if any, shall be submitted to the USFWS and CDFW for review and approval prior to commencement of any on-site remediation work or sediment/vegetation removal work at HSP or the connecting channel and culverts. If the USFWS or CDFW determines, based on the results of the sediment core sampling tests, that remediation measures are required, the SFRPD shall submit a remediation and monitoring plan to all applicable resource agencies for review and approval prior to implementation of the remediation measures. Copies of all correspondence with the resource agencies shall be submitted to the ERO for review. The sediment core sampling tests shall include the following elements:

1. Work Plan

   A Work Plan for sediment core sampling tests shall be prepared by a qualified SFRPD biological/hydrological consultant and submitted to the USFWS and CDFW for review and comment prior to commencement of any on-site work related to the sampling tests. The Work Plan shall describe, at a minimum, compliance with Items 2 through 6 of this mitigation measure. Copies of all correspondence with the resource agencies shall be submitted to the ERO for review.

2. Sampling of Sediment Cores

   The sampling test shall include collection of, at minimum, one sediment core from HSP, two from the connecting channel, and one from LS. The exact locations of sampling shall be determined pursuant to the work plan developed in accordance with Item 1, above. Sample sediment cores shall include the soils between the current surface sediment level and approximately two to three feet below the current surface. This depth shall be at least one foot below the proposed depth of the future sediment-water interface.

3. Analysis of Sediment Cores and Estimation of the Potential for Formation of Acid Sulfate Soils

   The sediment cores shall be analyzed every five centimeters over the first 20 centimeters of core depth and then every 10 centimeters for the remainder of the core length for the following components: Total Organic Carbon (TOC), carbonate/bicarbonate, sulfate, sulfide, sulfites, pH, calcium, sodium, iron, aluminum, chloride, conductivity, redox potential, refractory organics, organic nitrogen, total phosphorus, ammonia, nitrate+nitrite nitrogen, soluble reactive phosphorus, organic phosphorus, loosely-sorbed phosphorus, iron-phosphorus, iron-phosphorus, aluminum-phosphorus, and calcium-phosphorus. Sediment core chemistry shall be analyzed to assess the potential reduction of sulfate to form hydrogen sulfate, iron sulfides, and reduction buffering capacity relative to acid-neutralizing capacity.

In addition, sediment oxygen demand (SOD) in the sediment cores shall be measured. Results shall be compared to the total oxidizable organic material, which would be estimated from the difference of TOC and refractory organic carbon (labile carbon). These results shall be used in the analysis of potential for formation of anoxic conditions within the newly restored HSP and connecting channel.

Sediment cores shall be analyzed based on Toxicity Reference Values (TRVs) from the USEPA and Screening Quick Reference Tables (SQuiRT) from the NOAA.[208] A draft summary of potential toxics shall be provided to the USFW, CDFW, and ERO for review and, if needed, revision will be made to the toxicity ranges appropriate for use in analyzing the sediment cores.

The potential for formation of acid sulfate soils and anoxic conditions in the water column shall be estimated based on this analysis and in coordination with the USFWS and CDFW. If this analysis determines that acid sulfate soils could be present in this location, the SFRPD shall perform a toxic pathway analysis[209] to determine the appropriate remediation measures. The analysis results and determination shall be submitted to the USFWS, CDFW, and ERO for review.

4. Toxics Pathway Analysis

   Should the potential for acid sulfate soils and anoxic conditions be present, a toxics pathway analysis shall be conducted for potential risks and toxicities to species that may be affected by localized increases in acidity, hypoxia, or dissolved metals concentration. During this Task, toxicity standards shall be established by the USFWS, CDFW, and ERO based on the results of Items 2 and 3 above, site-specific hydrologic conditions including water exchange and dissolved oxygen levels, the species that are known to be present, and literature review. The results of this task shall be submitted to the USFWS and CDFW and any applicable resource agencies for review and approval. Copies of all correspondence with the resource agencies shall be submitted to the ERO for review.

   Should the results of the sediment core tests reveal that there has been an appreciable increase in the amount of nitrogen and related compounds in the sediment cores, any necessary measures to remediate such compounds shall be undertaken in accordance with Task 5, below. The SFRPD shall hire a qualified biological/hydrological consultant to prepare a remediation and monitoring plan which shall be submitted to the USFWS and CDFW for review and approval. Copies of all correspondence with the resource agencies shall be submitted to the ERO for review.

5. Remediation

   If results of the sediment core chemistry analysis reveal the potential for reduction of sulfate to form hydrogen sulfate, iron sulfides, and its reduction in buffering capacity

[208] NOAA, Office of Response and Restoration. *SQuiRT Cards*. Available online at: *http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html*. Accessed July 17, 2013.

[209] A toxic pathway analysis identifies potential risks and toxicities to species that may be affected by localized increases in acidity, hypoxia, or dissolved metals concentration.

relative to acid-neutralizing capacity, or if the toxics pathway analysis indicates that their presence could potentially result in substantial stress to special-status species, the SFRPD shall implement remediation measures, as approved by the USFWS and CDFW.

Remediation measures could include, but are not limited to:

a. Addition of lime to neutralize any acid that exists or which may form during the sediment removal process;

b. Injection of sodium nitrate to oxidize the sediments, thereby satisfying the sediment oxygen demand; or

c. Use of suction hydraulic sediment removal that reduces re-suspension of any form of sediments.

Depending on the severity of the condition (e.g., hypoxia), the remediation measure selected for implementation would be the least intensive beginning with Item a, when signs of hypoxia are present, to the most intensive with Item c, when hypoxia is persistent and/or widespread. The SFRPD shall select the remediation measure in consultation with the USFWS and CDFW. The remediation measure shall be selected based on immediate threats to species and sensitive life stages present during occurrence of the hypoxic condition.

6. Monitoring

During sediment and vegetation removal in HSP and the connecting channel and culverts, pH levels immediately above the sediment shall be monitored by the SFRPD to ensure that implementation of the proposed project would not adversely affect special-status species.[210] To ensure that residual acid sulfates in the water column would not adversely impact special-status species, pH levels in HSP and the connecting channel shall be monitored by the SFRPD for a period of six weeks after the proposed sediment and vegetation removal is completed. A remediation measure, such as addition of lime or injection of sodium nitrate, shall be implemented if the monitoring warrants such a remediation measure to protect special-status species based on the toxicity standards that are established in accordance with Task 4 above.[211]

Mitigation Measure M-BIO-2c - Protection of Bird Species

Vegetation removal activities shall be conducted outside the breeding season (February 1 to August 31), unless the following specific conditions are met: a breeding bird survey by a qualified biologist has been conducted prior to any vegetation removal activities. If active nests (or large abandoned stick nests) of a sensitive species are discovered, a 150-foot-radius avoidance buffer shall be centered on the nest site(s) to prevent nesting birds from being disturbed by power tools or other equipment. Weeds may be pulled by hand no closer than 50 feet from the nest.

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[210] pH is an indicator of anoxic conditions at the sediment-surface water interface. Under anoxic conditions, hydrogen ion availability increases and binds with sulfides mobilized from sediments. Rates of transformation of sulfur are mediated by microorganisms in both the sediments and surface water. Suspension of hydrogen sulfide (H_2S) in the water column is oxidized in surface water to form sulfuric acid (H_2SO_4).

[211] David Munro, Tetra Tech, Inc. *Email to Stacy Bradley, SFRPD, Sharp Park Appeal: M-BIO-2b - Post Construction Monitoring*, January 7, 2014. This document is available for review as part of Case File No. 2012.1427E at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, California 94103.

Mitigation Measure M-BIO-4a - Protection of Wetlands and Natural Habitat

The SFRPD shall obtain all applicable permits from the SFBRWQCB, CCC, USACE, and CDFW to protect wetlands and natural habitat. Measures identified in these permits shall be applied, in addition to the following measures, unless otherwise specified by resource agencies:

1. In areas where work is not directly taking place, a minimum 100-foot buffer surrounding all wetlands, ponds, streams, drainages, and other aquatic habitats located on or within 100 feet of the project site shall be clearly designated on the final project construction plans and marked on the site with wildlife-friendly orange construction fencing or silt fencing. If the area is on a slope, silt fencing or other comparable management measures will be installed to prevent polluted runoff, as well as equipment, from entering the buffer area. Signs shall be installed every 100 feet on or adjacent to the buffer fence that read, "Environmentally Sensitive Area – Keep Out." Fencing and management measures shall be installed and inspected prior to project implementation and maintained throughout the restoration period. No equipment mobilization, grading, clearing, storage of equipment or machinery, vehicle or equipment washing, or similar activity, may occur until a representative of the SFRPD has inspected and approved the fencing and/or management measures installed around these features;

2. Vehicle and equipment operators shall use existing access roads and shall remain outside of wetlands and riparian areas that are not directly associated with the proposed project. Project construction and staging areas shall be delineated with construction fencing and shall avoid wetland habitat to the maximum extent feasible; and

3. All vehicles shall be brought in clean and free of weeds to prevent the spread or introduction of invasive plant species. Vehicles and equipment shall be fueled, maintained, and parked at least 100 feet from wetlands. Each morning, operators shall inspect all equipment that requires the use of fuel or fluids for leaks.

Mitigation Measure M-BIO-4b - Wetland Mitigation Plan for Temporarily Affected Areas

Consistent with the requirements for a Section 401 water quality certification permit, the SFRPD shall prepare a wetland mitigation plan for temporarily effected wetlands. Additionally, because the proposed project includes habitat restoration (i.e., construction of a perennial pond), the CCC may require an objective performance evaluation to determine project success which would include a monitoring program and methods for evaluating performance, which could be accomplished through implementation of the wetland mitigation plan. The wetland mitigation plan shall include, at a minimum, a description of the following:

- Proposed project's physical and biological impacts;
- Mitigation goals;
- Mitigation work plan;
- Management and maintenance plan;
- Success criteria and performance indicators;
- Monitoring plan; and
- Site protection measures.

The components of the above mitigation plan may be altered, supplemented, or deleted during the SFBRWQCB's review process, as the SFBRWQCB has final authority over the terms of the water quality certification.

G. PUBLIC NOTICE AND COMMENT

A "Notification of Project Receiving Environmental Review" was sent out on January 15, 2013, to the owners of properties within 300 feet of the Sharp Park boundaries and to occupants of properties adjacent to the project site, as well as to other interested parties. The Planning Department received several letters in response to the notice. Respondents requested to receive environmental review documents and/or expressed concerns regarding the proposed project, which included: (1) impacts to CRLF and SFGS; (2) impacts to other special-status species and wetland habitats; and 3) historic resource impacts. These issues are addressed in the appropriate topic areas in Section E, Evaluation of Environmental Effects.

H. DETERMINATION

On the basis of this initial study:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, no further environmental documentation is required.

DATE: January 9th, 2014

Viktoriya Wise for

Sarah B. Jones
Environmental Review Officer
for
John Rahaim
Director of Planning

I. INITIAL STUDY PREPARERS

Initial Study Authors

Planning Department, City and County of San Francisco
1650 Mission Street, Suite 400
San Francisco, CA 94103

Environmental Review Officer: Sarah B. Jones
Project Supervisor: Rick Cooper
Environmental Coordinator: Kei Zushi
Air Quality and GHG: Jessica Range
Archeology: Randall Dean
Historical Resources: Shelley Caltagirone

Biological Consultant

Dave Munro
Tetra Tech, Inc.
1020 SW Taylor St., Suite 530
Portland, OR 97205
(503) 223-5388 ext. 112

Project Sponsor

Recreation and Park Department, City and County of San Francisco
McLaren Lodge-Golden Gate Park
501 Stanyan Street
San Francisco, CA 94117
(415) 575-5609
Contact: ~~Karen Mauney-Brodek~~ Stacy Bradley

Project Site Owner

Recreation and Park Department, City and County of San Francisco
McLaren Lodge & Annex
501 Stanyan Street
San Francisco, CA 94117
(415) 575-5609
Contact: ~~Karen Mauney-Brodek~~ Stacy Bradley

CASE NUMBER: For Staff Use only	

APPLICATION FOR
Board of Supervisors Appeal Fee Waiver

1. Applicant and Project Information

APPLICANT NAME:	
San Francisco Recreation and Park Department	
APPLICANT ADDRESS: McLaren Lodge-Golden Gate Park 501 Stanyan St. San Francisco, CA 94117	TELEPHONE: (415) 575-5609 EMAIL: stacy.bradley@sfgov.org

NEIGHBORHOOD ORGANIZATION NAME:	
Wild Equity Institute	
NEIGHBORHOOD ORGANIZATION ADDRESS: 474 Valencia St., Suite 295 San Francisco, CA 94103	TELEPHONE: (415) 349-5787 EMAIL: info@wildequity.org

PROJECT ADDRESS:		
Sharp Park		
PLANNING CASE NO.:	BUILDING PERMIT APPLICATION NO.:	DATE OF DECISION (IF ANY):
2012.1427E	n/a	01/23/2014

2. Required Criteria for Granting Waiver

(All must be satisfied; please attach supporting materials)

☒ The appellant is a member of the stated neighborhood organization and is authorized to file the appeal on behalf of the organization. Authorization may take the form of a letter signed by the President or other officer of the organization.

☒ The appellant is appealing on behalf of an organization that is registered with the Planning Department and that appears on the Department's current list of neighborhood organizations.

☒ The appellant is appealing on behalf of an organization that has been in existence at least 24 months prior to the submittal of the fee waiver request. Existence may be established by evidence including that relating to the organization's activities at that time such as meeting minutes, resolutions, publications and rosters.

☒ The appellant is appealing on behalf of a neighborhood organization that is affected by the project and that is the subject of the appeal.

For Department Use Only

Application received by Planning Department:

By: ______________________________ Date: ______________

Submission Checklist:

☐ APPELLANT AUTHORIZATION

☐ CURRENT ORGANIZATION REGISTRATION

☐ MINIMUM ORGANIZATION AGE

☐ PROJECT IMPACT ON ORGANIZATION

☐ WAIVER APPROVED ☐ WAIVER DENIED

SAN FRANCISCO
PLANNING
DEPARTMENT

FOR MORE INFORMATION:
Call or visit the San Francisco Planning Department

Central Reception
1650 Mission Street, Suite 400
San Francisco CA 94103-2479

TEL: **415.558.6378**
FAX: **415.558.6409**
WEB: **http://www.sfplanning.org**

Planning Information Center (PIC)
1660 Mission Street, First Floor
San Francisco CA 94103-2479

TEL: **415.558.6377**
Planning staff are available by phone and at the PIC counter. No appointment is necessary.

WILD Equity
INSTITUTE
Building a healthy and sustainable global community for people and the plants and animals that accompany us on Earth

February 21, 2014

Angela Calvillo
Clerk of the Board
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, CA 94102-4689

Jane Hicks, Chief
Regulatory Division
U.S. Army Corps of Engineers
San Francisco District
1455 Market Street, 16th Floor
San Francisco, CA 94103

Dan Crum, Assistant Special Agent in Charge
Office of Law Enforcement
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way, W-2928
Sacramento, California 95825

RE: Case No. 2012.1427E. APPEAL OF THE FINAL MITIGATED NEGATIVE DECLARATION AND PROJECT APPROVAL FOR THE SAN FRANCISCO RECREATION AND PARK DEPARTMENT'S PROPOSED "SHARP PARK PUMPHOUSE SAFETY AND INFRASTRUCTURE IMPROVEMENT PROJECT"

To Whom It May Concern:

I, Brent Plater, am authorized to file this appeal on behalf of the Wild Equity Institute in my capacity as President, Executive Director, and member of the organization.

The Wild Equity Institute is registered with the Planning Department as a neighborhood organization, and appears on the Department's current list of neighborhood organizations.

The Wild Equity Institute has been in existence for longer than 24 months, and has been actively involved in issues around Sharp Park for many years. For example, please see the attached 60-day notice filed with the City in 2009.

Sincerely,

Brent Plater

Brent Plater

Brent Plater, Executive Director ❧ 474 Valencia St., Suite 295 ❧ San Francisco, CA ❧ 94103
O: 415-349-5787 ❧ C: 415-572-6989 ❧ bplater@wildequity.org ❧ http://wildequity.org

WILD Equity
INSTITUTE
Building a healthy and sustainable global community for people and the plants and animals that accompany us on Earth

December 14, 2009

General Manager Phil Ginsburg
San Francisco Recreation and Park Department
501 Stanyan Street
San Francisco, CA 94117

Secretary Ken Salazar
U.S. Department of the Interior
1849 C Street, NW
Washington, D.C. 20240

RE: 60-DAY NOTICE OF INTENT TO SUE FOR VIOLATING THE ENDANGERED SPECIES ACT

Dear General Manager Ginsburg and Secretary Salazar:

On behalf of the Wild Equity Institute ("WEI"), I write to inform you of the San Francisco Recreation and Park Department's ("SFRPD") ongoing violations of the Endangered Species Act ("ESA"), 16 U.S.C. § 1531 *et seq.*, and provide official notice pursuant to 16 U.S.C. § 1540(g) of WEI's intent to file suit in federal court if these violations are not remedied within the next 60 days.

As you know, Sharp Park Golf Course—owned by the City and County of San Francisco, operated by SFRPD, but located in Pacifica, California—has been harming two of the Bay Area's most wondrous and imperiled animals for several years: the threatened California red-legged frog, *Rana draytonii,* and the endangered San Francisco garter snake, *Thamnophis sirtalis tetrataenia.* Specifically, SFRPD has killed California red-legged frogs by pumping freshwater from the frog's aquatic habitats during the breeding season, exposing the species' egg masses to the air and killing the eggs. SFRPD has also killed the San Francisco garter snake by mowing the species' upland habitats, resulting in the actual death or injury of individual snakes. The United States Fish and Wildlife Service have documented both of these forms of take, and both plainly violate the ESA.

Despite these violations, SFRPD has failed to finalize a plan to come into compliance with the ESA; it has failed to implement measures in its final draft compliance plan; and it is proposing to move forward with an 18-hole golf alternative at Sharp Park that will, if implemented, result in significant modification and degradation of existing habitat for both species.

By authorizing and committing activities that result in take of these species, SFRPD is in violation of Section 9 of the ESA, which prohibits the taking of listed species. Moreover, if SFRPD continues to pursue an 18-hole golf alternative at Sharp Park, the required habitat modifications will result in illegal harm to the species through modification or degradation of existing habitats. This would not only constitute illegal take under the ESA, but will also jeopardize the long-term recovery of both species. SFRPD must therefore cease harmful activities at Sharp Park, reconsider future land management at the property, and come into compliance with the law.

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I. BACKGROUND

A. The California red-legged frog, *Rana draytonii*

The California red-legged frog is the largest frog native to the western United States. For many years, it was considered one of two subspecies of the red-legged frog, *Rana aurora*, with the boundary between the two subspecies just north of the Golden Gate National Parks: for example, Point Reyes National Seashore can have individuals from both subspecies, as well as intergrades of the two. However, recent studies indicate that the California red-legged frog is its own species, *Rana draytonii*, and that the boundary between it and *Rana aurora* is much farther north.

The California red-legged frog has been intertwined with California history and the lore of the West in several surprising ways. Made famous as the title character of Mark Twain's tale "The Celebrated Jumping Frog of Calaveras County," it was a favorite competitor in jumping frog competitions—until the species was displaced by species imported from other parts of the world. It became a staple of the diet of the forty-niners during the California Gold Rush, and eventually became an item on the menu of San Francisco's finest dining establishments.

Unfortunately, the California red-legged frog has now been lost from over 70% of its historic range. It is currently only found in select coastal drainages from Marin County south to Baja California, with a few isolated populations in the Sierra Nevada and the Transverse ranges. In 1996, the United States Fish and Wildlife Service listed the California red-Legged frog as a threatened species under the Endangered Species Act.

The threats facing the frog are numerous, and correspond to a global decline in amphibian species: urban encroachment on existing habitats; the construction of reservoirs and water diversions that destroy feeding and breeding habitats; pesticide runoff and drift disrupting the species' endocrine systems; livestock grazing; and the introduction of invasive, colonial species that compete—and sometimes eat—the California red-legged frog.

At Sharp Park, SFRPD's operation and management of the golf course is causing take of the California red-legged frog in numerous ways. First, by pumping water out of the species' aquatic habitats during the frog's breeding season, SFRPD strands California red-legged frog egg masses, causing these eggs to desiccate and die. From 2003-05, SFRPD observed stranded egg masses after pumping operations in Horse Stable Pond, where the pump house is located. Although pumping protocols were implemented to prevent egg mass standings, these protocols have not been effective: in 2008 SFRPD contractors observed "several" stranded egg masses after pumping operations, despite these protocols.

Second, by pumping water out of Laguna Salada, Sanchez Creek, and Horse Stable Pond during any time of the year, SFRPD is reducing the availability of aquatic habitat for the species. These aquatic habitats are essential for breeding, feeding, and sheltering, and by significantly modifying and destroying these habitats through pumping operations SFRPD is illegally causing harm to the species.

Third, SFRPD uses significant amounts of fertilizers and other chemical compounds to operate and maintain Sharp Park Golf Course, and these compounds directly or indirectly enter aquatic habitat features used by the California red-legged frog. These compounds degrade habitat quality, significantly modifying these habitats and harming the species. The compounds may also be directly toxic to amphibians.

Fourth, the California red-legged frog uses animal burrows for cover, and these burrows are essential elements of the species' upland habitat requirements. SFRPD destroys animal burrows and actively traps animals to prevent them from burrowing on the property. By reducing the availability of burrows, RPD is significantly modifying and degrading the species' habitats at Sharp Park, causing illegal harm to the species. Moreover, the traps themselves can cause death or injury to the California red-legged frog.

Fifth, SFRPD has failed to provide adequate protections from sea level rise for the California red-legged frogs at Sharp Park. As sea levels rise and SFRPD invests more resources into armoring the existing sea wall, California red-legged frog habitats at Sharp Park will be below sea level, and combined with ongoing pumping of freshwater from the Lagoon, this will inevitably result in seepage of saline water through the groundwater buffers into Laguna Salada. As the salinity gradient increases, the habitat will become adversely modified and degraded, resulting in harm to the species.

Sixth, SFRPD pumping operations and impinge and entrain California red-legged frog eggs and tadpoles. Recent expansion of pumping outflow at Sharp Park has already caused other species such as crayfish to become entrained by pumping operations, killing the animals. SFRPD biologists have noted that a similar fate may occur to California red-legged frogs.

B. The San Francisco garter snake, *Thamnophis sirtalis tetrataenia*

The San Francisco garter snake has been called North America's most beautiful serpent. A fantastically colored species that does justice to its moniker, it is identified by its reddish-orange head with red, black, and blue racing stripes on its sides and back.

Unfortunately this harmless and gorgeous critter isn't easily seen, in part because it is on the brink of extinction. Restricted primarily to San Mateo County, the species' preferred habitats—wet and marshy habitats with access to upland areas—have been modified and destroyed by agricultural, residential, commercial, and even recreational development. There may be only one to two thousand individuals remaining in the wild today.

The San Francisco garter snake was protected as an endangered species under the Federal Endangered Species Act when the Act was passed in 1973. Since that time great effort has gone into conserving the species, including the creation of a recovery plan and controlling developments to ensure that the species' habitats aren't adversely modified. However, many obstacles still remain to the species survival. Indeed, it is even starting to lose its favored prey: the California red-legged frog is itself threatened with extinction by development and other threats.

At Sharp Park, SFRPD's operation and management of the golf course is causing take of the San Francisco garter snake in numerous ways. First, mowing has lead to the direct death of at least one San Francisco garter snake at Sharp Park, and ongoing mowing operations continue to pose a risk of direct take of the species. Moreover, ongoing mowing operations significantly degrade and modify potential habitats for the species, causing harm in violation of the ESA.

Second, by pumping water out of Laguna Salada, Sanchez Creek, and Horse Stable Pond during any time of the year, SFRPD is reducing the availability of aquatic habitat for the species. These aquatic habitats are essential for breeding, feeding, and sheltering, and by significantly modifying and destroying these habitats through pumping operations SFRPD is illegally causing harm to the species.

Third, SFRPD uses significant amounts of fertilizers and other chemical compounds to operate and maintain Sharp Park Golf Course, and these compounds directly or indirectly enter aquatic habitat features used by the San Francisco garter snake. These compounds degrade habitat quality, significantly modifying these habitats and harming the species. These compounds may also be directly toxic to reptiles.

Fourth, the San Francisco garter snake uses animal burrows for cover, and these burrows are essential elements of the species' upland habitat requirements. SFRPD destroys rodent burrows and actively traps animals to prevent them from burrowing on the property. By reducing the availability of burrows, RPD is significantly modifying and degrading the species' habitats at Sharp Park, causing illegal harm to the species. Moreover, the traps themselves can cause death or injury to the San Francisco garter snake.

Fifth, SFRPD has failed to provide adequate protections from sea level rise for the California red-legged frog at Sharp Park. As sea levels rise and SFRPD invests more resources into armoring the existing sea wall, San Francisco garter snake habitats at Sharp Park will be below sea level, and combined with ongoing pumping of freshwater from the Lagoon, this will inevitably result in seepage of saline water through groundwater buffers into Laguna Salada. As the salinity gradient increases, the habitat will become adversely modified and degraded, resulting in harm to the species.

Sixth, golf cart asphalt pathways and other upland areas are used as basking habitats for San Francisco garter snakes. SFRPD-leased golf carts operating on these pathways may directly kill or injure San Francisco garter snakes basking in the sun or absorbing warmth from the dark pathways. Golf cart leasing operations that cause take are impermissible under the ESA.

II. REMEDIAL MEASURES

SFRPD must take remedial measures to eliminate the risk of take caused by the operations and maintenance of Sharp Park Golf Course. To provide effective, sustainable resolution of these legal violations, Sharp Park's existing land use patterns must be reconfigured to eliminate existing threats to the species and to prepare Sharp Park for changes wrought by climate change.

Sharp Park Golf Course currently impinges on Laguna Salada's historic footprint: the golf course's construction filled-in the lagoon's best habitats for the endangered species while preventing natural freshwater outflow to the ocean. Today the lagoon is surrounded by an eroding sea wall and a low-quality golf course that impairs the lagoon's ability to adapt to changing conditions.

But as climate change causes sea levels to rise, the pressure on the sea wall will increase the probability of a catastrophic flooding event that might harm both endangered species and the surrounding communities.

Restoring wetlands and upland habitats while allowing the natural barrier lagoon system to migrate inland and upland in concert with sea level rise will be the most sustainable method for preventing and reducing flood risks while improving habitat conditions for the endangered species on the property. This will not only reduce the probability of a catastrophic flooding event, it will also reduce the nature of any harm a flooding event might cause. Restored wetlands will reduce the wave energy of flooding events, absorb water, and ultimately ensure that flood waters do not extend to the inland reaches of Sharp Park, narrowing the band of land that might be affected if a flooding event occurs.

III. NOTICE OF VIOLATION OF SECTION 9 OF THE ESA

Section 9 of the ESA prohibits the take of any species listed under the ESA. 16 U.S.C. § 1538. SFRPD is violating Section 9 of the ESA. It is committing illegal, ongoing take of the California red-legged frog and the San Francisco garter snake. There is documented evidence of past and recent take of both species, directly and through significant habitat modification and degradation. It is reasonably certain that imminent harm will continue at Sharp Park under existing and proposed management activities. This violates the ESA, and WEI will pursue legal remedies in federal court if these harms are not remedied within 60-days of receipt of this letter.

If SFRPD has any questions about this notice letter, or wishes to discuss this matter further, please feel free to contact me at the number listed on this letterhead.

Sincerely,

Brent Plater