SAN FRANCISCO PUBLIC UTILITIES COMMISSION

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WATER & POWER
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San Francisco Public Utilities Commission
City and County of San Francisco
Contract Administration Bureau
1155 Market Street, 9th Floor
San Francisco, California 94103

Agreement between the City and County of San Francisco and

URS Corporation

This Agreement is made this 24th day of May, 2006, in the City and County of San Francisco, State of California, by and between: URS Corporation, 1333 Broadway, Suite 800, Oakland, California 94612, hereinafter referred to as "Contractor," and the City and County of San Francisco, a municipal corporation, hereinafter referred to as "City," acting by and through its Director of the Office of Contract Administration or the Director's designated agent, hereinafter referred to as "Purchasing."

Recitals

WHEREAS, the San Francisco Public Utilities Commission ("Department") wishes to retain the services of URS Corporation, 1333 Broadway, Suite 800, Oakland, California 94612, to provide Professional Engineering Services to the new Irvington Tunnel; and,

WHEREAS, a Request for Proposal ("RFP") was issued on January 18, 2006, and City selected Contractor as the highest qualified scorer pursuant to the RFP; and

WHEREAS, Contractor represents and warrants that it is qualified to perform the services required by City as set forth under this Contract; and,

WHEREAS, approval for said Agreement was obtained from a Civil Service Commission Notice of Action for Contract Number 4055-05/06 on December 5, 2005; and

WHEREAS, On May 9, 2006, per Resolution No. 06-0081, attached hereto, the San Francisco Public Utilities Commission approved the selection of URS Corporation and authorized the General Manager of the San Francisco Public Utilities Commission to execute a written contract for CS-820 Engineering Services, The New Irvington Tunnel, to provide Engineering Services for an amount not to exceed $8,600,000 and with a duration of 84 months from the date of Controller certification.

Now, THEREFORE, the parties agree as follows:

1. Certification of Funds; Budget and Fiscal Provisions; Termination in the Event of Non-Appropriation

This Agreement is subject to the budget and fiscal provisions of City's Charter. Charges will accrue only after prior written authorization certified by the Controller, and the amount of City's obligation hereunder shall not at any time exceed the amount certified for the purpose and period stated in such advance authorization.

This Agreement will terminate without penalty, liability or expense of any kind to City at the end of any fiscal year if funds are not appropriated for the next succeeding fiscal year. If funds are appropriated for a portion of the fiscal year, this Agreement will terminate, without penalty, liability or expense of any kind at the end of the term for which funds are appropriated.

City has no obligation to make appropriations for this Agreement in lieu of appropriations for new or other agreements. City budget decisions are subject to the discretion of the Mayor and the Board of Supervisors. Contractor's assumption of risk of possible non-appropriation is part of the consideration for this Agreement.

THIS SECTION CONTROLS AGAINST ANY AND ALL OTHER PROVISIONS OF THIS AGREEMENT.

2. Term of the Agreement

Subject to Section 1, the term of this Agreement shall be 84 months from the effective date as set forth in Section 3.

3. Effective Date of Agreement

This Agreement shall become effective when the Controller has certified to the availability of funds and Contractor has been notified in writing.

4. Services Contractor Agrees to Perform

The Contractor agrees to perform the services provided for in Appendix A, "Description of Services," attached hereto and incorporated by reference as though fully set forth herein.

5. Compensation

Compensation shall be made in monthly payments on or before the first day of each month for work, as set forth in Section 4 of this Agreement that the General Manager, in his or her sole discretion, concludes has been performed as of the last day of the immediately preceding month. In no event shall the amount of this Agreement exceed Eight Million Six Hundred Thousand Dollars ($8,600,000). The breakdown of costs associated with this Agreement appears in Appendix B, "Calculation of Charges," attached hereto and incorporated by reference as though fully set forth herein.

As part of this contract Task Orders will be prepared in accordance with Appendix A. Task Orders will identify a detailed project scope, sub tasks, staffing plan, DBE utilization, schedule, deliverables, budget and costs to complete the task. A final task order scope will be negotiated between the SFPUC Project Manager and the Contractor and then submitted to Project Management Bureau Manager for approval. Each Task Order shall identify the entire amount to which the Contractor shall be entitled to fully perform and deliver to City all work identified in that Task Order. The task order request will be processed for Controller certification of funding, after which a *Notice to Proceed* will be issued. The Contractor is hereby notified that work cannot commence until the Contractor receives a written Notice to Proceed in accordance with Chapter 6 of the San Francisco Administrative Code. ***Any work performed without a Notice to Proceed will be at the Contractor's own commercial risk.*** The calculations of costs and methods of compensation for all task orders under this contract shall be in accordance with the negotiated master contract and billing rates set forth in Appendix B. However, as provided in the RFP, the budget identified for tasks in Appendix B is an estimate, and the City reserves the right to modify the

budget allocated to any task as more specific information concerning the task order scope becomes available.

No charges shall be incurred under this Agreement nor shall any payments become due to Contractor until reports, services, or both, required under this Agreement are received from Contractor and approved by the San Francisco Public Utilities Commission as being in accordance with this Agreement. City may withhold payment to Contractor in any instance in which Contractor has failed or refused to satisfy any material obligation provided for under this Agreement.

In no event shall City be liable for interest or late charges for any late payments.

The Controller is not authorized to pay invoices submitted by Contractor prior to Contractor's submission of HRC Form 7, "Prime Consultant/Joint Venture Partner(s) and Sub-consultant Participation Report." If HRC Form 7 is not submitted with Contractor's invoice, the Controller will notify the department, the Director of HRC and Contractor of the omission. If Contractor's failure to provide HRC Form 7 is not explained to the Controller's satisfaction, the Controller will withhold 20% of the payment due pursuant to that invoice until HRC Form 7 is provided.

Following City's payment of an invoice, Contractor has ten days to file an affidavit using HRC Form 9, "Sub-Consultant Payment Affidavit," verifying that all subcontractors have been paid and specifying the amount.

6. Guaranteed Maximum Costs

a. City's obligation hereunder shall not at any time exceed the amount certified by the Controller for the purpose and period stated in such certification.

b. Except as may be provided by laws governing emergency procedures, officers and employees of City are not authorized to request, and City is not required to reimburse the Contractor for, Commodities or Services beyond the agreed upon contract scope unless the changed scope is authorized by amendment and approved as required by law.

c. Officers and employees of City are not authorized to offer or promise, nor is City required to honor, any offered or promised additional funding in excess of the maximum amount of funding for which the contract is certified without certification of the additional amount by the Controller.

d. The Controller is not authorized to make payments on any contract for which funds have not been certified as available in the budget or by supplemental appropriation.

7. Payment; Invoice Format

Invoices furnished by Contractor under this Agreement must be in a form acceptable to the Controller, and must include the Contract Progress Payment Authorization number. All amounts paid by City to Contractor shall be subject to audit by City.

City shall make payment to Contractor at the address specified in the section entitled "Notices to the Parties."

8. Submitting False Claims; Monetary Penalties

Pursuant to San Francisco Administrative Code §21.35, any Contractor, subcontractor or consultant who submits a false claim shall be liable to City for three times the amount of damages which City sustains because of the false claim. A Contractor, subcontractor or consultant who submits a false claim shall also be liable to City for the costs, including attorneys' fees, of a civil action brought to recover any of those penalties or damages, and may be liable to City for a civil penalty of up to $10,000 for each false claim. A Contractor, subcontractor or consultant will be deemed to have submitted a false claim to City if the Contractor, subcontractor or consultant: (a) knowingly presents or causes to be presented to an officer or employee of City a false claim or request for payment or approval; (b) knowingly makes, uses, or causes to be made or used a false record or statement to get a false claim paid or approved by City; (c) conspires to defraud City by getting a false claim allowed or paid by City; (d) knowingly makes, uses, or causes to be made or used a false record or statement to conceal, avoid, or decrease an obligation to pay or transmit money or property to City; or (e) is a beneficiary of an inadvertent submission of a false claim to City, subsequently discovers the falsity of the claim, and fails to disclose the false claim to City within a reasonable time after discovery of the false claim.

9. Disallowance

If Contractor claims or receives payment from City for a service, reimbursement for which is later disallowed by the State of California or United States Government, Contractor shall promptly refund the disallowed amount to City upon City's request. At its option, City may offset the amount disallowed from any payment due or to become due to Contractor under this Agreement or any other Agreement.

By executing this Agreement, Contractor certifies that Contractor is not suspended, debarred or otherwise excluded from participation in federal assistance programs. Contractor acknowledges that this certification of eligibility to receive federal funds is a material term of the Agreement.

10. Taxes

a. Payment of any taxes, including possessory interest taxes and California sales and use taxes, levied upon or as a result of this Agreement, or the services delivered pursuant hereto, shall be the obligation of Contractor.

b. Contractor recognizes and understands that this Agreement may create a "possessory interest" for property tax purposes. Generally, such a possessory interest is not created unless the Agreement entitles the Contractor to possession, occupancy, or use of City property for private gain. If such a possessory interest is created, then the following shall apply:

(1) Contractor, on behalf of itself and any permitted successors and assigns, recognizes and understands that Contractor, and any permitted successors and assigns, may be subject to real property tax assessments on the possessory interest;

(2) Contractor, on behalf of itself and any permitted successors and assigns, recognizes and understands that the creation, extension, renewal, or assignment of this Agreement may result in a "change in ownership" for purposes of real property taxes, and therefore may result in a revaluation of

any possessory interest created by this Agreement. Contractor accordingly agrees on behalf of itself and its permitted successors and assigns to report on behalf of City to the County Assessor the information required by Revenue and Taxation Code section 480.5, as amended from time to time, and any successor provision.

(3) Contractor, on behalf of itself and any permitted successors and assigns to report any change in ownership to the County Assessor, the State Board of Equalization or other public agency as required by law.

(4) Contractor further agrees to provide such other information as may be requested by City to enable City to comply with any reporting requirements for possessory interests that are imposed by applicable law.

11. Payment Does Not Imply Acceptance of Work

The granting of any payment by City, or the receipt thereof by Contractor, shall in no way lessen the liability of Contractor to replace unsatisfactory work, equipment, or materials, although the unsatisfactory character of such work, equipment or materials may not have been apparent or detected at the time such payment was made. Materials, equipment, components, or workmanship that do not conform to the requirements of this Agreement may be rejected by City and in such case must be replaced by Contractor without delay.

12. Qualified Personnel

Work under this Agreement shall be performed only by competent personnel under the supervision of and in the employment of Contractor. Contractor will comply with City's reasonable requests regarding assignment of personnel, and Contractor must supervise all personnel, including those assigned at City's request. Contractor shall commit adequate resources to complete the project within the project schedule specified in this Agreement.

13. Responsibility for Equipment

City shall not be responsible for any damage to persons or property as a result of the use, misuse or failure of any equipment used by Contractor, or by any of its employees, even though such equipment be furnished, rented or loaned to Contractor by the City.

14. Independent Contractor; Payment of Taxes and Other Expenses

a. **Independent Contractor.** Contractor or any agent or employee of Contractor shall be deemed at all times to be an independent Contractor and is wholly responsible for the manner in which it performs the services and work requested by City under this Agreement. Contractor or any agent or employee of Contractor shall not have employee status with City, nor be entitled to participate in any plans, arrangements, or distributions by City pertaining to or in connection with any retirement, health or other benefits that City may offer its employees. Contractor or any agent or employee of Contractor is liable for the acts and omissions of itself, its employees and its agents. Contractor shall be responsible for all obligations and payments, whether imposed by federal, state or local law, including, but not limited to, FICA, income tax withholdings, unemployment compensation, insurance, and other similar responsibilities related to Contractor's performing services and work, or any agent or employee of Contractor providing same. Nothing in this Agreement shall be construed as creating an employment or agency relationship between City and Contractor or any agent or employee of Contractor.

Any terms in this Agreement referring to direction from City shall be construed as providing for direction as to policy and the result of Contractor's work only, and not as to the means by which such a result is obtained. City does not retain the right to control the means or the method by which Contractor performs work under this Agreement.

b. **Payment of Taxes and Other Expenses.** Should City, in its discretion, or a relevant taxing authority such as the Internal Revenue Service or the State Employment Development Division, or both, determine that Contractor is an employee for purposes of collection of any employment taxes, the amounts payable under this Agreement shall be reduced by amounts equal to both the employee and employer portions of the tax due (and offsetting any credits for amounts already paid by Contractor which can be applied against this liability). City shall then forward those amounts to the relevant taxing authority.

Should a relevant taxing authority determine a liability for past services performed by Contractor for City, upon notification of such fact by City, Contractor shall promptly remit such amount due or arrange with City to have the amount due withheld from future payments to Contractor under this Agreement (again, offsetting any amounts already paid by Contractor which can be applied as a credit against such liability).

A determination of employment status pursuant to the preceding two paragraphs shall be solely for the purposes of the particular tax in question, and for all other purposes of this Agreement, Contractor shall not be considered an employee of City. Notwithstanding the foregoing, should any court, arbitrator, or administrative authority determine that Contractor is an employee for any other purpose, then Contractor agrees to a reduction in City's financial liability so that City's total expenses under this Agreement are not greater than they would have been had the court, arbitrator, or administrative authority determined that Contractor was not an employee.

15. Insurance

a. Without in any way limiting Contractor's liability pursuant to the "Indemnification" section of this Agreement, Contractor must maintain in force, during the full term of the Agreement, insurance in the following amounts and coverages:

(1) Workers' Compensation, in statutory amounts, with Employers' Liability Limits not less than $1,000,000 each accident; and

(2) Commercial General Liability Insurance with limits not less than $3,000,000 each occurrence Combined Single Limit for Bodily Injury and Property Damage, including Contractual Liability, Personal Injury, Products and Completed Operations; and

(3) Commercial Automobile Liability Insurance with limits not less than $1,000,000 each occurrence Combined Single Limit for Bodily Injury and Property Damage, including Owned, Non-Owned and Hired auto coverage, as applicable.

(4) Professional liability insurance with limits not less than $4,000,000 each claim with respect to negligent acts, errors or omissions in connection with professional services to be provided under this Agreement and any deductible not to exceed $50,000 each claim.

b. Commercial General Liability and Commercial Automobile Liability Insurance policies must provide the following:

(1) Name as Additional Insured the City and County of San Francisco, its Officers, Agents, and Employees.

(2) That such policies are primary insurance to any other insurance available to the Additional Insureds, with respect to any claims arising out of this Agreement, and that insurance applies separately to each insured against whom claim is made or suit is brought.

c. All policies shall provide thirty days' advance written notice to City of cancellation mailed to the following address:

City And County of San Francisco
San Francisco Public Utilities Commission
Contract Administration Bureau
1155 Market Street, 9th Floor
San Francisco, CA 94103

d. Should any of the required insurance be provided under a claims-made form, Contractor shall maintain such coverage continuously throughout the term of this Agreement and, without lapse, for a period of three years beyond the expiration of this Agreement, to the effect that, should occurrences during the contract term give rise to claims made after expiration of the Agreement, such claims shall be covered by such claims-made policies.

e. Should any of the required insurance be provided under a form of coverage that includes a general annual aggregate limit or provides that claims investigation or legal defense costs be included in such general annual aggregate limit, such general annual aggregate limit shall be double the occurrence or claims limits specified above.

f. Should any required insurance lapse during the term of this Agreement, requests for payments originating after such lapse shall not be processed until City receives satisfactory evidence of reinstated coverage as required by this Agreement, effective as of the lapse date. If insurance is not reinstated, City may, at its sole option, terminate this Agreement effective on the date of such lapse of insurance.

g. Before commencing any operations under this Agreement, Contractor shall do the following: (a) furnish to City certificates of insurance, and additional insured policy endorsements with insurers with ratings comparable to A-, VIII or higher, that are authorized to do business in the State of California, and that are satisfactory to City, in form evidencing all coverages set forth above, and (b) furnish complete copies of policies promptly upon City request. Failure to maintain insurance shall constitute a material breach of this Agreement.

h. Approval of the insurance by City shall not relieve or decrease the liability of Contractor hereunder.

16. Indemnification

To the fullest extent permitted by law, Contractor shall assume the defense of, indemnify and save harmless the City and its officers and employees (collectively "Indemnitees") from any claim, loss, damage, injury (including, without limitation, injury to or death of an employee of the Contractor or its subcontractors) and liabilities of every kind, nature and description (including, without limitation, incidental and consequential damages, court costs, attorney's fees and costs of investigation) that arise directly or indirectly, in whole or in part, from (1) the services under this Agreement, or any part thereof, (2) any act or omission of the Contractor and subcontractor to the Contractor, anyone directly or indirectly employed by them, or anyone that they control (collectively "Liabilities"), even if such Liabilities are caused in part by the negligence of any Indemnitee, subject to the provisions set forth herein.

To the extent, however, that the foregoing provision imposes an obligation on the Contractor which does not involve any negligence or other breach of obligation on the part of Contractor or its subcontractors, then, provided that Contractor is in compliance with its insurance obligations under Article 15 above, such obligations shall be limited to the extent to which it is covered by Contractor's insurance and that of its subcontractors.

In no event, however, shall Contractor's liability or indemnification responsibilities be so limited in the event of negligence or other breach of obligation on the part of the Contractor or its subcontractors.

The Contractor assumes no liability whatsoever for the sole negligence or willful misconduct of any Indemnitee or the Contractors of any Indemnittee.

The Contractor's indemnification obligations of claims involving "Professional Liability" (claims involving acts, errors or omissions in the rendering of professional services) and "Economic Loss Only" (claims involving economic loss which are not connected with bodily injury or physical damage to property) shall be limited to the extent of the Contractor's negligence or other breach of duty.

Contractor shall also indemnify, defend and hold harmless all Indemnitees from all suits or claims for infringement of the patent rights, copyright, trade secret, trade name, trademark, service mark, or any other proprietary right of any person or persons in consequence of the use by the City, or any of its officers, employees, or agents, of articles or services to be supplied in then performance of Contractor's services under this Agreement.

In addition to Contractor's obligation to indemnify City, Contractor specifically acknowledges and agrees that it has an immediate and independent obligation to defend City from any claim which actually or potentially falls within this indemnification provision, even if the allegations are or may be groundless, false or fraudulent, which obligation arises at the time such claim is tendered to Contractor by City and continues at all times thereafter.

Contractor shall indemnify and hold City harmless from all loss and liability, including attorneys' fees, court costs and all other litigation expenses for any infringement of the patent rights, copyright, trade secret or any other proprietary right or trademark, and all other intellectual property claims of any

person or persons in consequence of the use by City, or any of its officers or agents, of articles or services to be supplied in the performance of this Agreement.

17. Incidental and Consequential Damages

Contractor shall be responsible for incidental and consequential damages resulting in whole or in part from Contractor's acts or omissions. Nothing in this Agreement shall constitute a waiver or limitation of any rights that City may have under applicable law.

18. Liability of City

CITY'S PAYMENT OBLIGATIONS UNDER THIS AGREEMENT SHALL BE LIMITED TO THE PAYMENT OF THE COMPENSATION PROVIDED FOR IN SECTION 5 OF THIS AGREEMENT. NOTWITHSTANDING ANY OTHER PROVISION OF THIS AGREEMENT, IN NO EVENT SHALL CITY BE LIABLE, REGARDLESS OF WHETHER ANY CLAIM IS BASED ON CONTRACT OR TORT, FOR ANY SPECIAL, CONSEQUENTIAL, INDIRECT OR INCIDENTAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOST PROFITS, ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT OR THE SERVICES PERFORMED IN CONNECTION WITH THIS AGREEMENT.

19. Liquidated Damages

Left blank by agreement of the parties.

20. Default; Remedies

a. Each of the following shall constitute an event of default ("Event of Default") under this Agreement:

(1) Contractor fails or refuses to perform or observe any term, covenant or condition contained in any of the following Sections of this Agreement: 8, 10, 15, 24, 30, 37, 53, 55, 57, or 58.

(2) Contractor fails or refuses to perform or observe any other term, covenant or condition contained in this Agreement, and such default continues for a period of ten days after written notice thereof from City to Contractor.

(3) Contractor (A) is generally not paying its debts as they become due, (B) files, or consents by answer or otherwise to the filing against it of, a petition for relief or reorganization or arrangement or any other petition in bankruptcy or for liquidation or to take advantage of any bankruptcy, insolvency or other debtors' relief law of any jurisdiction, (C) makes an assignment for the benefit of its creditors, (D) consents to the appointment of a custodian, receiver, trustee or other officer with similar powers of Contractor or of any substantial part of Contractor's property or (E) takes action for the purpose of any of the foregoing.

(4) A court or government authority enters an order (A) appointing a custodian, receiver, trustee or other officer with similar powers with respect to Contractor or with respect to any substantial part of Contractor's property, (B) constituting an order for relief or approving a petition for relief or reorganization or arrangement or any other petition in bankruptcy or for liquidation or to take advantage

of any bankruptcy, insolvency or other debtors' relief law of any jurisdiction or (C) ordering the dissolution, winding-up or liquidation of Contractor.

b. On and after any Event of Default, City shall have the right to exercise its legal and equitable remedies, including, without limitation, the right to terminate this Agreement or to seek specific performance of all or any part of this Agreement. In addition, City shall have the right (but no obligation) to cure (or cause to be cured) on behalf of Contractor any Event of Default; Contractor shall pay to City on demand all costs and expenses incurred by City in effecting such cure, with interest thereon from the date of incurrence at the maximum rate then permitted by law. City shall have the right to offset from any amounts due to Contractor under this Agreement or any other agreement between City and Contractor all damages, losses, costs or expenses incurred by City as a result of such Event of Default and any liquidated damages due from Contractor pursuant to the terms of this Agreement or any other agreement.

c. All remedies provided for in this Agreement may be exercised individually or in combination with any other remedy available hereunder or under applicable laws, rules and regulations. The exercise of any remedy shall not preclude or in any way be deemed to waive any other remedy.

21. Termination for Convenience

a. City shall have the option, in its sole discretion, to terminate this Agreement, at any time during the term hereof, for convenience and without cause. City shall exercise this option by giving Contractor written notice of termination. The notice shall specify the date on which termination shall become effective.

b. Upon receipt of the notice, Contractor shall commence and perform, with diligence, all actions necessary on the part of Contractor to effect the termination of this Agreement on the date specified by City and to minimize the liability of Contractor and City to third parties as a result of termination. All such actions shall be subject to the prior approval of City. Such actions shall include, without limitation:

(1) Halting the performance of all services and other work under this Agreement on the date(s) and in the manner specified by City.

(2) Not placing any further orders or subcontracts for materials, services, equipment or other items.

(3) Terminating all existing orders and subcontracts.

(4) At City's direction, assigning to City any or all of Contractor's right, title, and interest under the orders and subcontracts terminated. Upon such assignment, City shall have the right, in its sole discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts.

(5) Subject to City's approval, settling all outstanding liabilities and all claims arising out of the termination of orders and subcontracts.

(6) Completing performance of any services or work that City designates to be completed prior to the date of termination specified by City.

(7) Taking such action as may be necessary, or as City may direct, for the protection and preservation of any property related to this Agreement which is in the possession of Contractor and in which City has or may acquire an interest.

c. Within 30 days after the specified termination date, Contractor shall submit to City an invoice, which shall set forth each of the following as a separate line item:

(1) The reasonable cost to Contractor, without profit, for all services and other work City directed Contractor to perform prior to the specified termination date, for which services or work City has not already tendered payment. Reasonable costs may include a reasonable allowance for actual overhead, not to exceed a total of 10% of Contractor's direct costs for services or other work. Any overhead allowance shall be separately itemized. Contractor may also recover the reasonable cost of preparing the invoice.

(2) A reasonable allowance for profit on the cost of the services and other work described in the immediately preceding subsection (1), provided that Contractor can establish, to the satisfaction of City, that Contractor would have made a profit had all services and other work under this Agreement been completed, and provided further, that the profit allowed shall in no event exceed 5% of such cost.

(3) The reasonable cost to Contractor of handling material or equipment returned to the vendor, delivered to City or otherwise disposed of as directed by City.

(4) A deduction for the cost of materials to be retained by Contractor, amounts realized from the sale of materials and not otherwise recovered by or credited to City, and any other appropriate credits to City against the cost of the services or other work.

d. In no event shall City be liable for costs incurred by Contractor or any of its subcontractors after the termination date specified by City, except for those costs specifically enumerated and described in the immediately preceding subsection (c). Such non-recoverable costs include, but are not limited to, anticipated profits on this Agreement, post-termination employee salaries, post-termination administrative expenses, post-termination overhead or unabsorbed overhead, attorneys' fees or other costs relating to the prosecution of a claim or lawsuit, prejudgment interest, or any other expense which is not reasonable or authorized under such subsection (c).

e. In arriving at the amount due to Contractor under this Section, City may deduct: (1) all payments previously made by City for work or other services covered by Contractor's final invoice; (2) any claim which City may have against Contractor in connection with this Agreement; (3) any invoiced costs or expenses excluded pursuant to the immediately preceding subsection (d); and (4) in instances in which, in the opinion of City, the cost of any service or other work performed under this Agreement is excessively high due to costs incurred to remedy or replace defective or rejected services or other work, the difference between the invoiced amount and City's estimate of the reasonable cost of performing the invoiced services or other work in compliance with the requirements of this Agreement.

f. City's payment obligation under this Section shall survive termination of this Agreement.

22. Rights and Duties Upon Termination or Expiration

a. This Section and the following Sections of this Agreement shall survive termination or expiration of this Agreement: 8 through 11, 13 through 18, 24, 26, 27, 28, 48 through 52, 56, and 57.

materials produced as a part of, or acquired in connection with the performance of this Agreement, and any completed or partially completed work which, if this Agreement had been completed, would have been required to be furnished to City. This subsection shall survive termination of this Agreement.

23. Conflict of Interest

Through its execution of this Agreement, Contractor acknowledges that it is familiar with the provision of Section 15.103 of City's Charter, Article III, Chapter 2 of City's Campaign and Governmental Conduct Code, and Section 87100 et seq. and Section 1090 et seq. of the Government Code of the State of California, and certifies that it does not know of any facts which constitutes a violation of said provisions and agrees that it will immediately notify the City if it becomes aware of any such fact during the term of this Agreement.

24. Proprietary or Confidential Information of City

Contractor understands and agrees that, in the performance of the work or services under this Agreement or in contemplation thereof, Contractor may have access to private or confidential information which may be owned or controlled by City and that such information may contain proprietary or confidential details, the disclosure of which to third parties may be damaging to City. Contractor agrees that all information disclosed by City to Contractor shall be held in confidence and used only in performance of the Agreement. Contractor shall exercise the same standard of care to protect such information as a reasonably prudent contractor would use to protect its own proprietary data.

25. Notices to the Parties

Unless otherwise indicated elsewhere in this Agreement, all written communications sent by the parties may be by U.S. mail, e-mail or by fax, and shall be addressed as follows:

To City: Gilbert Tang
Engineering Management Bureau
San Francisco Public Utilities Commission
1155 Market Street, 3rd Floor
San Francisco, CA 94103
(Tel.) 415-551-4866
(Fax) 415-551-4877
Email: gtang@sfwater.org

To Contractor: Noel C. Wong, P.E.
Vice President/Project Director
URS Corporation
1333 Broadway, Suite 800
Oakland, CA 94612
(Tel.) 510-893-3600
(Fax) 510-874-3268
Email: noel_wong@urscorp.com

Any notice of default must be sent by registered mail.

Email: noel_wong@urscorp.com

Any notice of default must be sent by registered mail.

26. Ownership of Results

Any interest of Contractor or its Subcontractors, in drawings, plans, specifications, blueprints, studies, reports, memoranda, computation sheets, computer files and media or other documents prepared by Contractor or its subcontractors in connection with services to be performed under this Agreement, shall become the property of and will be transmitted to City. However, Contractor may retain and use copies for reference and as documentation of its experience and capabilities.

27. Works for Hire

If, in connection with services performed under this Agreement, Contractor or its subcontractors create artwork, copy, posters, billboards, photographs, videotapes, audiotapes, systems designs, software, reports, diagrams, surveys, blueprints, source codes or any other original works of authorship, such works of authorship shall be works for hire as defined under Title 17 of the United States Code, and all copyrights in such works are the property of City. If it is ever determined that any works created by Contractor or its subcontractors under this Agreement are not works for hire under U.S. law, Contractor hereby assigns all copyrights to such works to City, and agrees to provide any material and execute any documents necessary to effectuate such assignment. With the approval of City, Contractor may retain and use copies of such works for reference and as documentation of its experience and capabilities.

28. Audit and Records

a. Audit and Inspection of Records

Contractor agrees to maintain and make available to City, during regular business hours, accurate books and accounting records relating to its work under this Agreement. Contractor will permit City to audit, examine and make excerpts and transcripts from such books and records, and to make audits of all invoices, materials, payrolls, records or personnel and other data related to all other matters covered by this Agreement, whether funded in whole or in part under this Agreement, except that the Contractor's billing rates are not subject to audit with respect to the makeup or composition of the rates but actual salaries must be verifiable by certified payroll records. Contractor shall maintain such data and records in an accessible location and condition for a period of not less than three years after final payment under this Agreement or until after final audit has been resolved, whichever is later. The State of California or any federal agency having an interest in the subject matter of this Agreement shall have the same rights conferred upon City by this Section.

b. Duty to Cooperate

Contractor agrees to assist and fully cooperate with City regarding any claims, disputes or litigation City may have with any third parties where Contractor has information and/or records arising from Contractor's participation in this Agreement.

29. Subcontracting

Contractor is prohibited from subcontracting this Agreement or any part of it unless such subcontracting is first approved by City in writing. Neither party shall, on the basis of this Agreement, contract on behalf of or in the name of the other party. An agreement made in violation of this provision shall confer no rights on any party and shall be null and void.

30. Assignment

The services to be performed by Contractor are personal in character and neither this Agreement nor any duties or obligations hereunder may be assigned or delegated by the Contractor unless first approved by City by written instrument executed and approved in the same manner as this Agreement.

31. Non-Waiver of Rights

The omission by either party at any time to enforce any default or right reserved to it, or to require performance of any of the terms, covenants, or provisions hereof by the other party at the time designated, shall not be a waiver of any such default or right to which the party is entitled, nor shall it in any way affect the right of the party to enforce such provisions thereafter.

32. Earned Income Credit (EIC) Forms

Administrative Code section 12O requires that employers provide their employees with IRS Form W-5 (The Earned Income Credit Advance Payment Certificate) and the IRS EIC Schedule, as set forth below. Employers can locate these forms at the IRS Office, on the Internet, or anywhere that Federal Tax Forms can be found.

a. Contractor shall provide EIC Forms to each Eligible Employee at each of the following times: (i) within thirty days following the date on which this Agreement becomes effective (unless Contractor has already provided such EIC Forms at least once during the calendar year in which such effective date falls); (ii) promptly after any Eligible Employee is hired by Contractor; and (iii) annually between January 1 and January 31 of each calendar year during the term of this Agreement.

b. Failure to comply with any requirement contained in subparagraph (a) of this Section shall constitute a material breach by Contractor of the terms of this Agreement. If, within thirty days after Contractor receives written notice of such a breach, Contractor fails to cure such breach or, if such breach cannot reasonably be cured within such period of thirty days, Contractor fails to commence efforts to cure within such period or thereafter fails to diligently pursue such cure to completion, City may pursue any rights or remedies available under this Agreement or under applicable law.

c. Any Subcontract entered into by Contractor shall require the subcontractor to comply, as to the subcontractor's Eligible Employees, with each of the terms of this section.

d. Capitalized terms used in this Section and not defined in this Agreement shall have the meanings assigned to such terms in Section 12O of the San Francisco Administrative Code.

33. Disadvantaged Business Enterprise Utilization; Liquidated Damages

a. The DBE Ordinance

Contractor, shall comply with all the requirements of the Disadvantaged Business Enterprise Ordinance set forth in Chapter 14A of the San Francisco Administrative Code as it now exists or as it may be amended in the future (collectively the "DBE Ordinance"), provided such amendments do not materially increase Contractor's obligations or liabilities, or materially diminish Contractor's rights, under this Agreement. Such provisions of the DBE Ordinance are incorporated by reference and made a part of this Agreement as though fully set forth in this section. Contractor's willful failure to comply with any applicable provision of the DBE Ordinance is a material breach of Contractor's obligations under this Agreement and shall entitle City, subject to any applicable notice and cure provisions set forth in this Agreement, to exercise any of the remedies provided for under this Agreement, under the DBE Ordinance or otherwise available at law or in equity, which remedies shall be cumulative unless this Agreement expressly provides that any remedy is exclusive. In addition, Contractor shall comply fully with all other applicable local, state and federal laws prohibiting discrimination and requiring equal opportunity in contracting, including subcontracting.

b. Compliance and Enforcement

1. Enforcement

If Contractor willfully fails to comply with any of the provisions of the DBE Ordinance, the rules and regulations implementing the DBE Ordinance, or the provisions of this Agreement pertaining to DBE participation, Contractor shall be liable for liquidated damages in an amount equal to Contractor's net profit on this Agreement, or 10% of the total amount of this Agreement, or $1,000, whichever is greatest. The Director of City's Human Rights Commission or any other public official authorized to enforce the DBE Ordinance (separately and collectively, the "Director of HRC") may also impose other sanctions against Contractor authorized in the DBE Ordinance, including declaring the Contractor to be irresponsible and ineligible to contract with City for a period of up to five years or revocation of the Contractor's DBE certification. The Director of HRC will determine the sanctions to be imposed, including the amount of liquidated damages, after investigation pursuant to Administrative Code §14A.13(B).

By entering into this Agreement, Contractor acknowledges and agrees that any liquidated damages assessed by the Director of the HRC shall be payable to City upon demand. Contractor further acknowledges and agrees that any liquidated damages assessed may be withheld from any monies due to Contractor on any contract with City.

Contractor agrees to maintain records necessary for monitoring its compliance with the DBE Ordinance for a period of three years following termination or expiration of this Agreement, and shall make such records available for audit and inspection by the Director of HRC or the Controller upon request.

2. Subcontracting Goals

The DBE subcontracting participation goal for this contract is 6%. Contractor shall fulfill the subcontracting commitment made in its bid or proposal. Each invoice submitted to City for payment shall include the information required in HRC Form 7 and Form 9. Failure to provide HRC Form 7 and

Form 9 with each invoice submitted by Contractor shall entitle City to withhold 20% of the amount of that invoice until HRC Form 7 and Form 9 is provided by Contractor.

Contractor shall not participate in any back contracting to the Contractor or lower-tier subcontractors, as defined in the DBE Ordinance, for any purpose inconsistent with the provisions of the DBE Ordinance, its implementing rules and regulations, or this Section.

3. Subcontract Language Requirements

Contractor shall incorporate the DBE Ordinance into each subcontract made in the fulfillment of Contractor's obligations under this Agreement and require each subcontractor to agree and comply with provisions of the ordinance applicable to subcontractors.

Contractor shall include in all subcontracts with DBEs made in fulfillment of Contractor's obligations under this Agreement, a provision requiring Contractor to compensate any DBE subcontractor for damages for breach of contract or liquidated damages equal to 5% of the subcontract amount, whichever is greater, if Contractor does not fulfill its commitment to use the DBE subcontractor as specified in the bid or proposal, unless Contractor received advance approval from the Director of HRC and Purchasing to substitute subcontractors or to otherwise modify the commitments in the bid or proposal. Such provisions shall also state that it is enforceable in a court of competent jurisdiction.

Subcontracts shall require the subcontractor to maintain records necessary for monitoring its compliance with the DBE Ordinance for a period of three years following termination of this contract and to make such records available for audit and inspection by the Director of HRC or the Controller upon request.

4. Payment of Subcontractors

Contractor shall pay its subcontractors within three working days after receiving payment from City unless Contractor notifies the Director of HRC in writing within ten working days prior to receiving payment from City that there is a bona fide dispute between Contractor and its subcontractor and the Director waives the three-day payment requirement, in which case Contractor may withhold the disputed amount but shall pay the undisputed amount.

Contractor further agrees, within ten working days following receipt of payment from City, to file an affidavit (HRC Form 9) with the Controller, under penalty of perjury, that the Contractor has paid all subcontractors. The affidavit shall provide the names and addresses of all subcontractors and the amount paid to each. Failure to provide such affidavit may subject Contractor to enforcement procedure under Administrative Code §14A.13.

34. Nondiscrimination; Penalties

a. Contractor Shall Not Discriminate

In the performance of this Agreement, Contractor agrees not to discriminate against any employee, City and County employee working with such contractor or subcontractor, applicant for employment with such Contractor or subcontractor, or against any person seeking accommodations, advantages, facilities, privileges, services, or membership in all business, social, or other establishments or organizations, on the basis of the fact or perception of a person's race, color, creed, religion, national origin, ancestry, age, height, weight, sex, sexual orientation, gender identity, domestic partner status,

marital status, disability or Acquired Immune Deficiency Syndrome or HIV status (AIDS/HIV status), or association with members of such protected classes, or in retaliation for opposition to discrimination against such classes.

b. Subcontracts

Contractor shall incorporate by reference in all subcontracts the provisions of §§12B.2(a), 12B.2(c)-(k), and 12C.3 of the San Francisco Administrative Code (copies of which are available from Purchasing) and shall require all subcontractors to comply with such provisions. Contractor's failure to comply with the obligations in this subsection shall constitute a material breach of this Agreement.

c. Nondiscrimination in Benefits

Contractor does not as of the date of this Agreement and will not during the term of this Agreement, in any of its operations in San Francisco, on real property owned by San Francisco, or where work is being performed for City elsewhere in the United States, discriminate in the provision of bereavement leave, family medical leave, health benefits, membership or membership discounts, moving expenses, pension and retirement benefits or travel benefits, as well as any benefits other than the benefits specified above, between employees with domestic partners and employees with spouses, and/or between the domestic partners and spouses of such employees, where the domestic partnership has been registered with a governmental entity pursuant to state or local law authorizing such registration, subject to the conditions set forth in §12B.2(b) of the San Francisco Administrative Code.

d. Condition to Contract

As a condition to this Agreement, Contractor shall execute the "Chapter 12B Declaration: Nondiscrimination in Contracts and Benefits" form (form HRC-12B-101) with supporting documentation and secure the approval of the form by the San Francisco Human Rights Commission.

e. Incorporation of Administrative Code Provisions by Reference

The provisions of Chapters 12B and 12C of the San Francisco Administrative Code are incorporated in this Section by reference and made a part of this Agreement as though fully set forth herein. Contractor shall comply fully with and be bound by all of the provisions that apply to this Agreement under such Chapters, including but not limited to the remedies provided in such Chapters. Without limiting the foregoing, Contractor understands that pursuant to §12B.2(h) of the San Francisco Administrative Code, a penalty of $50 for each person for each calendar day during which such person was discriminated against in violation of the provisions of this Agreement may be assessed against Contractor and/or deducted from any payments due Contractor.

35. MacBride Principles—Northern Ireland

Pursuant to San Francisco Administrative Code §12F.5, the City and County of San Francisco urges companies doing business in Northern Ireland to move towards resolving employment inequities, and encourages such companies to abide by the MacBride Principles. The City and County of San Francisco urges San Francisco companies to do business with corporations that abide by the MacBride Principles. By signing below, the person executing this agreement on behalf of Contractor acknowledges and agrees that he or she has read and understood this section.

36. Tropical Hardwood and Virgin Redwood Ban

Pursuant to §804(b) of the San Francisco Environment Code, the City and County of San Francisco urges contractors not to import, purchase, obtain, or use for any purpose, any tropical hardwood, tropical hardwood wood product, virgin redwood or virgin redwood wood product.

37. Drug-Free Workplace Policy

Contractor acknowledges that pursuant to the Federal Drug-Free Workplace Act of 1989, the unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited on City premises. Contractor agrees that any violation of this prohibition by Contractor, its employees, agents or assigns will be deemed a material breach of this Agreement.

38. Resource Conservation

Chapter 5 of the San Francisco Environment Code ("Resource Conservation") is incorporated herein by reference. Failure by Contractor to comply with any of the applicable requirements of Chapter 5 will be deemed a material breach of contract.

39. Compliance with Americans with Disabilities Act

Contractor acknowledges that, pursuant to the Americans with Disabilities Act (ADA), programs, services and other activities provided by a public entity to the public, whether directly or through a contractor, must be accessible to the disabled public. Contractor shall provide the services specified in this Agreement in a manner that complies with the ADA and any and all other applicable federal, state and local disability rights legislation. Contractor agrees not to discriminate against disabled persons in the provision of services, benefits or activities provided under this Agreement and further agrees that any violation of this prohibition on the part of Contractor, its employees, agents or assigns will constitute a material breach of this Agreement.

40. Sunshine Ordinance

In accordance with San Francisco Administrative Code §67.24(e), contracts, Contractors' bids, responses to solicitations and all other records of communications between City and persons or firms seeking contracts, shall be open to inspection immediately after a contract has been awarded. Nothing in this provision requires the disclosure of a private person or organization's net worth or other proprietary financial data submitted for qualification for a contract or other benefit until and unless that person or organization is awarded the contract or benefit. Information provided which is covered by this paragraph will be made available to the public upon request.

41. Public Access to Meetings and Records

If the Contractor receives a cumulative total per year of at least $250,000 in City funds or City-administered funds and is a non-profit organization as defined in Chapter 12L of the San Francisco Administrative Code, Contractor shall comply with and be bound by all the applicable provisions of that Chapter. By executing this Agreement, the Contractor agrees to open its meetings and records to the public in the manner set forth in §§12L.4 and 12L.5 of the Administrative Code. Contractor further agrees to make-good faith efforts to promote community membership on its Board of Directors in the manner set forth in §12L.6 of the Administrative Code. The Contractor acknowledges that its material failure to comply with any of the provisions of this paragraph shall constitute a material breach of this

Agreement. The Contractor further acknowledges that such material breach of the Agreement shall be grounds for City to terminate and/or not renew the Agreement, partially or in its entirety.

42. Limitations on Contributions

Through execution of this Agreement, Contractor acknowledges that it is familiar with section 1.126 of City's Campaign and Governmental Conduct Code, which prohibits any person who contracts with City for the rendition of personal services or for the furnishing of any material, supplies or equipment to City, whenever such transaction would require approval by a City elective officer of the board on which that City elective officer serves, from making any campaign contribution to the officer at any time from the commencement of negotiations for the contract until the later of either (1) the termination of negotiations for such contract or (2) three months after the date the contract is approved by City elective officer or the board on which that City elective officer serves.

43. Requiring Minimum Compensation for Covered Employees

Contractor agrees to comply fully with and be bound by all of the provisions of the Minimum Compensation Ordinance (MCO), as set forth in San Francisco Administrative Code Chapter 12P (Chapter 12P), including the remedies provided, and implementing guidelines and rules. The provisions of Chapter 12P are incorporated herein by reference and made a part of this Agreement as though fully set forth. The text of the MCO is available on the web at http://www.sfgov.org/oca/lwlh.htm. Capitalized terms used in this Section and not defined in this Agreement shall have the meanings assigned to such terms in Chapter 12P. Consistent with the requirements of the MCO, Contractor agrees to all of the following:

a. For each hour worked by a Covered Employee during a Pay Period on work funded under the City contract during the term of this Agreement, Contractor shall provide to the Covered Employee no less than the Minimum Compensation, which includes a minimum hourly wage and compensated and uncompensated time off consistent with the requirements of the MCO. For the hourly gross compensation portion of the MCO, Contractor shall pay a minimum of $10.77 an hour beginning January 1, 2005 and for the remainder of the term of this Agreement; provided, however, that Contractors that are Nonprofit Corporations or public entities shall pay a minimum of $9 an hour for the term of this Agreement.

b. Contractor shall not discharge, reduce in compensation, or otherwise discriminate against any employee for complaining to City with regard to Contractor's compliance or anticipated compliance with the requirements of the MCO, for opposing any practice proscribed by the MCO, for participating in proceedings related to the MCO, or for seeking to assert or enforce any rights under the MCO by any lawful means.

c. Contractor understands and agrees that the failure to comply with the requirements of the MCO shall constitute a material breach by Contractor of the terms of this Agreement. The City, acting through the Contracting Department, shall determine whether such a breach has occurred.

d. If, within 30 days after receiving written notice of a breach of this Agreement for violating the MCO, Contractor fails to cure such breach or, if such breach cannot reasonably be cured within such period of 30 days, Contractor fails to commence efforts to cure within such period, or thereafter fails diligently to pursue such cure to completion, City, acting through the Contracting Department, shall have the right to pursue the following rights or remedies and any rights or remedies available under applicable

law:

(1) The right to charge Contractor an amount equal to the difference between the Minimum Compensation and any compensation actually provided to a Covered Employee, together with interest on such amount from the date payment was due at the maximum rate then permitted by law;

(2) The right to set off all or any portion of the amount described in Subsection (d)(1) of this Section against amounts due to Contractor under this Agreement;

(3) The right to terminate this Agreement in whole or in part;

(4) In the event of a breach by Contractor of the covenant referred to in Subsection (b) of this Section, the right to seek reinstatement of the employee or to obtain other appropriate equitable relief; and

(5) The right to bar Contractor from entering into future contracts with City for three years.

Each of the rights provided in this Subsection (d) shall be exercisable individually or in combination with any other rights or remedies available to City. Any amounts realized by City pursuant to this subsection shall be paid to the Covered Employee who failed to receive the required Minimum Compensation.

e. Contractor represents and warrants that it is not an entity that was set up, or is being used, for the purpose of evading the intent of the MCO.

f. Contractor shall keep itself informed of the current requirements of the MCO, including increases to the hourly gross compensation due Covered Employees under the MCO, and shall provide prompt written notice to all Covered Employees of any increases in compensation, as well as any written communications received by the Contractor from City, which communications are marked to indicate that they are to be distributed to Covered Employees.

g. Contractor shall provide reports to City in accordance with any reporting standards promulgated by City under the MCO, including reports on subcontractors.

h. The Contractor shall provide City with access to pertinent records after receiving a written request from City to do so and being provided at least five (5) business days to respond.

i. The City may conduct random audits of Contractor. Random audits shall be (i) noticed in advance in writing; (ii) limited to ascertaining whether Covered Employees are paid at least the minimum compensation required by the MCO; (iii) accomplished through an examination of pertinent records at a mutually agreed upon time and location within ten days of the written notice; and (iv) limited to one audit of Contractor every two years for the duration of this Agreement. Nothing in this Agreement is intended to preclude City from investigating any report of an alleged violation of the MCO.

j. Any subcontract entered into by Contractor shall require the subcontractor to comply with the requirements of the MCO and shall contain contractual obligations substantially the same as those set forth in this Section. A subcontract means an agreement between the Contractor and a third party which

requires the third party to perform all or a portion of the services covered by this Agreement. Contractor shall notify the Department of Administrative Services when it enters into such a subcontract and shall certify to the Department of Administrative Services that it has notified the subcontractor of the obligations under the MCO and has imposed the requirements of the MCO on the subcontractor through the provisions of the subcontract. It is Contractor's obligation to ensure that any subcontractors of any tier under this Agreement comply with the requirements of the MCO. If any subcontractor under this Agreement fails to comply, City may pursue any of the remedies set forth in this Section against Contractor.

k. Each Covered Employee is a third-party beneficiary with respect to the requirements of subsections (a) and (b) of this Section, and may pursue the following remedies in the event of a breach by Contractor of subsections (a) and (b), but only after the Covered Employee has provided the notice, participated in the administrative review hearing, and waited the 21-day period required by the MCO. Contractor understands and agrees that if the Covered Employee prevails in such action, the Covered Employee may be awarded: (1) an amount equal to the difference between the Minimum Compensation and any compensation actually provided to the Covered Employee, together with interest on such amount from the date payment was due at the maximum rate then permitted by law; (2) in the event of a breach by Contractor of subsections (a) or (b), the right to seek reinstatement or to obtain other appropriate equitable relief; and (3) in the event that the Covered Employee is the prevailing party in any legal action or proceeding against Contractor arising from this Agreement, the right to obtain all costs and expenses, including reasonable attorney's fees and disbursements, incurred by the Covered Employee. Contractor also understands that the MCO provides that if Contractor prevails in any such action, Contractor may be awarded costs and expenses, including reasonable attorney's fees and disbursements, from the Covered Employee if the court determines that the Covered Employee's action was frivolous, vexatious or otherwise an act of bad faith.

l. If Contractor is exempt from the MCO when this Agreement is executed because the cumulative amount of agreements with this department for the fiscal year is less than $25,000 ($50,000 for nonprofits), but Contractor later enters into an agreement or agreements that cause contractor to exceed that amount in a fiscal year, Contractor shall thereafter be required to comply with the MCO under this Agreement. This obligation arises on the effective date of the agreement that causes the cumulative amount of agreements between the Contractor and this department to exceed $25,000 ($50,000 for nonprofits) in the fiscal year.

44. Requiring Health Benefits for Covered Employees

Unless exempt, Contractor agrees to comply fully with and be bound by all of the provisions of the Health Care Accountability Ordinance (HCAO), as set forth in San Francisco Administrative Code Chapter 12Q, including the remedies provided, and implementing regulations, as the same may be amended from time to time. The provisions of Chapter 12Q are incorporated by reference and made a part of this Agreement as though fully set forth herein. The text of the HCAO is available on the web at http://www.sfgov.org/oca/lwlh.htm. Capitalized terms used in this Section and not defined in this Agreement shall have the meanings assigned to such terms in Chapter 12Q.

a. For each Covered Employee, Contractor shall provide the appropriate health benefit set forth in Section 12Q.3 of the HCAO. If Contractor chooses to offer the health plan option, such health plan shall meet the minimum standards set forth by the San Francisco Health Commission.

b. Notwithstanding the above, if the Contractor is a small business as defined in Section

12Q.3(d) of the HCAO, it shall have no obligation to comply with part (a) above.

c. Contractor's failure to comply with the HCAO shall constitute a material breach of this agreement. City shall notify Contractor if such a breach has occurred. If, within 30 days after receiving City's written notice of a breach of this Agreement for violating the HCAO, Contractor fails to cure such breach or, if such breach cannot reasonably be cured within such period of 30 days, Contractor fails to commence efforts to cure within such period, or thereafter fails diligently to pursue such cure to completion, City shall have the right to pursue the remedies set forth in 12Q.5(f)(1-5). Each of these remedies shall be exercisable individually or in combination with any other rights or remedies available to City.

d. Any Subcontract entered into by Contractor shall require the Subcontractor to comply with the requirements of the HCAO and shall contain contractual obligations substantially the same as those set forth in this Section. Contractor shall notify City's Office of Contract Administration when it enters into such a Subcontract and shall certify to the Office of Contract Administration that it has notified the Subcontractor of the obligations under the HCAO and has imposed the requirements of the HCAO on Subcontractor through the Subcontract. Each Contractor shall be responsible for its Subcontractors' compliance with this Chapter. If a Subcontractor fails to comply, City may pursue the remedies set forth in this Section against Contractor based on the Subcontractor's failure to comply, provided that City has first provided Contractor with notice and an opportunity to obtain a cure of the violation.

e. Contractor shall not discharge, reduce in compensation, or otherwise discriminate against any employee for notifying City with regard to Contractor's noncompliance or anticipated noncompliance with the requirements of the HCAO, for opposing any practice proscribed by the HCAO, for participating in proceedings related to the HCAO, or for seeking to assert or enforce any rights under the HCAO by any lawful means.

f. Contractor represents and warrants that it is not an entity that was set up, or is being used, for the purpose of evading the intent of the HCAO.

g. Contractor shall keep itself informed of the current requirements of the HCAO.

h. Contractor shall provide reports to City in accordance with any reporting standards promulgated by City under the HCAO, including reports on Subcontractors and Subtenants, as applicable.

i. Contractor shall provide City with access to records pertaining to compliance with HCAO after receiving a written request from City to do so and being provided at least five business days to respond.

j. City may conduct random audits of Contractor to ascertain its compliance with HCAO. Contractor agrees to cooperate with City when it conducts such audits.

k. If Contractor is exempt from the HCAO when this Agreement is executed because its amount is less than $25,000 ($50,000 for nonprofits), but Contractor later enters into an agreement or agreements that cause Contractor's aggregate amount of all agreements with City to reach $75,000, all the agreements shall be thereafter subject to the HCAO. This obligation arises on the effective date of the agreement that causes the cumulative amount of agreements between Contractor and City to be equal to or greater than $75,000 in the fiscal year.

45. First Source Hiring Program

a. Incorporation of Administrative Code Provisions by Reference

The provisions of Chapter 83 of the San Francisco Administrative Code are incorporated in this Section by reference and made a part of this Agreement as though fully set forth herein. Contractor shall comply fully with, and be bound by, all of the provisions that apply to this Agreement under such Chapter, including but not limited to the remedies provided therein. Capitalized terms used in this Section and not defined in this Agreement shall have the meanings assigned to such terms in Chapter 83.

b. First Source Hiring Agreement.

(1) Contractor will comply with First Source interviewing, recruitment and hiring requirements, which will provide the San Francisco Workforce Development System with the exclusive opportunity to initially provide Qualified Economically Disadvantaged Individuals for consideration for employment for Entry Level Positions. The duration of the First Source interviewing requirement shall be ten (10) days, unless business necessity requires a shorter period of time;

(2) Contractor will comply with requirements for providing timely, appropriate notification of available Entry Level Positions to the San Francisco Workforce Development System so that the System may train and refer an adequate pool of Qualified Economically Disadvantaged Individuals to participating Employers;

(3) Contractor agrees to use good faith efforts to comply with the First Source hiring requirements. A Contractor may establish its good faith efforts by filling: 1) its first available Entry Level Position with a job applicant referred through the First Source Program; and, 2) fifty percent (50%) of its subsequent available Entry Level Positions with job applicants referred through the San Francisco Workforce Development System. Failure to meet this target, while not imputing bad faith, may result in a review of the Contractor's employment records.

c. Hiring Decisions.

Contractor shall make the final determination of whether an Economically Disadvantaged Individual referred by the System is "qualified" for the position.

d. Exceptions

Upon application by Employer, the First Source Hiring Administration may grant an exception to any or all of the requirements of Chapter 83 in any situation where it concludes that compliance with this Chapter would cause economic hardship.

e. Liquidated Damages

Violation of the requirements of Chapter 83 is subject to an assessment of liquidated damages in the amount of $2,070 for every new hire for an Entry Level Position improperly withheld from the first source hiring process. The assessment of liquidated damages and the evaluation of any defenses or mitigating factors shall be made by the FSHA.

f. Subcontracts

Any subcontract entered into by Contractor shall require the subcontractor to comply with the requirements of Chapter 83 and shall contain contractual obligations substantially the same as those set forth in this Section.

46. Prohibition on Political Activity with City Funds

In accordance with San Francisco Administrative Code Chapter 12.G, Contractor may not participate in, support, or attempt to influence any political campaign for a candidate or for a ballot measure (collectively, "Political Activity") in the performance of the services provided under this Agreement. Contractor agrees to comply with San Francisco Administrative Code Chapter 12.G and any implementing rules and regulations promulgated by City's Controller. The terms and provisions of Chapter 12.G are incorporated herein by this reference. In the event Contractor violates the provisions of this section, City may, in addition to any other rights or remedies available hereunder, (i) terminate this Agreement, and (ii) prohibit Contractor from bidding on or receiving any new City contract for a period of two (2) years. The Controller will not consider Contractor's use of profit as a violation of this section.

47. Preservative-treated Wood Containing Arsenic

Contractor may not purchase preservative-treated wood products containing arsenic in the performance of this Agreement unless an exemption from the requirements of Chapter 13 of the San Francisco Environment Code is obtained from the Department of the Environment under Section 1304 of the Code. The term "preservative-treated wood containing arsenic" shall mean wood treated with a preservative that contains arsenic, elemental arsenic, or an arsenic copper combination, including, but not limited to, chromated copper arsenate preservative, ammoniacal copper zinc arsenate preservative, or ammoniacal copper arsenate preservative. Contractor may purchase preservative-treated wood products on the list of environmentally preferable alternatives prepared and adopted by the Department of the Environment. This provision does not preclude Contractor from purchasing preservative-treated wood containing arsenic for saltwater immersion. The term "saltwater immersion" shall mean a pressure-treated wood that is used for construction purposes or facilities that are partially or totally immersed in saltwater.

48. Modification of Agreement

This Agreement may not be modified, nor may compliance with any of its terms be waived, except by written instrument executed and approved in the same manner as this Agreement. Contractor shall cooperate with the Department to submit to the Director of HRC any amendment, modification, supplement or change order that would result in a cumulative increase of the original amount of this Agreement by more than 20%.

49. Administrative Remedy for Agreement Interpretation

Should any question arise as to the meaning and intent of this Agreement, the question shall, prior to any other action or resort to any other legal remedy, be referred to Purchasing who shall decide the true meaning and intent of the Agreement.

50. Agreement Made in California; Venue

The formation, interpretation and performance of this Agreement shall be governed by the laws of the State of California. Venue for all litigation relative to the formation, interpretation and performance of this Agreement shall be in San Francisco.

51. Construction

All paragraph captions are for reference only and shall not be considered in construing this Agreement.

52. Entire Agreement

This contract sets forth the entire Agreement between the parties, and supersedes all other oral or written provisions. This contract may be modified only as provided in Section 48.

53. Compliance with Laws

Contractor shall keep itself fully informed of City's Charter, codes, ordinances and regulations of City and of all state, and federal laws in any manner affecting the performance of this Agreement, and must at all times comply with such local codes, ordinances, and regulations and all applicable laws as they may be amended from time to time.

54. Services Provided by Attorneys

Any services to be provided by a law firm or attorney must be reviewed and approved in writing in advance by the City Attorney. No invoices for services provided by law firms or attorneys, including, without limitation, as subcontractors of Contractor, will be paid unless the provider received advance written approval from the City Attorney.

55. Supervision of Minors

Left blank by agreement of the parties.

56. Severability

Should the application of any provision of this Agreement to any particular facts or circumstances be found by a court of competent jurisdiction to be invalid or unenforceable, then (a) the validity of other provisions of this Agreement shall not be affected or impaired thereby, and (b) such provision shall be enforced to the maximum extent possible so as to effect the intent of the parties and shall be reformed without further action by the parties to the extent necessary to make such provision valid and enforceable.

57. Nondisclosure of Private Information

As of March 5, 2005, Contractor agrees to comply fully with and be bound by all of the provisions of Chapter 12M of the San Francisco Administrative Code (the "Nondisclosure of Private Information Ordinance"), including the remedies provided. The provisions of the Nondisclosure of Private Information Ordinance are incorporated herein by reference and made a part of this Agreement as though fully set forth. Capitalized terms used in this section and not defined in this Agreement shall have the

meanings assigned to such terms in the Nondisclosure of Private Information Ordinance. Consistent with the requirements of the Nondisclosure of Private Information Ordinance, Contractor agrees to all of the following:

(a) Neither Contractor nor any of its Subcontractors shall disclose Private Information obtained from City in the performance of this Agreement to any other Subcontractor, person, or other entity, unless one of the following is true:

(i) The disclosure is authorized by this Agreement;

(ii) The Contractor received advance written approval from the Contracting Department to disclose the information; or

(iii) The disclosure is required by law or judicial order.

(b) Any disclosure or use of Private Information authorized by this Agreement shall be in accordance with any conditions or restrictions stated in this Agreement. Any disclosure or use of Private Information authorized by a Contracting Department shall be in accordance with any conditions or restrictions stated in the approval.

(c) Private Information shall mean any information that: (1) could be used to identify an individual, including without limitation, name, address, social security number, medical information, financial information, date and location of birth, and names of relatives; or (2) the law forbids any person from disclosing.

(d) Any failure of Contractor to comply with the Nondisclosure of Private Information Ordinance shall be a material breach of this Agreement. In such an event, in addition to any other remedies available to it under equity or law, City may terminate this Agreement, debar Contractor, or bring a false claim action against Contractor.

58. Graffiti Removal

Graffiti is detrimental to the health, safety and welfare of the community in that it promotes a perception in the community that the laws protecting public and private property can be disregarded with impunity. This perception fosters a sense of disrespect of the law that results in an increase in crime; degrades the community and leads to urban blight; is detrimental to property values, business opportunities and the enjoyment of life; is inconsistent with City's property maintenance goals and aesthetic standards; and results in additional graffiti and in other properties becoming the target of graffiti unless it is quickly removed from public and private property. Graffiti results in visual pollution and is a public nuisance. Graffiti must be abated as quickly as possible to avoid detrimental impacts on the City and County and its residents, and to prevent the further spread of graffiti.

Contractor shall remove all graffiti from any real property owned or leased by Contractor in the City and County of San Francisco within forty eight (48) hours of the earlier of Contractor's (a) discovery or notification of the graffiti or (b) receipt of notification of the graffiti from the Department of Public Works. This section is not intended to require a Contractor to breach any lease or other agreement that it may have concerning its use of the real property. The term "graffiti" means any inscription, word, figure, marking or design that is affixed, marked, etched, scratched, drawn or painted on any building, structure, fixture or other improvement, whether permanent or temporary, including by way of example only and

without limitation, signs, banners, billboards and fencing surrounding construction sites, whether public or private, without the consent of the owner of the property or the owner's authorized agent, and which is visible from the public right-of-way. "Graffiti" shall not include: (1) any sign or banner that is authorized by, and in compliance with, the applicable requirements of the San Francisco Public Works Code, the San Francisco Planning Code or the San Francisco Building Code; or (2) any mural or other painting or marking on the property that is protected as a work of fine art under the California Art Preservation Act (California Civil Code Sections 987 et seq.) or as a work of visual art under the Federal Visual Artists Rights Act of 1990 (17 U.S.C. §§ 101 et seq.).

Any failure of Contractor to comply with this section of this Agreement shall constitute an Event of Default of this Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day first mentioned above.

CITY

Approved by:

Susan Leal
General Manager
San Francisco Public Utilities Commission

Printed Name

Approved as to Form:

Dennis J. Herrera
City Attorney

By
Deputy City Attorney

Approved:

Naomi Little
Director of Office of Contract Administration/
Purchaser

CONTRACTOR

By signing this Agreement, I certify that I comply with the requirements of the Minimum Compensation Ordinance, which entitle Covered Employees to certain minimum hourly wages and compensated and uncompensated time off.

I have read and understood paragraph 35, the City's statement urging companies doing business in Northern Ireland to move towards resolving employment inequities, encouraging compliance with the MacBride Principles, and urging San Francisco companies to do business with corporations that abide by the MacBride Principles.

Authorized Signature

Louis J. Armstrong
Printed Name

Vice President
Title

URS Corporation
Company Name

1910301
City Vendor Number

1333 Broadway, Suite 800
Oakland, CA 94612

Address

941716908

Federal Employer ID Number

APPENDICES

A: Services to be Provided by Contractor
B: Calculation of Charges

Appendix A
Services to be Provided by Contractor

Contractor agrees to perform said services all in accordance with the terms of this Agreement.

1. Description of Tasks to be Performed by Contractor

Individuals listed in the Fee Schedule and whose resumes and qualifications have been submitted as part of the proposal to provide specific services are expected to work as part of the project team. Pursuant to the scope of services described in the RFP, the work plan, and the Fee Schedule submitted as part of Contractor's proposal, Contractor shall perform the following tasks:

Task 1: Management and Coordination of Consultants Services

Purpose and Objectives

The purpose and objective of this task is to provide coordination for keeping project participants informed of progress, technical issues, and planned activities and events, and further, to verify that the Scope of Services outlined herein will be completed on time, within budget, and to the standards of quality required by SFPUC.

Task-Specific Approach and Associated Work Elements

Task 1 shall be carried out in a series of subtasks as follows:

- Task 1.1 Develop Management Work Plan
- Task 1.2 Prepare for and Attend Project Kick-off meeting
- Task 1.3 Prepare for and Attend Bi-Weekly Progress Meetings
- Task 1.4 Prepare for and Present Interim and Final (35%, 65%, and 95% Level) Design Submittals
- Task 1.5 Prepare for and Facilitate Design Coordination Workshops
- Task 1.6 Submit Monthly Progress Reports
- Task 1.7 Maintain Project Files
- Task 1.8 Coordinate Work Product Review Comments

Details of the work to be completed and deliverables to be submitted as part of the effort associated with each of these Management subtasks are presented below. For scheduling of design phase activities we have included three weeks for SFPUC review of each Consultant deliverable, unless otherwise noted.

Task 1.1 Develop Management Work Plan (MWP)

Purpose and Objectives

The Management Work Plan (MWP) will serve as the roadmap for the Project Team in carrying out its work under the contract. The Work Plan is intended to lay the groundwork for efficient execution of contracted engineering services.

Assumptions

- The MWP will be developed and customized for this project, using existing Plans from other previous SFPUC projects for reference as applicable.

- Detailed change control procedures shall be initiated no later than the 35% design level to track cost impacts of significant changes during design development.

Task-Specific Approach and Associated Work Elements

The Consultant shall prepare a Draft Management Work Plan for review and acceptance by the SFPUC. The Final Management Work Plan shall be revised to incorporate all applicable SFPUC comments.

The Plan will include the following information:

1. Project Team organization and responsibility;
2. Consultant's Contract administration procedures;
3. Cost and schedule control procedures including detailed change control procedures to track and control construction cost changes during design development;
4. List of tasks and corresponding staff and budget;
5. Detailed Critical Path Method (CPM) design schedule;
6. File management and coordination guidelines;
7. Invoicing and progress reporting procedures;
8. Report/memo/templates and CADD drafting standards (conforming with SFPUC standards);
9. Technical reference lists;
10. Communications distribution lists and procedures;
11. QA/QC procedures; and
12. Technology transfer procedures.

The draft MWP shall be developed with input from the SFPUC, and once finalized shall be distributed to all key staff members of the CONSULTANT Team and the SFPUC.

Dependencies On / Among Other Tasks

None. The work under this subtask will be initiated immediately upon receipt of NTP.

Responsible Party

The MWP will be developed under the direction of the Consultant Project Manager.

Output / Deliverables

- Draft MWP, 20 hard copies and one copy in digital format, within 2 weeks from NTP
- Final MWP, 10 hard copies and one copy in digital format, within 5 weeks from NTP

Task 1.2 Prepare for and Attend Project Kick-off Meeting

Purpose and Objectives

The project kick-off meeting will help to orient the project team through discussions of the overall work plan, schedule, milestones, critical success factors and communications protocol.

Assumptions

- The meeting will be a half-day meeting in SFPUC's San Francisco Offices.
- The Project Schedule will be updated following the discussions at the kick-off meeting.

Task-Specific Approach and Associated Work Elements

Prepare for and attend project kick-off meeting to review tasks, milestones, roles, communication and coordination processes, and MWP. Attendees at the meeting shall include the Project Manager, QA/QC Officer, Key Task Leaders, and key discipline leaders from Consultant and Subconsultants.

Dependencies On / Among Other Tasks

None.

Responsible Party

The Consultant Project Manager will assist the SFPUC Project Engineer with assembling and distributing appropriate handouts to meeting attendees in advance of the meeting. In addition, Consultant Project Manager will be responsible for preparation of meeting minutes and for incorporation of comments to the draft minutes. The SFPUC Project Manager will conduct and coordinate the kick-off meeting.

Output / Deliverables

- Handouts in advance of the kick-off meeting
- Meeting minutes for project meetings, one copy in digital format.

Task 1.3 Prepare for and Attend Coordination Bi-Weekly Progress Meetings

Purpose and Objectives

The purpose of these meetings is to report on overall progress and status of the design effort, to develop solutions to project issues, and to achieve overall project coordination.

Assumptions

- 3 hours per meeting between SFPUC staff and 2 senior Consultant staff.
- Additional team members will attend meetings when needed.
- Periodic coordination meetings with related project teams will be held in addition to bi-weekly progress meetings when needed.

Task-Specific Approach and Associated Work Elements

Prepare for and attend coordination bi-weekly progress meetings for the duration of the contract. Report on progress and status, identify project issues, and discuss solutions to project issues. As part of this effort, the SFPUC Project Engineer will organize and lead periodic meetings as needed with the Alameda Siphon No. 4 and BDPL No. 5 design teams to coordinate design parameters and layouts, permitting issues, schedules, and deliverables between the interconnected projects.

Dependencies On / Among Other Tasks

None.

Responsible Party

The SFPUC Project Engineer will have overall responsibility for this Task. The SFPUC Project Engineer and Consultant Project Manager will jointly identify the appropriate personnel who should attend the meetings.

Output / Deliverables

- Handouts in advance of meetings
- Meeting minutes for project meetings, one copy in digital format.

Task 1.4 Prepare for and Present Interim and Final (35%, 65%, and 95% Level) Design Submittals

Purpose and Objectives

The purpose of the design submittal meetings is to present the design submittals at key stages of design development and to respond to questions from SFPUC and the SFPUC's Technical

Advisory Panel regarding the scope and content of the technical specifications, drawings, cost and schedule, and/or reports.

Assumptions

- A total of 3 full day Design Submittal Presentations will be convened.
- Up to 5 Consultant Design Team members (full time equivalents) will participate at appropriate time periods.

Task-Specific Approach and Associated Work Elements

Prepare and make a presentation to the SFPUC of the design and cost estimate at the 35%, 65%, 95% deliverable milestones.

Dependencies On / Among Other Tasks

The design submittal review meetings will be scheduled in consultation with the SFPUC. Design submittal review meetings will follow SFPUC review of the submittals.

Responsible Party

Consultant Project Manager will facilitate each of the Design Submittal Meetings with assistance, as appropriate, by each of the lead engineers and appropriate key discipline leaders.

Output / Deliverables

- Handouts in advance of each of the Design Submittal Meetings
- Meeting minutes for project meetings and workshops, one copy in digital format.

Task 1.5 Prepare for and Facilitate Design Coordination Workshops

Purpose and Objectives

The purpose of the Design Coordination Workshops is to review and discuss comments from the SFPUC on the 35%, 65%, and 95% design submittals.

Assumptions

- A total of 3 half-day Design Coordination Workshops will be convened.
- A total of up to 5 Design Team members (full-time equivalents) will participate at appropriate time periods throughout the meeting.
- SFPUC will coordinate and determine if Alameda Siphon No. 4 and BDPL No. 5 Design Consultants need to be included as meeting participants.
- Three weeks assumed for SFPUC review of each Consultant deliverable.

Task-Specific Approach and Associated Work Elements

Prepare for and participate in a minimum of 3 design coordination workshops. Each workshop shall be coordinated between the Consultant and SFPUC following the 35%, 65%, and 95% deliverable presentations.

Comments resulting from SFPUC's review of each main design deliverable (35%, 65%, and 95%) shall be addressed and settled on during the workshops before progressing further with the design.

Dependencies On / Among Other Tasks

The Design Coordination Workshops will generally be scheduled three weeks after each Task 1.4 Design Submittal Review Meeting.

Responsible Party

Consultant Project Manager will facilitate each of the Design Coordination Workshops with assistance, as appropriate, by each of the lead engineers and appropriate key discipline leaders

Output / Deliverables

- Meeting minutes for project meetings and workshops, one copy in digital format.

Task 1.6 Submit Monthly Progress Reports and Invoices

Purpose and Objectives

The purpose of this task is to keep the SFPUC fully apprised of the budget and schedule status of the project and any issues, scope/budget changes, or schedule changes that need to be resolved.

Assumptions

- None

Task-Specific Approach and Associated Work Elements

Submit monthly progress reports, with highlights of work achievements during the past month, and work planned and important milestones for the upcoming month. Also for each task provide: (1) suggested updates to schedule (for discussion); (2) estimate of actual (not based on budget) percent complete; and (3) summary of current expenditures (man hours, expenditure, and percent of task budget expended). The report shall identify any issues or potential or actual scope changes that may affect overall cost and/or schedule of design and/or construction.
The progress reports will identify areas needing immediate action including identification and notification of technical conflicts and timing of needed decisions to address those conflicts. The reports will also address budget/schedule variances and recommendations for mitigating them. The reports shall be prepared in a format acceptable to the SFPUC.

Dependencies On / Among Other Tasks

None.

Responsible Party

The Consultant Project Manager, with assistance from appropriate key discipline leaders.

Output / Deliverables

- Monthly Progress Reports, one copy in digital format, within 5 calendar days after the end of each month.
- Monthly invoices, three (3) hard copies, in accordance with City requirements.

Task 1.7 Maintain Project Files

Purpose and Objectives

The purpose of this task is to maintain and organize central files containing all relevant correspondence, calculations, analyses, and reports pertaining to development of the design documents.

Assumptions

- The project file will be maintained in Consultant's Oakland office.

Task-Specific Approach and Associated Work Elements

Maintain project files including all plans, reports, correspondence, calculations, project references, drawings, correspondence, meeting minutes, progress reports and other documents pertaining to the design. Establish a hard-copy Project File and a web-based project data management system that can be accessed by the project team and SFPUC. A fully collated, organized, indexed set of copies shall be transferred to the SFPUC within 20 working days of the 100% design completion, including copies of documents already passed to SFPUC during the assignment. All documents shall be fully checked and signed off in accordance with the Quality Assurance/Quality Control (QA/QC) procedures established in Task 2.

Dependencies On / Among Other Tasks

The project file will be updated on a continuous basis as the project proceeds. The filing system will be initiated following receipt of SFPUC review comments on the scope and system that will be used to organize the file (to be included in the MWP under Task 1.1).

Responsible Party

The project file will be set up and maintained by Consultant administrative staff under the direction of the Consultant Project Manager.

Output / Deliverables

- Project correspondence, calculations, and other project records, one copy in digital or hard copy format within 20 working days of the 100% design completion.

Task 1.8 Coordinate Work Product Review Comments

Purpose and Objectives

The purpose of this task is to coordinate review comments, and document/disseminate responses to review comments on contract deliverables and other contract work products.

Assumptions

Separate review comment logs will be developed for each work product.

Task-Specific Approach and Associated Work Elements

Coordinate review comments provided by others (SFPUC, outside agencies, Independent Reviewers, etc.) on reports, memoranda, contract documents, and other work products. Compile, maintain, and update review comment information including (date received, origin of comment, nature of comment, nature of response or action taken to respond to comments, date of response, etc.) in a separate log for each deliverable and/or work product. Document and disseminate responses to review comments.

Dependencies On / Among Other Tasks

The Work Product Review Comment log set up for each deliverable will be established and maintained and maintained throughout the development of the work product until it is finalized by the Project Team and approved as final by the SFPUC. All review comment response logs will be kept in a central file for real time retrieval by the project Team.

Responsible Party

The Work Product Review Comment log will be set up by CONSULTANT administrative staff and maintained by the CONSULTANT Project Manager with appropriate assistance by Lead Engineers, key discipline leaders, and other parties responsible for development of key Project Deliverables and work products.

Output / Deliverables

- Responses to review comments, one copy in digital format.
- Meeting minutes for project meetings and workshops, one copy in digital format.
- Updated logs of Work Product Review Comments with each successive revised draft of work products.

Task 2: Quality Assurance/Quality Control

Purpose and Objectives

The purpose of this Task is to develop and implement a Quality Assurance and Control Plan that will be used by the Project Team throughout the design process to verify that the design work is in compliance with applicable codes and standards, industry practices, and SFPUC requirements.

Assumptions

- A Draft QA/QC Plan will be submitted within 2 weeks following NTP, for review and acceptance by the SFPUC. 2 weeks are assumed for SFPUC review.
- The Final QA/QC Plan incorporating all applicable comments shall be submitted within 5 weeks of the NTP.

Task-Specific Approach and Associated Work Elements

The project-specific QA/QC Plan shall provide for alignment and consistency with the SFPUC QA/QC program, which also governs the work. The project QA/QC Plan shall identify the Consultant's requirements and procedures for ongoing QA/QC efforts, including, but not limited to:

- Verifying that all design work is in compliance with applicable codes and standards and industry practices;
- Procedures for reviewing, distributing, checking, tracking, controlling and documentation of all documents; and
- Procedures for resolution of review comments; procedures for coordination with the SFPUC Project Team, and any independent Technical Advisory Panel.

The Consultant shall implement QA/QC procedures uniformly throughout the design process. Internal QA/QC shall be conducted prior to presenting deliverables to the SFPUC. Established QA/QC procedures, to be employed by all designers, shall address the use of quality control review, calculation checking, design checking, AutoCAD interference and interface checking, construction and operation issues, and other measures necessary to maintain a consistent, complete, high quality, and compatible design. Consultant shall establish QA/QC procedures for successfully interfacing the design with Subconsultants and SFPUC Design Team.
The Consultant's QA Officer shall perform independent audits at periodic intervals to ensure that procedures specified in the QA/QC Plan are being followed. In addition, the Consultant's Principal-In-Charge will seek periodic client feedback reports from the SFPUC Project Engineer and schedule regular meetings to evaluate the performance of the team and develop corrective measures, if required.

Dependencies On / Among Other Tasks

None.

Responsible Party

The QA/QC Plan will be developed under the direction of the Consultant QA Officer, with assistance from Consultant Project Manager and key discipline leaders. The Consultant QA Officer will also conduct independent audits of project files to ensure compliance with the QA/QC Plan.

Output / Deliverables

- Draft QA/QC Plan, 20 hard copies and one digital copy, within two (2) weeks from NTP.
- Final QA/QC Plan, 10 hard copies and one digital copy, within five (5) weeks from NTP.

Task 3: Review Background Information

Purpose and Objectives

The purpose of this Task is to review and document relevant background information for the project. The information includes drawings and reports relative to the design and construction of the existing tunnel and the information and reports associated with conceptual design of the new tunnel. The objective of this task will be to verify the feasibility of the proposed design concept before initiating final design work on the new Irvington Tunnel.

Assumptions

- The SFPUC will provide copies of all available construction records, surveying data, and other data including records from the 1966 and earlier inspections of the tunnel.
- Alternative configurations for the layout of the new tunnel, if identified during the course of this task, will be evaluated as part of the Task 8 Preliminary Design efforts, subject to the approval of the SFPUC.
- Early coordination with the Alameda Siphon No. 4 and BDPL No. 5 Design Teams will be carried out to achieve a consistent approach with these adjacent projects in the feasibility verification efforts, and to verify that the proposed common manifold and connection points and construction plans for the adjacent facilities are compatible.
- Site reconnaissance and verification of existing site conditions and existing facilities/utilities will be conducted under Task 5.

Task-Specific Approach and Associated Work Elements

This task shall include the review of relevant project documents. At a minimum, the Consultant shall review the following:

1. Woodward-Clyde Conceptual Engineering Report, November 1991;
2. Water System Improvement Program Report, February 2005;
3. Water Infrastructure Partner Conceptual Engineering Report, September 2005;
4. Water Infrastructure Partner Conceptual Engineering Report - Appendices, September 2005;
5. Existing Irvington Tunnel Construction Drawings and Records; and
6. Existing Alameda East, Alameda West, and Irvington Portal Construction Drawings and Records.
7. Irvington Tunnel Alternatives – Optioneering Phase 1 – Needs/Alternatives Identification and Screening, March 2002;
8. Available Records from the 1966 and earlier inspections of the Existing Tunnel.
9. Published and Unpublished Geologic/Geotechnical and Seismic Information.

Additional materials to be reviewed if available include, but are not limited to, surveying data; aerial photos; topographic maps; right-of-way (ROW) maps; mitigation studies; design and as-

built drawings related to the existing facilities; and information related to environmental studies, Alternative Analysis Report (AAR), and Conceptual Engineering Report (CER) for the southern alignment.

In the reviews of existing documentation and reports, information relating to specific issues and topics will be observed and summarized including:

- Geologic/Geotechnical Information, such as lithology/materials information, discontinuities/faults, groundwater regime, geochemistry, gas occurrence, durability information, geologic hazards, seismicity and seismic design information;
- Construction (As-Built) Information from original tunnel, including squeezing ground behavior, ground stability issues, support requirements/issues, groundwater inflow (face/heading/portal), gas occurrence, excavation rate;
- Tunnel Inspection Information, including Irvington Tunnel 1966 inspection records, records from earlier inspections, ENR articles at the time of tunnel construction;
- Tunnel Grouting Information, including face grouting during excavation and any post excavation grouting;
    - Hydrogeologic Effects Due to Tunnel Construction, including groundwater draw-down observations (and locations) and mitigation efforts.

After completing review of the available information, the Consultant shall prepare a memorandum verifying the feasibility of the proposed design concept presented in the CER. The memorandum shall identify any data gaps that must be completed prior to the commencement of the design of the New Irvington Tunnel and related connections and facilities. The memorandum will also identify suggested alternatives or modifications to the proposed concept (subject to the approval of the SFPUC) and steps that need to be taken to evaluate them. The Consultant will coordinate closely with the Alameda Siphon No. 4 and BDPL No. 5 Design Teams in carrying out the concept feasibility verification process.

Dependencies On / Among Other Tasks

None. Data review and feasibility verification effort shall be initiated at the onset of the work following receipt of hard and/or electronic copies of applicable documents from SFPUC's files.

Responsible Party

The data review will be carried out by the key discipline leads, including Lead Geotechnical Engineer, Lead Tunnel Engineer, and additional technical staff as appropriate.

Output / Deliverables

- Draft and Final Technical memorandum verifying the adequacy and feasibility of the proposed design concept presented in the above documentation; identifying any data gaps that must be completed prior to the design of the tunnel; and presenting a schedule for recovery of the data gaps.

Task 4: Establish Design Criteria

Purpose and Objectives

The objective of this task is to develop civil, hydraulic, seismic, geotechnical, structural and mechanical/ electrical criteria for design that are consistent with SFPUC criteria for the design-specific requirements of this project and the operational and serviceability requirements of the

system. The criteria shall include identification and definition of applicable codes and standards for the project, and facility-specific serviceability requirements, including applicable loads and pressure capacities of conduits, vaults, controls, interfaces with adjacent facilities, and geometrical configurations.

Assumptions

- SFPUC program design criteria, guidelines, general standards, requirements, and details shall form the basis of the general and specific design criteria developed for this project.
- The SFPUC Design Team will provide essential criteria from systemwide hydraulic analysis.

Task-Specific Approach and Associated Work Elements

The Consultant shall establish and implement general and specific design requirements for the tunnel and associated facilities consistent with the SFPUC program design criteria and guidelines. Consultant shall:

- Establish general design requirements and define applicable standards; and
- Establish specific design criteria and parameters.

The design criteria shall meet the overall SFPUC water transmission system hydraulic and serviceability requirements. The design criteria shall specify anticipated internal, external, and seismic loads; and shall address environmental criteria to be met during implementation and operation. The tunnel design shall be developed to meet the objective of continued operation of the tunnel facilities after a major seismic event.

The design criteria shall be drafted following a Design Criteria Workshop to be conducted with the SFPUC Design Team members prior to preliminary design. The finalized design criteria shall be included in the 35% Design Report.

Selective, specific seismic design criteria were presented in the CER for the proposed tunnel, but the RFP states that the Seismic Design Criteria shall conform to program-wide standards currently under development by the SFPUC. Specific hydraulic design criteria and tunnel flow rate performance requirements following an earthquake were also presented in the CER. As part of this task, all design criteria from the CER shall be reviewed and confirmed or updated as appropriate. A draft design criteria memorandum shall be developed by the Consultant in close cooperation with SFPUC during the early stages of the 35% design efforts as described above. Whenever possible, the memorandum shall provide justifications for the selected criteria. The memorandum shall also describe any assumptions made while establishing the design criteria. The design criteria shall be developed under the following general headings/sections:

- General and Hydraulic Criteria
  - Design life
  - Redundancy and mode of operation (including the existing Irvington tunnel)
  - Confirm final diameter (ID)
  - Maximum flow through the tunnel
  - Required flow through the tunnel following the design earthquake
  - Conduit Invert Gradient
  - Static and operating hydraulic grade lines
  - Transient pressures and overflow elevation
  - Horizontal alignment constraints including right-of-way limits
  - Vertical alignment constraints

- Permanent access requirements
- Connections and manifolds
- System operation and controls
- Vaults and structures
- Roads and utilities
- Serviceability
- Inspection frequency; tunnel dewatering requirements

- Geotechnical and Seismic Criteria
  - Design earthquake/parameters consistent with SFPUC-established program criteria
  - Fault offsets, shaking, and racking
  - Portal/shaft locations
  - Groundwater infiltration during construction
  - Water handling, treatment, and disposal requirements
  - Differential settlement criteria
  - Muck disposal requirements
  - Ground loads including squeezing ground
  - Groundwater inflow/control
  - Hydrogeological considerations; water table impact limitations
  - Groundwater levels and effects
  - Groundwater quality
  - Slope stabilization
  - TBM criteria

- Structural Criteria
  - Initial support and lining
  - Final lining
  - Types of liner systems and materials
  - Steel lining allowable stress
  - Surge pressure
  - Design external pressure
  - Internal pressure (portal areas and low ground cover areas)
  - Temperature stresses
  - Poisson's stresses
  - Steel lining handling requirements
  - Infiltration through the final liner
  - Blast/security resistance at portal structures
  - Liner tolerances
  - Corrosion protection
  - Extent of steel lining
  - Reinforced concrete lining
  - Manifolds/connections

- Electrical Criteria
  - Remote operation of valves including but not limited to seismic sensors
  - Control panel types, locations

- SCADA system requirements
- Communication capabilities
- Access controls and alarms
- Permanent backup power criteria
- Construction power criteria

- Mechanical Criteria
  - Allowable maximum time to remove water from the tunnel for inspection
  - Pump criteria
  - Ventilation criteria
  - Discharge receptors
  - Discharge velocities
  - Valves and control requirements
  - Pipe material requirements
  - Corrosion protection standards and design requirements

Dependencies On / Among Other Tasks

The development of the design criteria will be dependent on the following:

- Input provided by the SFPUC (e.g., program-wide seismic design criteria)
- Background information review (Task 3)
- The geotechnical site investigations and reports (Tasks 6 and 7)
- Input from the technical issues addressed during design (Task 8)
- Input from the environmental review consultant and from adjacent project design teams

Responsible Party

The Lead Tunnel Engineer will be responsible for the design criteria, with support from the Project Manager and the key discipline leaders for each area of the design.

Output / Deliverables

- Draft and Final Technical memoranda summarizing recommended design criteria for the New Irvington Tunnel. The Draft Technical memorandum will be updated as required and included in the 35% Design Report. The Final Technical memorandum will be included in the Final Design Report.

Task 5: Conduct Necessary Surveying, Mapping, and Underground Utility Search

Purpose and Objectives

The purpose of this task is to obtain and summarize available information on locations of existing and proposed utilities and facilities, as needed for preparation of background drawings for the entire length of the new tunnel alignment. Available underground critical utility information shall be recorded on a utility plan and on appropriate drawings, including requirements for additional research by the construction contractor, where needed. This task shall include development of a topographic plan and base map that includes existing site features and utilities along the tunnel alignment. This task also includes and development of alternative approaches for accommodating utilities conflicts, if any.

Assumptions

- The existing topographic base maps and survey data utilized in preparation of the CER will be provided by SFPUC. Limited additional surveys will be needed to finalize portal and facility layouts.
- SFPUC will facilitate communication with existing utility owners.
- SFPUC will define the width of alignment corridor, datum, and scales and contour intervals.
- ////
- The SFPUC will provide design for any required relocation of SFPUC utilities or facilities.
- Field surveys will be required to map and verify utility locations. The SFPUC will provide existing utility location information for the portal sites located on SFPUC property. Field surveys for utility locations will not be needed along most of the tunnel alignment because it is too deep to interfere with surface utilities.

Task-Specific Approach and Associated Work Elements

Obtain information on locations of existing and proposed utilities and facilities, as needed for preparation of background drawings for the entire length of the new tunnel alignment. All underground critical utility information shall be recorded on a utility plan and on appropriate drawings, including requirements for additional research by the Contractor. The utility search and conflict resolution shall be coordinated with the applicable agencies through the SFPUC and shall generally be in accordance with ***American Society of Civil Engineers (ASCE) C-I 38-02, Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data.***
Conduct supplemental surveying if required to finalize overflow shaft design, connections to existing facilities, earthwork quantities, and access road designs. Datum, scale and contour interval of plots of survey information shall be reviewed by SFPUC. Survey field notes and data shall be submitted to the SFPUC with the alignment and profile plots, if any. Field book entries shall be neat, legible, and sequential and include the names of crewmembers, date at the beginning of each day-entry, an index, and the serial number and type of instrument used. There shall be a maximum of one (1) horizontal setup per page.
Coordinate with local agencies, municipalities, and Underground Service Alert through SFPUC representatives for surveying and utility location work.
Obtain access or environmental permits, required to accomplish Task 5, by completing and processing permit applications and by providing technical support to the SFPUC, as needed, to secure these permits.
Fieldwork shall be performed in consideration of public safety, per industry standards, and in accordance with applicable permit and environmental regulations, traffic control guidelines, and guidelines outlined in the Watershed Land Protection Procedures in the Peninsula and Alameda Watershed Field Manual published by the SFPUC Land and Resource Management Section.

Dependencies On / Among Other Tasks

Review of available background information (Task 3) will be finalized prior to initiating this task.

Responsible Party

The Lead Civil/Pipeline Engineer will be responsible for overall coordination of surveying, mapping, and utility research efforts, along with appropriate technical staff.

Output / Deliverables

- Utility Drawings. Based upon available data, prepare and submit a utility plan identifying existing and abandoned utilities including horizontal locations and vertical depths. Submit 2 bond full size sets, 1 unbound half size set, and 1 digital set in AutoCAD.
- Draft and Final Technical Memoranda summarizing the results of utility and facility location work. The memorandum, and accompanying documents, shall document information on utilities and facilities that may conflict with the tunnel facilities. Specifically, the memorandum shall identify and record existing and abandoned utilities and facilities, utilities and facilities requiring relocation, and proposed utilities and facilities that would be impacted by construction of the tunnel and associated facilities. Submit one hard copy and one digital copy of the memorandum and accompanying documents.
- Supplemental Survey Information. Submit digital and hard copies of survey field notes, data, and other backup information used in refining and/or supplementing the available topographic survey drawings and data provided by the SFPUC.

Task 6: Perform Geotechnical Investigation and Site Characterization

Purpose and Objectives

The purpose of this task is to perform geotechnical investigations and site characterizations for the New Irvington Tunnel, including the tunnel alignment, the Alameda West Portal and the Irvington Portal. The primary objective of the geotechnical investigation program is to provide a detailed characterization of soil, rock, seismic and groundwater conditions along the project alignment to provide the necessary data for final design of the system.

Discussion of Key Geotechnical Issues

The proposed geotechnical investigations for the New Irvington Tunnel will involve collecting sufficient data to identify the distribution of the various lithologies of the rock along the alignment and to obtain a range of material properties, including rock strength; abrasiveness and hardness; degree of rock mass weathering; and discontinuity spacings (i.e., joints, faults, shears, etc.), orientations, aperture widths, and infilling characteristics. The investigations proposed to collect this data include geologic mapping, aerial photo review, fault trenching, test pits, core hole drilling and down-hole testing, laboratory testing and groundwater monitoring and modeling.

Key geologic issues that will be investigated and addressed during the investigation and characterization program include but are not limited to the following:

- Geologic rock mass designation of the portals, shafts, and tunnel;
- Potential squeezing ground condition along the tunnel alignment;
- Potential for hazardous gases and soil materials;
- Groundwater levels, water quality/chemistry (especially with respect to corrosivity), and monitoring, including seasonal variations;
- Permeability of the various intact rock masses, fracture zones, fault zones, and other discontinuities along the tunnel alignment;

- Requirements for ground/soil improvement (if needed)
- Groundwater modeling using commercially available, three-dimensional anisotropic modeling tools, to establish base line conditions, impacts from tunnel construction, and groundwater inflows during tunnel construction;
- Bedrock elevations;
- Slope stability and landslide hazards;
- Design parameters of necessary shoring, retaining walls, pipelines, pipe trenches, and valve vaults, and grading at the portals;
- Base, sub-grade, and paving requirements for access road construction;
- Corrosive properties of soil and groundwater;
- Site specific seismic design response spectrum for maximum probable and credible earthquakes;
- Coefficients of friction between concrete and soil or structural fill material;
- Design parameters for deep foundations (if needed); and
- Hazardous soil materials (if encountered).

The Consultant shall develop and perform all geotechnical investigation and site characterization work necessary for the design of all project facilities including the Escobar Shaft. The investigation program shall provide necessary information to characterize the ground conditions and develop the GIR and GBR to support an effective design and to minimize construction risks. The exploratory drilling, boring, testing, and inspection program shall obtain site specific geotechnical and seismic information for design of the tunnel, portals, temporary shoring, realignment of roadways/access roads, retaining structures, hydraulic facilities, the Escobar shaft, vaults, together with the groundwater table elevation. Any potential hazardous material that the borings may encounter during the exploratory drilling program shall be reported.
The proposed borings shall be appropriately spaced and located to allow characterization along the tunnel alignment and sufficient lateral and vertical coverage at all significant structures. Depths of borings shall be appropriate to the anticipated depth and zone of stress influence of the anticipated structures. Sampling, in-situ testing, and laboratory testing shall be appropriate to generally characterize the subsurface materials including index and engineering properties. Fieldwork shall be performed in consideration of public safety, per industry standards, and in accordance with applicable permit and environmental regulations, traffic control guidelines, and guidelines outlined in the Watershed Land Protection Procedures in the Peninsula and Alameda Watershed Field Manual published by the SFPUC Land and Resource Management Section. All boring locations, trench locations, and geophysical test locations (coordinates) and elevations shall be surveyed.

Task-Specific Approach and Associated Work Elements

Task 6 shall be carried out in a series of subtasks as follows:

- Task 6.1 Develop Geotechnical Investigation and Site Characterization Work Plan
- Task 6.2 Geologic Mapping and Well and Spring Survey
- Task 6.3 Environmental Clearance and Reporting

- Task 6.4 Fault Trenching and Seismic Refraction Surveys
- Task 6.5 Subsurface Investigations
- Task 6.6 Seismic Criteria
- Task 6.7 Groundwater Modeling

Details of the work to be completed and deliverables to be submitted as part of the effort associated with each of these subtasks are presented below.

Task 6.1 Develop Geotechnical Investigation and Site Characterization Work Plan

Purpose and Objectives

The purpose of this task is to define the planned scope for the geotechnical investigation and site characterization and the specific procedures and protocols that will be used to implement the plan. The work plan will be used in the permitting efforts under Task 6.3 to provide clear descriptions of the work to be performed and environmental mitigation and/or avoidance measures to be implemented. In addition, the work plan will provide a basis for negotiating rights-of-entry to private property, if required.

Assumptions

- 2 weeks allowed for SFPUC review of draft work plan; Final work plan to be submitted 4 weeks following submittal of draft.

Task-Specific Approach and Associated Work Elements

Prepare draft and final Geotechnical Investigation and Site Characterization Work Plan to address the following topics:

- Introduction, project team, background information and scope of geotechnical investigation;
- Right-of-way and environmental requirements;
- Objectives and key geotechnical issues for the project;
- Scope of work and approach for investigating and characterizing the site conditions; and
- Field procedures to be used during the investigations to insure required information is obtained in a consistent manner.

Prepare a site specific Health and Safety Plan addressing health and safety issues and procedures for personnel completing field activities will be prepared. Develop a Storm Water Pollution and Prevention Plan (SWPPP) addressing Best Management Practices (BMP's) to be utilized for erosion and sediment control at all sites where ground disturbing activities take place.

The Work Plan shall include a map identifying the location of the investigations (i.e. borings, test pits, fault trenches, geophysical surveys, geologic mapping, piezometers), access routes to the investigation sites; purpose and estimated depths of borings, test pits, and trenches; in-situ and laboratory testing on rock and soil samples; exploration schedule and cost; and environmental considerations for the investigation.

Applicable portions of the Plan shall provide sufficient detail for obtaining permits for fieldwork (Under Task 6.3) and for the public outreach staff to notify affected public in advance of fieldwork (Task 13). The exploration work shall only begin after SFPUC's review and acceptance of the Final Geotechnical Investigation and Site Characterization Work Plan submitted by the Consultant. The plan shall include a table that identifies the anticipated habitat

type (i.e., grassland, oak woodland, wetland, etc.) at each exploration site, along with the standard BMP's to be used at each site.

Dependencies On / Among Other Tasks

The results of the Task 3 (including aerial photographs, geologic maps, right-of-way maps, and the existing Irvington Tunnel records, reports, and other previously completed borings) will be used in the development of the Geotechnical Investigation Work Plan. The work plan will be used as an input to Task 6.3 and Task 13.

Responsible Party

The Work Plan as well as the SWPPP and Health and Safety Plan will be prepared under the direction the Lead Geotechnical Engineer and Lead Engineering Geologist, with assistance from other key team members. The Lead Tunnel Engineer will also provide input regarding the locations of the test borings and test pits, the depths and types of piezometers to be installed in the borings, and the number and type of in-situ and laboratory tests to be completed.

Output / Deliverables

- Draft and Final Geotechnical Investigation and Site Characterization Work Plan. Provide 10 hard copies and one digital copy of each.
- Draft and Final Health and Safety Plan. Provide 10 hard copies and one digital copy of each.
- Draft and Final Stormwater Pollution Prevention Plan (SWPPP). Provide 10 hard copies and one digital copy of each.

Task 6.2 Geologic Mapping and Well and Spring Survey

Purpose and Objectives

The purpose of this task will be to document rock outcrops in the project area, as well as private use wells and springs that could be affected by planned construction.

Assumptions

- Geologic mapping and well and spring surveys will be limited to a corridor 1000 feet on each side of the existing Irvington Tunnel.
- SFPUC will facilitate obtaining right-of-entry to existing right-of-way and private property parcels as required.

Task-Specific Approach and Associated Work Elements

Develop a thorough understanding of the soil and rock conditions at the tunnel portals and along the tunnel alignment. Identify the limits of the various soil and rock units, the location and orientation of faults and other structural discontinuities, and the limits of landslides and other potential slope instability at the portals and adjacent pipeline connections. Prepare a geologic strip map with identification of springs and wells above and near the tunnel alignment. Mapping presented in the CER as well as previous geologic and landslide maps of the project area prepared by the U.S. Geological Survey and the California Geologic survey and construction records from the Irvington Tunnel No.1 and the Mission Tunnel will be utilized as inputs for the preparation of the detailed geologic strip map.

Before the start of the field mapping, review aerial photography along the Tunnel corridor using existing high-resolution topographic data acquired by the City of Fremont, detailed aerial photographs taken in 1940 and 1957, and recent aerial photographs obtained by the SFPUC for the CER work.

The geologic mapping under this task will be completed to confirm the mapping presented in the CER. Specific activities will include delineating surface geologic deposits including geologic contacts, recording orientations of bedding and joints, verification of fault-related features, and refining the mapped locations of secondary faults. Locations of springs, seeps, and wet areas will be identified, and discharge rates will be estimated for springs. Locations of water wells above and adjacent to the tunnel corridor as mapped in the CER, will be reviewed and confirmed. Available well information will be obtained including well depth, water levels, production rates, and groundwater quality, if available. As appropriate, landowners above the tunnel corridor will also be contacted to gain additional information on the locations, water levels, and production rates of wells and springs on their properties. Locations of the springs, wells, and wet areas will be plotted on the geologic strip map to form a preliminary groundwater resources map. Summary tables of the collected well and spring data will also be prepared. Records of groundwater impacts from the Irvington Tunnel No. 1 and Mission Tunnel construction as presented in the CER will be reviewed and included on the map as appropriate.

Dependencies On / Among Other Tasks

The results of the Task 3, including aerial photographs, geologic maps, right-of-way maps, and the existing Irvington and Mission Tunnel records and other previously completed borings will be used together with the results of the field mapping under this task in the development of the updated geologic strip map for the proposed new tunnel alignment.

Responsible Party

The geologic mapping will be led by the Consultant Team's lead engineering and seismic geologists.

Output / Deliverables

Deliverables from the Task 6.2 will include an updated geologic strip map and groundwater resources map and summary table to be presented in the Task 7 Geotechnical Data Report.

Task 6.3 Environmental Clearance and Permitting

Purpose and Objectives

The proposed geotechnical investigation program for the New Irvington Tunnel will be conducted in or near a number of habitat types, including oak woodlands, chaparral, grasslands, and potentially other jurisdictional wetland areas. Listed species in the project area include the California red-legged frog, Alameda whipsnake, and tiger salamander and potentially a number of listed plant species. Work in these areas may fall under the jurisdiction of a number of regulatory agencies, and permits may need to be obtained prior to conducting the ground-disturbing geotechnical investigations. Government agencies that may be involved in various aspects of the permitting process would include Alameda County, the US Army Corps of Engineers (Corps), US Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), Regional Water Quality Control Board (RWQCB), and the State Historic Preservation Office (SHPO).

Assumptions

- SFPUC will facilitate CONSULTANT access to the proposed exploration locations along the tunnel alignment as needed for environmental clearance.

- No formal surveys or delineations of wetlands or waters are required. If present, wetlands and other waters or special status species will be evaluated based on visual assessment of the proposed investigation sites.
- The SFPUC will conduct CEQA review as needed for the geotechnical exploration program.
- Consultation with the USFWS can be completed informally and will not require a habitat conservation plan under Section 10 or formal Section 7 consultation as defined by the Federal Endangered Species Act.
- Avoidance measures can be developed that will avoid take of federal or state listed species.
- The SFPUC will be responsible for any permit application fees, other than the Alameda County Boring permits.
- The ACOE will authorize the proposed geotechnical investigation sites under Nationwide Permit #6 for Survey Activities with no additional Section 106 compliance for cultural resources.
- One round of SFPUC review for each deliverable/permit application.
- If needed, a conceptual mitigation/avoidance plan will be developed to address mitigation/avoidance requirements of the ACOE, the RWQCB, CDFG, and the USFWS associated with the geotechnical exploration program. Development of a detailed mitigation and monitoring plan will not be necessary.
- Specialized Field monitoring of the geotechnical investigation work to comply with the terms and conditions of the environmental permits (if any) will not be required.
- Maximum of one archeological site identified and recorded. Site evaluation (testing) will not be required.

Task-Specific Approach and Associated Work Elements

The Consultant shall obtain the necessary environmental clearances and/or permits from regulatory agencies to carry out the proposed field investigation work which has the potential to impact both biological and cultural resources. The Consultant shall meet with the environmental representative in the field as needed to discuss the field investigation procedures, stake exploration locations and make adjustments to exploration locations as required.

To initiate the environmental clearance and permitting process, a CONSULTANT biologist and permitting expert along with the Lead Geotechnical Engineer and Lead Engineering Geologist will conduct a site reconnaissance of the boring locations to determine unique characteristics of each. The proposed locations will be staked and recorded using GPS. During the reconnaissance, the biologist will review the areas for potential presence of habitat for listed plant and animal species. The site reconnaissance will aid in developing information on the permitting options and avoidance and impact minimization measures to be presented in the permit applications. The site reconnaissance, discussions with regulatory agencies, and preparation of permit applications would be initiated immediately upon authorization to proceed from the SFPUC.

The locations for ground-disturbing exploration (e.g., roads, borings, test pits) will be selected to minimize impact by avoiding sensitive habitats and avoiding take of listed species to the extent possible, while still providing the critical data needed for tunnel design. However, we assume that even with this approach, certain permits will still be required.

The proposed geotechnical investigation work sites will require different levels of environmental compliance depending on the potential level of impact. The environmental compliance requirements are:

- Minimal Impact. Sites with no potential for significant environmental impacts;
- Potentially Significant Impact. Sites that may require mitigation to avoid potentially significant environmental impacts. This group can be further divided into two subgroups:
- CEQA Review Only. Sites that only require CEQA review and do not require other resource agency permits or formal review, and
- CEQA Review and Resource Agency Permitting. Sites that will require CEQA review and also require permits or other review prior to initiating ground-disturbing work.

Consultant will implement the following steps to facilitate the environmental review and clearance process:

- Perform a field review of the proposed geotechnical investigation sites to determine whether the work would potentially affect historic or prehistoric cultural resources, special status species, sensitive natural communities, wetlands, non-wetland aquatic habitats regulated under the Clean Water Act, or bed and bank areas regulated under the California Fish and Game Code. Sites that require CEQA review and additional permitting will be identified during the field review and avoided if possible by relocating the boring and/or access route.
- Transmit data to support the CEQA-review process. Provide the results of the field review to the SFPUC to support CEQA review, where required.
- Coordinate with SFPUC and agency staff to facilitate the application reviews and implement mitigation/avoidance measures required by the CEQA document and final permits from the resource agencies (if any).

If permit applications to regulatory agencies are required, Consultant will prepare the permit applications with input from SFPUC. SFPUC will review and approve each application prior to the Consultant submitting it to the proper agency, unless otherwise directed. The following permitting activities are anticipated for the geotechnical investigation effort:

- **Section 404 Permit - US Army Corps of Engineers.** Borings and fault trenches may occur within habitats regulated under the Clean Water Act (Section 404) within the jurisdiction of the Corps. The work is expected to qualify under the Corps Nationwide Permit #6 for surveying activities. This nationwide permit also covers clearance under Section 10 of the Rivers and Harbors Act. All General Conditions of this nationwide permit must be met, including complying with endangered species regulations. Although this is considered a "non-reporting" permit, Consultant will prepare a single pre-construction notification to the Corps for all boring locations.
- **Section 106 – State Historic Preservation Office.** Consultant will assess potential Section 106 compliance requirements. A record search of the project area including a 1/2 –mile radius will be conducted at the Northwest Information Center of the California Historical Resources Information System at CSU Sonoma. The California Native American Heritage Commission (NAHC) will be contacted for a review of its Sacred Lands File as well as to obtain a list of Native American individuals or groups who might have knowledge or specific concerns related to the project area. Consultant will prepare a letter for these NAHC contacts.

Consultant archaeologists will develop an Area of Potential Effects (APE) map for the project and conduct a pedestrian survey of the accessible terrestrial portions of the project APE. Following completion of the survey Consultant will prepare a technical memorandum of findings for submittal to the Corps for their use for consultation with the SHPO.

- The work will also include development of a Cultural Resources Letter Report to meet California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA)/National Historic Preservation Act (NHPA) requirements for reporting. The confidential letter report will include a summary of the archival and background literature review conducted to provide input to the Field Investigation Work Plan. The report will also summarize the results of any field surveys conducted in advance of the field investigations, including recommendations for avoidance or other mitigation measures necessary to complete the field investigation program. Any cultural resources observed during the surveys will be recorded (or updated as appropriate) on California Department of Park and Recreation (DPR) 523 forms (at a minimum DPR 523 Primary Forms will be prepared) which will be included with the report. The report will also summarize the results of any agency coordination conducted as part of this effort.
- **Water Quality Certification/Section 401 – Regional Water Quality Control Board.** Compliance with Section 401 of the Clean Water Act will be a condition of the Nationwide Permit #6 described above. The State Water Resources Control Board has "pre-certified" a number of the nationwide Permits, including #6. Compliance with Section 401 requires that notification be sent to the RWQCB at least 30 days prior to the start of work. Consultant will prepare the needed notification and will work with RWQCB staff as needed to expedite the certification process.
- **California Department of Fish and Game.** Any work within the bed and bank of significant drainages as well as riparian areas would likely require permits from the CDFG under Section 1600 of the Fish and Game Code. However, based on preliminary reconnaissance, all such areas along the tunnel alignment can be avoided. We have therefore assumed that a CDFG streambed alteration agreement will not be needed for the tunnel exploration program.

Dependencies On / Among Other Tasks

The results of the Task 3, including right-of-way maps and the aerial photo review as well as the Task 6.1 Work Plan will be used in the environmental clearance and permitting effort.

Responsible Party

The CONSULTANT environmental permitting specialist will lead the environmental clearance and permitting efforts, with assistance from key discipline leaders and SFPUC staff, as required.

Output / Deliverables

- Draft Field Review Technical Memorandum to summarize field observations and proposed measures to avoid or minimize potentially significant impacts identified during the field review.
- Final Field Review Technical Memorandum to incorporate changes to the draft report based on one round of review by the client.
- Draft and final technical memoranda summarizing findings of the cultural resources survey.
- United States Army Corps of Engineers (USACE) Nationwide Program Number 6 permit for Drilling Activities.

- Regional Water Quality Control Board (RWQCB) 401 Certification.
- USACE Nationwide Permit Notification which includes information required for the applicable Nationwide Permit.
- RWQCB Section 401 Water Quality Certification/Waiver application.
- USFWS consultation documentation complete including conversation records that document informal consultation with USFWS staff.
- Cultural Resources Letter Report meeting the requirements of CEQA, NEPA and NHPA for reporting.

Task 6.4 Fault Trenching and Seismic Refraction Surveys

Purpose and Objectives

The purpose of this task will be to evaluate and define fault characteristics along the Tunnel alignment. Information on the location, width, and amount of expected deformation along the Sinbad fault is critical for developing detailed engineering designs for the Alameda West Portal and adjacent parts of the Irvington Tunnel. In addition, the locations and characteristics of secondary faults along the alignment may have important implications for design of the tunnel to remain in service following the design earthquake.

Assumptions

- SFPUC will negotiate and facilitate obtaining right-of-access to the right-of-way and private property parcels along the tunnel alignment.
- Seismic refraction surveys will be limited to a single line at the Alameda West Portal area.
- Fault trenching will be limited to a length of 200 feet and 10 to 12 feet in depth at the Sinbad Fault.

Task-Specific Approach and Associated Work Elements

Information on the location, width, and amount of expected deformation along the Sinbad fault is critical for developing detailed engineering designs for the Alameda West Portal and adjacent parts of the proposed Irvington Tunnel No. 2. Also, evaluating the locations and characteristics of secondary faults to be crossed by the Tunnel is important for anticipating conditions that will be encountered during construction (i.e., areas of intensely fractured or squeezing ground coincident with clay-rich fault zones). Specific activities for each are presented below.

- **Sinbad Fault.** Task 6.4 will focus on assessing the location of the Sinbad fault at the proposed New Tunnel alignment through analysis of existing and proposed geotechnical borehole data, field reconnaissance mapping, geophysical surveying, and limited exploratory trenching. Initial non-invasive efforts using a seismic refraction survey line will assess the presence or absence of lithologic or elevation changes in bedrock that might provide information on fault location. Following analysis of the seismic refraction survey, approximately 200 lineal feet of trenching will constrain the fault location and help estimate the characteristics of the fault. The proposed trench will be located south of the existing siphons to cross the fault trace, yet avoid utilities and possible important habitat. Depending on the depth of artificial fill located directly south of the existing siphons and within the SFPUC right-of-way, the trench will need to be about 10 to 12 ft deep. The exposed trench walls will be shored for safety and then logged and documented. If the field reconnaissance

and seismic refraction survey indicates the presence of thick artificial fill present directly south of the Alameda West Portal, an alternative trench location exists south of Pirate Creek. The investigation will include trench review with SFPUC personnel to discuss preliminary findings.

- **Secondary Faults Within East Bay Hills.** Previous mapping demonstrates the presence of at least three secondary faults crossing the proposed tunnel alignment, including the Sheridan Creek fault, an unnamed fault, and the Mill Creek fault. The characteristics of these faults will be further documented by additional mapping along the tunnel alignment corridor, by review of exploratory borings drilled in the faulted zones, and by review of the records from the original tunnel construction.

Dependencies On / Among Other Tasks

The results of the Task 3 Data Review, including aerial photographs, geologic maps, right-of-way maps, and the existing Irvington and Mission Tunnel records and other previously completed borings will be used in the planning and execution of the fault investigation program. The Work Plan, Health and Safety Plan and SWPPP as described in Task 6.1 will also be used in the planning and performance of Task 6.4.

Responsible Party

The fault trenching effort will be the primary responsibility of Consultant geologists with assistance from other key staff for the seismic refraction survey, permitting and environmental clearance.

Output / Deliverables

Deliverables from the Task 6.4 will include a Technical Memorandum that documents the factual data from the surface rupture hazard characterization, including geologic maps and the trench logs. Surface and subsurface geologic conditions along the tunnel alignment will be presented in the Task 7 Geotechnical Data Report and Geotechnical Interpretive Report.

Task 6.5 Subsurface Investigations

Purpose and Objectives

The purpose of the subsurface investigation program is to characterize the range of soil, rock and groundwater conditions that can be expected along the tunnel corridor. The key objective is to aid in the design of the project and to limit geotechnical risks associated with tunnel construction. The objective of the test pits and core drilling program is to obtain representative samples of the major rock types that will be encountered in the tunnel excavation, along with discontinuity orientation data and fault characteristics at tunnel depth and information regarding groundwater conditions. The data from this task will be used to define the stratigraphy and structure of rock expected at the portals and along the tunnel alignment. An additional objective of this work is to collect representative rock core samples for engineering testing and evaluation, so that key aspects of the rock mass and its behavior can be characterized.

Assumptions

- SFPUC will negotiate and facilitate obtaining right-of-access to the right-of-way and private property parcels.
- Borings and test pits can be located to minimize requirements for environmental mitigation.
- Two test pits each will be excavated to depths of 8 to 15 feet at the AWP and Irvington Portals.

- A total of 17 core borings will be drilled along the tunnel alignment and at the portals.
- Alameda County drilling and well permits will be obtained as required.

Task-Specific Approach and Associated Work Elements

The proposed subsurface exploration program will be detailed in the Geotechnical Investigation Work Plan prepared in Task 6.1. The plan will include boring and test pit designations, approximate tunnel station location, depth, inclination of the boring from horizontal, anticipated formation that will be encountered, access conditions, the goal of each boring or test pit and in-situ testing and type of piezometer that will be completed.

The proposed subsurface investigations will be performed in general accordance with industry standards and with due consideration of public safety. The investigations will not start before applicable environmental regulations have been satisfied and required permits and rights-of-entry have been obtained. If required, traffic control will be provided using the latest Caltrans standards and in accordance with Alameda County regulations. The guidelines in the Watershed Land Protection Procedures in the Peninsula and Alameda Watershed Field Manual, published by the SFPUC Land and Resource Management Section will also be followed. The following paragraphs detail the proposed work elements that comprise the geotechnical subsurface investigation program.

Test Pits. Test pits will be completed to investigate the near-surface soil conditions at the AWP and Irvington Portal. At the AWP, two test pits (TP-1 and TP-2) are planned to investigate the limits and depth of the suspected landslide. These will likely need to be excavated using a track-mounted backhoe or small excavator due to the steep terrain. One to two additional test pits may also be excavated to supplement information from the core boring planned near the eastern limit of the AWP and to obtain soil samples for corrosion testing and to verify the depth to bedrock. These would only be completed if the planned fault trench to investigate the Sinbad fault is relocated to the south near Pirate Creek, otherwise the fault trench will provide the required information. Two test pits are also planned to investigate the subsurface conditions at the Irvington Portal and for a new access road to the portal. The test pits will be excavated to depths ranging from 8 to 15 feet and logged in accordance with standard Consultant procedures, which will be outlined in the Work Plan prepared in Task 6.1.

Core Drilling. A total of 17 diamond core borings are proposed. The core borings will be drilled to investigate each of the major rock types along the tunnel corridor, to cross the mapped faults near tunnel depth, and to investigate the nature of major formational contacts. Several of the borings will be inclined with the intention of intercepting bedding and faults. Borings will also be drilled to investigate soil and rock conditions for the AWP and Irvington Portal, the suspected landslide near the AWP, the new surge shaft at the AWP and the low-cover area and the Escobar shaft near the I-680 crossing.

The core borings will be drilled using HQ-3 size wire-line coring methods, which provides a 2.5-inch diameter core and a 4-inch hole. All recovered core will be logged under the supervision of an engineering geologist or geotechnical engineer in accordance with procedures in the Work Plan, photographed, and placed in wooden core boxes. Core subject to deterioration due to air slaking will be immediately placed in plastic tubing and sealed to preserve the natural moisture content. Borings that encounter thick alluvium, such as those near the Escobar Shaft or at the suspected AWP landslide, will be sampled using an SPT or modified California split spoon sampler until bedrock is encountered. In order to prevent drilling muds from plugging the natural fractures in the rock mass, which could result in erroneous packer test results, only chlorine

degradable polymer drilling mud will be used. At the completion of drilling, the locations of all borings, test pits, and the fault trench will be staked and surveyed.

The final core boring locations will be selected based on access and right-of-entry considerations, environmental considerations and geologic considerations. The boring locations will be reviewed with the SFPUC before the start of the permitting and environmental clearance under Task 6.3. Where possible, the borings will be located along or adjacent to existing paved or dirt roads, some of which may need improvement. For those borings not near a road or situated in steep topography (assumed to include up to four borings), a helicopter will be used to lift the drill rig and equipment to the site if necessary. In general, the core boring locations with deep piezometers will be offset from the proposed tunnel alignment by about 40 feet to avoid destroying the installed piezometers during future tunnel excavation. All core borings will extend to a depth of at least 20 below the lowest tunnel invert given potential vertical alignment alternatives under consideration. To avoid the possibility of intercepting the existing nearby tunnel during drilling due to drift on the deeper core borings, downhole alignment surveys will be completed in selected borings during drilling.

During drilling, gas monitoring equipment will be onsite at all times to check for the presence of methane and/or hydrogen sulfide gas at the borehole collar. If possible, gas bubbles detected in the drill fluids will be collected and tested. Additional screening-level tests for hazardous substances will be performed on water samples from the standpipe piezometers. Suspected soil or groundwater contamination found during the drilling will also be screened and tested. Drill cuttings and fluids will be contained at each drill site and pumped into 55-gallon drums for subsequent removal and disposal at a site designated in the Work Plan. We assume this will be at a disposal pit excavated in the staging area near the AWP or some other nearby location specified by the SFPUC. If any suspected hazardous soil or groundwater is encountered, it will be placed in 55-gallon drums, tested, and disposed of at a licensed facility.

Packer Testing. Hydraulic conductivity (packer) testing will be completed in all of the core borings with the exception of the shallow core borings at the portals and in the AWP suspected landslide. The packer testing will provide data to help characterize the overall rock mass permeability and potential impacts to surface groundwater resources.

Because of the generally soft rock conditions found along the tunnel alignment and the potential for these rocks to easily erode during the drilling process, the packer testing will be "down-staged," meaning packer testing will be performed in intervals as the boring is drilled. Packer testing will start below the weathered rock interface and will be completed in 30 to 50 foot intervals until the boring is within 60 to 80 feet of the proposed tunnel crown. Packer testing will then be completed at 20-foot intervals as the boring is advanced until the target depth of 20 feet below the proposed tunnel invert is reached. A pressure transducer mounted in the test zone will be used to accurately measure test water pressures.

Televiewer Logging. Downhole oriented acoustic televiewer logging will be carried out in a majority of the borings (as summarized in the table) to obtain rock discontinuity data as well as providing a survey of the hole deviation. If the groundwater or fluid level in the borehole is more than 100 to 200 feet below ground surface during the televiewer logging, then an optical televiewer system may be used in that upper portion of the hole. The depth and borehole deviation data will be used to recover true strike and dip of discontinuities such as bedding and joints, along with discontinuity aperture widths, a plot of the borehole wall, and a stereonet of all features analyzed. Prior to performing the televiewer logging, a caliper log of the borehole will be made to detect any zones of washout or constrictions in the borehole. Any constriction zones

encountered will be closely compared with the geologic logs and drilling conditions (i.e., binding drill rods) to characterize possible squeezing ground conditions, especially within fault or shear zones. The televiewer logging will be completed after the boring is drilled and packer tested, but before the installation of piezometers.

Piezometer Installation and Monitoring. Piezometers will be installed in all of the borings except for the shallow borings at the portals. Both standpipe and vibrating wire piezometers (VWP) will be used, as shown in the summary table. The standpipe piezometers will consist of 1.5 inch PVC flush-mount threaded pipe with 0.020-inch slotted screens installed in a sand pack. The upper 20 feet (minimum) of each piezometer borehole will be grouted with cement to provide a reliable seal. Locking steel monuments will be installed at each piezometer installation. The standpipe piezometers will be installed in selected borings that are vertical or inclined at an angle of 70 degrees or steeper. The standpipes will extend to depths of up to 200 feet to allow for long term monitoring of the groundwater levels before and during tunnel construction and to allow groundwater samples to be obtained with a bailer for chemical and corrosivity testing.

In addition to the standpipe piezometers, VWP's will be installed in a majority of the borings as indicated in the summary table. The VWP's will typically be installed near tunnel depth and will be grouted in-place. All piezometer installations will be made under permit with Alameda County.

Long term monitoring of the open standpipe piezometers will be performed on a monthly basis for at least one year following installation. Automated data recorders will be installed at all VWP's and the data will be downloaded, reduced, and plotted twice a year during the course of the contract.

Erosion Control and Site Restoration. At the completion of drilling, packer testing, and piezometer installation in the borings, and after completion of the test pits and fault trenching, the exploration sites will be regraded and restored. Erosion control measures outlined in the SWPPP will be implemented during drilling, such as silt fences, straw wattles, and jute netting. After backfill of the test pits and trenches and removal of the drilling equipment from the drill sites, all refuse will be removed, any damage from drill water runoff will be repaired and erosion control measures will be installed. If new roads are required to access the drill sites, they will also be regraded and protected from erosion as required.

Laboratory Testing. The laboratory testing program will include tests on rock core and soil samples retrieved from the borings and test pits, as well as tests on groundwater samples obtained from the piezometers. The geotechnical team will coordinate closely with the tunnel design team in the selection of samples for testing. The rock testing will focus on strength, abrasivity, and mineralogy of the various rock types. In addition, representative core samples from each of the formations that occur along the tunnel alignment will be sampled for TBM performance testing by the Earth Mechanics Institute at the Colorado School of Mines. These specialized tests provide estimates of TBM penetration rates and cutter wear.

Point load index testing will be completed on the harder rock samples to provide a preliminary field characterization of the rock strength. Slake-durability tests will be performed on siltstone and shale samples for the various formations. Corrosion testing will be performed on soil, soft rock, and groundwater samples. Details of the proposed testing will be included in the Geotechnical Investigation Work Plan prepared in Task 6.1. The final numbers of tests will be determined once the samples are obtained during the investigations.

Dependencies On / Among Other Tasks

The Task 6.5 Subsurface Investigation Program is dependent on several of the other tasks, including Task 2 - QA/QC for the review of core samples and for laboratory testing, Task 3 - Data Review, including aerial photographs, geologic maps, right-of-way maps, and other previously completed borings, and Task 5 - Surveying. The Work Plan, Health and Safety Plan and SWPPP as described in Task 6.1 will also be used in the planning and performance of Task 6.5 as well as the results of the geologic mapping performed in Task 6.2, the permitting and environmental clearance in Task 6.3, and the fault investigations in Task 6.4.

Responsible Party

The subsurface investigation effort will be the primary responsibility of the Consultant Lead Geotechnical Engineer with assistance from the Lead Engineering Geologist and other team members.

Output / Deliverables

Deliverables from the Task 6.5 will include drilling and well permits, test pit logs, boring logs, groundwater level monitoring results, down hole geophysical results and interpretations, packer test results and laboratory test results. This information will be presented in the Geotechnical Data Report prepared in Task 7.

Task 6.6 Seismic Criteria

Purpose and Objectives

The purpose and objective of this task is to develop site-specific design response spectra for the Maximum Probable Earthquake (MPE) and Maximum Credible Earthquake (MCE) for the project facilities.

Assumptions

- If available, SFPUC will provide WSIP seismic design criteria and guidelines for use on this project. Otherwise, Consultant will recommend appropriate criteria for use.
- The new attenuation relationships from the ongoing PEER Center's NGA Project will be utilized if available in time for use in developing the design spectra. If not, currently available attenuation relationships will be used.

Task-Specific Approach and Associated Work Elements

- Evaluate orientation, geometry, rupture dimensions, rupture process, and recurrence of significant seismic sources in the project area (i.e. Hayward, Calaveras, and San Andreas Faults).
- Calculate MPE and MCE magnitudes for significant seismic sources based on state-of-the-art empirical relationships between rupture dimensions and magnitude and recurrence of events on the faults. Where applicable, verify and use the MCE values developed for the nearby faults as part of the ongoing studies for Calaveras Dam
- Calculate controlling MPE and MCE design ground motion parameters including design response spectra, using empirical attenuation relationships and numerical models. Include near field effects on the response spectra as appropriate.

Dependencies On / Among Other Tasks

The seismic analyses described herein will require that the geologic and subsurface information collected under Task 6.5 be substantially complete.

Responsible Party

Consultant's Earthquake Engineering specialist will be responsible for leading this task, with assistance from key technical staff.

Output / Deliverables

Draft and Final Technical Memoranda will be prepared summarizing the results of the analyses. This information will also be presented in the Task 7 Geotechnical Interpretive Report (GIR).

Task 6.7 Groundwater Modeling

Purpose and Objectives

The purpose of this task will be to establish baseline conditions, impacts from tunnel construction, and expected groundwater inflows during tunnel construction. The analysis will help predict the effects of planned construction on groundwater resources in the project area, including springs, riparian habitat, and privately developed wells. The analyses will be used to help determine final lining requirements for the tunnel. The analyses will be include short-term construction conditions and long-term conditions following construction.

Assumptions

- Boundary conditions for the analyses can be adequately represented by the data collected in previous tasks.
- Modeling will require a 3D analysis utilizing either discrete element or finite element computer models; these models are commercially available and readily used and accessible.

Task-Specific Approach and Associated Work Elements

Regional ground water flow and associated impacts to springs and private wells from construction of the New Irvington Tunnel is a complex problem. Flows will be substantially influenced by construction methods, including details of the tunnel boring machine and installation of tunnel linings. In addition, and as importantly, flows will be influenced by geologic conditions; groundwater levels and their variations with time; sources of recharge to the project area; permeability of subsurface materials; rock structure, including interconnected joints, shear zones, and/or faults; and external boundary conditions.

Historical impacts from construction of the Irvington Tunnel No. 1 has on ground water resources in the area will be used in calibrating the analysis model.

The numerical modeling under this task will be carried out using a commercially available three-dimensional anisotropic groundwater model acceptable to the SFPUC. Initial efforts at calibration and parametric studies will be based on 2D analyses. Once model calibration and sensitivity have been evaluated, a 3D model will be developed, so that effects on ground water resources can be assessed both for short term conditions and over the long term following construction.

Dependencies On / Among Other Tasks

Development of a suitable 3D model to evaluate groundwater flows during construction will require input from the tunnel design team and important decisions on construction methods and linings developed under Task 8.1. In addition, before the model can be developed, the geologic and subsurface information collected under Task 6.5 must be substantially complete.

Responsible Party

The Lead Geotechnical Engineer will be responsible for this task, with support from experienced groundwater hydrogeology and modeling staff.

Output / Deliverables

Draft and Final Technical Memoranda will be prepared summarizing the results of the analyses. This information will also be presented in the Task 7, Geotechnical Interpretive Report (GIR).

Task 7: Prepare Geotechnical Reports

Purpose and Objectives

The purpose and objectives of this task are to prepare geotechnical reports summarizing the geotechnical conditions along the alignment of the tunnel and in the portal areas and to provide recommendations and baselines for design and construction.

Based on the results of Task 6, the Consultant shall prepare reports summarizing the information obtained, interpreting geologic and geotechnical conditions, and providing recommendations for design.

The Geotechnical Reports shall encompass three separate reports:

- Draft and Final Geotechnical Data Report (GDR). The report will provide factual data and information obtained from the geotechnical investigation efforts. The report will include, geologic maps, information from borings, test pits and groundwater well completion logs, results of geophysical surveys, results from borability study, and results from in-situ and laboratory test results.
- Draft and Final Geotechnical Interpretive Report (GIR). This report will provide interpretation of factual data derived from field investigations. The purpose of the report is to document interpretations used in design and in preparation of the GBR. This report is not intended for inclusion in the construction contract documents.
- Draft and Final Geotechnical Baseline Report (GBR). This report will provide baselines for geotechnical conditions to be anticipated to be encountered during underground and sub-surface construction. The GBR will be included in the construction contract documents. The report will be prepared in general accordance with the guidelines presented in the latest version of the ASCE publication "Geotechnical Baseline Reports for Underground Construction."

Task-Specific Approach and Associated Work Elements

Task 7 shall be carried out under the following subtasks:

- Task 7.1 Draft and Final Geotechnical Data Report (GDR)
- Task 7.2 Draft and Final Geotechnical Interpretive Report (GIR)
- Task 7.3 Draft and Final Geotechnical Baseline Report (GBR)

Details of the work to be completed and deliverables to be submitted as part of the effort associated with each of these subtasks are presented below.

Task 7.1 Draft and Final Geotechnical Data Report (GDR)

Purpose and Objectives

The purpose of this task will be to summarize and document all factual site and subsurface data collected under Task 6. The GDR will organize the factual data in a manner that is logical, clear, concise, and which can be used by prospective contractors to develop their bids and plan their work on the project.

Assumptions

- GDR will be incorporated into the Contract Documents for the project.
- GDR will be limited to factual information.

Task-Specific Approach and Associated Work Elements

A GDR will be prepared to present the factual geologic and geotechnical data and information resulting principally from the activities of Task 6. The report will include an overview of the geologic setting, plus a summary of the site exploration program and the results of surface geologic mapping. The GDR will discuss geotechnical test procedures and standards, borehole logging standards, and the approach to selecting the number, location, and depth of borings. Data will include borehole logs, core photos, fault trench logs, and field and laboratory test results including the borehole packer tests. Other geotechnical data, obtained from the fault trench, test pits, piezometer monitoring, and results of geophysical surveys will also be presented.
In addition to the collection and generation of site-specific investigation data, existing data obtained during the background review of Task 3 will be summarized and included where appropriate to verify and augment the new data. In particular, existing data will be utilized from the various Preliminary Engineering and Conceptual Engineering Reports prepared by Woodward-Clyde, the Water System Improvement Program, and the Water Infrastructure Partnership. The more recent CER for the southern tunnel alignment may also provide an additional geotechnical database.

Dependencies On / Among Other Tasks

The GDR will present all results from the geotechnical investigation and site characterization activities that were performed in Task 6. Existing data obtained from the Task 3 review will also be included. The data in the GDR will form the basis for geotechnical related design criteria outlined in Task 4.

Responsible Party

The GDR will be the responsibility of the Lead Engineering Geologist and Lead Geotechnical Engineer, with inputs provided by other members of the project team.

Output / Deliverables

A draft GDR will be prepared following the initial site exploration phase and provided with the 35% submittal. The GDR will be completed following the final site and laboratory investigations and a final GDR will be provided with the 65% submittal. Fifteen (15) hard copies and one (1) digital copy of the Draft GDR, and thirty (30) hard copies and one (1) copy in digital format of the Final GDR will be submitted.

Task 7.2 Draft and Final Geotechnical Interpretive Report (GIR)

Purpose and Objectives

The purpose of the geotechnical interpretive report will be to develop interpretations of ground conditions for internal use by the project team in designing the tunnel, portals, and shafts. In addition, the report will document ground characterizations, engineering properties and behavior of the rock mass, slope stability analyses, the Sinbad fault characterization, and the ground water inflow analyses.

Assumptions

- GIR will be an internal design team document that is not part of the contract documents.

Task-Specific Approach and Associated Work Elements

The GIR will be prepared to provide interpretations of the factual data derived from field investigations.

Using the GDR information, such as borehole logs, laboratory tests on material properties, soil and rock classification methods, and the geologic surface mapping, a geologic profile (vertical alignment section) will be developed showing formation contacts. Using this information, the tunnel will be divided into reaches with each reach having similar geologic characteristics. This task will aid in estimating the extent of each type of ground conditions, including possible squeezing, swelling and raveling conditions.

Groundwater inflows to the tunnel will be estimated using a combination of existing construction data, engineering judgment, standard empirical methods, and applicable numerical models. The actual inflows will also depend on the contractor's means of water control, whether a tunnel shield is being used, whether gasketed segments are being used to line the tunnel, and if pre-excavation grouting is being undertaken. Groundwater inflow estimates, including modeling, will be performed under Task 6.7 in order to assess the maximum inflows expected from the entire tunnel for the duration of tunneling as well as the potential maximum that could be encountered at the tunnel heading.

The GIR will also include a section entitled "Hazardous Materials Assessment". This section will provide estimated locations, any soils and groundwater encountered containing hazardous constituents. Possible constituents of concern would include hydrocarbons and asbestos. The GIR will also provide information for developing methods and locating sites for handling, treatment, storage, and disposal of excavated materials. The report will be used for planning and design of materials management on the project, including preparation of contract specifications regarding testing of excavated materials during construction and handling and disposal of clean and contaminated soils and groundwater.

The potential for explosive gas such as methane and toxic gas such as hydrogen sulphide will also be evaluated in the GIR. In addition to the existing Irvington Tunnel records and other existing construction records, information on the local site geology and regional geology will aid in determining the gas potential. This evaluation will form the basis for the GBR baseline on gas.

In summary, the GIR will include:

- A geologic map and profile along the tunnel based on the geologic evaluation (Task 6) and taking into account criteria for vertical and horizontal alignment (from Task 4) and in addition to results of survey and utility information (Task 5).
- Interpretation of the location and activity of the Sinbad fault and if active, the expected fault displacement during a large earthquake.
- Descriptions of the materials, characteristics, and initial support requirements for the ground expected to be encountered during construction of the tunnel, portals, shafts, and vaults.
- A TBM boreability report to be appended to the GIR.
- Groundwater evaluation and modeling for shafts and tunnels with the documentation of results of the modeling and the anticipated groundwater occurrence.
- Assessment of possible soil, rock, and groundwater contaminants and methods for the treatment and disposal of any contaminated/hazardous materials.

- Discussion of parameters for analysis and mitigation measures for slope stability and liquefaction, as appropriate.
- Further design parameter inputs to the development of seismic design criteria (Task 4).

Dependencies On / Among Other Tasks

The major input to the GIR will come from the GDR (Task 6). The GIR will provide direct input to the GBR (Task 7) and to the further development of the project design criteria (Task 4).

Responsible Party

The GIR will be the responsibility of the Lead Geotechnical Engineer and Lead Tunnel Engineer, with inputs provided by other key members of the design team.

Output / Deliverables

A draft GIR will be prepared following the initial site investigation phase and will be provided with the 35% submittal. The GIR will be completed following the end of the site investigations and a final GIR will be provided with the 65% submittal. Fifteen (15) hard copies and one (1) digital copy of the Draft GIR, and fifteen (15) hard copies and one (1) copy in digital format of the Final GIR will be submitted.

Task 7.3 Draft and Final Geotechnical Baseline Report (GBR)

Purpose and Objectives

The purpose of the geotechnical baseline report (GBR) is to provide a contractual statement of the anticipated geotechnical conditions that prospective contractors can rely on in preparing their bids and planning the work. The GBR will include development of representative baseline quantities and statements to assure that all bidders have a common basis for their bids and a basis for quantifying any future changes during construction. Also, the baselines will be used in the evaluation of differing site conditions claims that may arise during construction.

Assumptions

- GBR will be incorporated into the Construction Contract Documents for the project.
- SFPUC will provide key input on risk tolerance for establishing the appropriate baseline.

Task-Specific Approach and Associated Work Elements

The GBR will be based on an assessment of the variability in the expected geologic conditions, the selected construction means and methods, and the project team's approach to risk allocation. The report will rely on input and data produced by the Geotechnical Investigation and Site Characterization Task 6, as presented in the GDR. The GBR will also build on the results of the geologic data analyses presented in the GIR. Permeability test data from the GDR will be used to model and predict groundwater inflows as reported in the GIR, and the final determination of maximum inflows that will impact construction means and methods will be stated in the GBR. Boreability data for mechanical machine selection will be compiled from the GDR and from the results of a boreability report done for the GIR. The existing construction records from the original Irvington Tunnel will also constitute an important input to the GBR.

The GBR will provide baselines for geotechnical conditions anticipated to be encountered during underground and sub-surface construction. Baselines that will be defined for the New Irvington Tunnel project include:

- Designation of tunnel reaches giving the anticipated composition, extent, and location of expected geologic materials

- Expected locations and characteristics of geologic discontinuities such as joints and faults
- Presence of toxic and hazardous gas
- Anticipated type and extent of difficult ground behavior during construction including: raveling, running, flowing, and squeezing conditions
- Strength of intact and rockmass material
- Boreability parameters (based on GIR report)
- Corrosion potential of soil and water
- The anticipated amount and duration of groundwater inflows to be encountered during construction
- Tunnel excavation and support requirements
- Support requirements for the stabilization of the tunnel portal excavations

Dependencies On / Among Other Tasks

The primary input for the GBR will come from the GIR, which contains the results of analyses. The Task 3 review of as-builts for existing construction project and information on design and construction methods will provide important input.

Responsible Party

The GBR will be the responsibility of the Lead Tunnel Engineer and Lead Geotechnical Engineer with inputs provided by other members of the team.

Output / Deliverables

The Draft GBR shall be provided as part of the 65 percent plans and specifications submittal. The submittal shall consist of fifteen (15) hard copies and one (1) digital copy. The final GBR submittal shall consist of thirty (30) hard copies and one (1) digital copy.

Task 8: Design and Prepare the New Irvington Tunnel Construction Contract Documents

Purpose and Objectives

The purposes of this task are to carry out appropriate engineering analyses, develop detailed design drawings, technical specifications, and supporting documentation, and assemble contract bid documents for construction of the New Irvington Tunnel, portals and appurtenant facilities.

Task-Specific Approach and Associated Work Elements

The Consultant will provide engineering analysis and design services to prepare a complete and detailed design package for the new tunnel, portals, and associated facilities. During the design development phase, the Consultant will complete engineering evaluations/studies, which will be used as a basis for preparing the contract documents. The specific work to be completed under Task 8 shall include:

- Development of design calculations and design reports;
- Development of design drawings;
- Development of technical specifications;

- Assistance to SFPUC staff for the preparation of Division 0 and 1 of the project specifications, including, but not limited to, providing project specific requirements and constraints, and limitations on noise, vibration, and work hours,
- Development of construction cost estimate and CPM schedule;
- QA/QC, and constructability reviews; and
- Value engineering and peer review of design (by others). The Consultant will make an overview presentation of the project to the Value Engineering Workshop.

The work completed under Task 8 will be carried out in a series of five (5) subtasks as follows:

- Task 8.1 Design Development
- Task 8.2 Preliminary Design (35%)
- Task 8.3 65% Design
- Task 8.4 95% Design
- Task 8.5 100% (Bid Ready) Design

Task 8.1 Design Development

Purpose and Objectives

The purpose of this task is to carry out comprehensive engineering studies and analyses for use as a basis for development of the final design of the project.

Task Specific Approach and Associated Work Elements

The Task 8.1 Design Development evaluation/study effort will be divided into a series of studies as indicated below. The evaluations/studies will focus on specific aspects of the project and will be summarized in a series of technical memoranda (TM). The timing and completion of the TMs will be a function of available information and coordination with the other project tasks. The TMs will serve to document the analysis/study effort and will be carried forward to develop the final design. The TMs are as follows:

- TM8-01 Tunnel analysis and design
- TM8-02 Tunnel borability study to determine method of construction
- TM8-03 Acceptance Criteria for Water Inflow and Excavation Tolerances
- TM8-04 Design modifications to existing Irvington tunnel portals
- TM8-05 Design of Escobar Shaft
- TM8-06 New tunnel portals analysis and design at AWP and Irvington Portal
- TM8-07 Grouting program and/or other groundwater infiltration control measures
- TM8-08 Construction power requirements
- TM8-09 Ventilation requirements
- TM8-10 Noise and vibration control
- TM8-11 Muck disposal and construction access

- TM8-12 Construction staging layout
- TM8-13 Design of preliminary and final tunnel liner
- TM8-14 Design of overflow shaft
- TM8-15 Design of tunnel connections (temporary and permanent) to Alameda Siphons and to BDPLs including manifold, piping, valve vaults, valves, actuators and associated electrical work
- TM8-16 Design of settling basins, water treatment system, and appurtenant facilities to treat and discharge tunnel construction water

TM8-01 Tunnel Analysis and Design

Purpose and Objectives

The purpose of this TM is to finalize the layout and configuration of the new tunnel facilities and define serviceability, tunnel support, and lining requirements.

Assumptions

- Geotechnical investigations and ground characterization are proceeding concurrently
- The CER concept generally reflects the SFPUC's objectives

Task-Specific Approach and Associated Work Elements

Careful attention will be given to several inter-related design considerations in finalizing the layout and configuration of the new tunnel and in assessing its excavation and support requirements. These considerations include serviceability requirements, constructability, construction methods and equipment, geologic and geotechnical characteristics, topography, site access, environmental considerations, regulatory restrictions, and schedule requirements. The Consultant will address the following elements of the tunnel design:

- Tunnel alignment geometry
- Hydraulics and serviceability requirements
- Rock mass characteristics
- Rock material characteristics
- Groundwater regime/characteristics/control requirements
- Feasible excavation methods/equipment
- Tunnel length and access
- Primary ground support requirements
- Final lining requirements

Evaluations and analyses will be made of each of these design aspects. Geologic/geotechnical parameters from the site characterization efforts will provide important information needed to define support and lining requirements, construction methods and anticipated rates of construction. The Consultant will also include the information collected from the construction records of the existing tunnel and previously completed boring data..

Close attention will be given to providing reliability of the new facilities following the design earthquake. In particular, attention will be given to the splays of either the Hayward or Calaveras faults that have been identified along the tunnel alignment, and in developing lining systems that will accommodate movements across these splays. In this regard, the final lining in the tunnel will be designed to minimize damage to the facilities/components as a result of a "design magnitude" seismic event, and to minimize time required to restore service in the tunnel following such an event. In areas along the alignment outside the influence of the fault crossings, the tunnel opening and tunnel lining will move with the ground during an earthquake and will be relatively safe from the types of damage commonly experienced by above ground structures during major earthquake events. The main mechanisms impacting the tunnel during an earthquake will be addressed.

Tunnel Alignment Geometry

The CER report presents a design concept placing the new tunnel within the right-of-way obtained for construction of the existing tunnel in the late 1920's. The exact location of the horizontal alignment of the new tunnel (within the existing right-of-way) will be verified. The Consultant will consider potential improvements in the layout and configuration of the new tunnel as it relates to Siphon No. 4 and Pipeline #5. The Consultant will identify and discuss changes in the layout and configuration of the manifolds connecting the siphons and pipelines in the respective portal areas, and pending any needs for changes of the vertical alignment to reduce construction costs and schedule. The Consultant will also look at ways to obtain adequate clearance between the new tunnel excavation and the existing tunnel to minimize the potential for damage to the existing tunnel during construction of the new tunnel. Similarly, adequate clearance must be provided between the new tunnel and the boundary of the existing right-of-way, to the extent practicable.

For the New Irvington Tunnel, a tentative vertical alignment was presented in the CER. This alignment, and any needed adjustments, will be evaluated based on several important considerations including:

- Hydraulics requirements for reliable operation
- Access for construction, muck disposal, and groundwater control/handling requirements
- Environmental considerations related to the proximity of local residences
- Topographic and geotechnical conditions affecting the selection of vertical alignment, where critical
- Location of tunnel portals and connections to existing and new pipelines and siphons
- Space requirements for new and existing manifolds/connections in the portal areas
- Requirements for tunnel maintenance unwatering and access by workers for future O&M work
- Requirements for control valves/vaults and future access for these
- Approaches to making connections to existing facilities to minimize disruptions.
- Separation distance from the existing tunnel to avoid unacceptable impacts
- Need for increased terrorist-threat security of new facilities

Careful consideration will be given to the ground conditions along the alignment of the new tunnel in establishing its horizontal and vertical alignment. Of particular concern is the highly fractured ground and potentially large inflows of water in the low cover area where the tunnel crosses under Interstate I-680. The rock cover is low at this location and soil and/or difficult mixed face tunneling conditions could be encountered. These conditions represent significant potential tunneling risks and risk of damage to I-680. Opportunities for lowering the vertical alignment in the vicinity of I-680 will be explored to minimize or eliminate these risks. In addition, alignment alternatives to minimize impacts construction impacts and improve long term access to at the Irvington Portal will also be explored. Depending on construction sequencing, the Consultant will look at the feasibility of independently excavating a portion of the tunnel from the west end.

Appropriate tunnel construction methods will be identified considering cost, schedule, and environmental risk-related issues. The final alignments and configurations of the portal area manifolds and connections will be examined.

The width of the existing right-of-way will have a significant influence on the final horizontal alignment. Within this right-of-way, the Consultant will look to separate the two tunnels as much as possible to avoid impacting the existing tunnel.

Hydraulics and Serviceability Requirements

In parallel with the effort to define the horizontal and vertical alignments, effort will be made to define the dimensions of the completed pipelines and siphons, and the layout and configuration of necessary connections and appurtenances. This work will be performed considering operation of either or both tunnels. The Consultant will review the previous analyses that have already been made of these operational scenarios. Additional work will be limited to review and verification of the previous results, as appropriate. Potential changes in the alignment and configuration of the Alameda Creek Siphons and connections to be made at both portals may result in needs for adjustment of some system design parameters.

TM8-02 Tunnel Borability Study to Determine Construction Method

Purpose and Objectives

The purpose of this TM is to evaluate the applicable tunnel excavation methods and determine the feasible methods. The Consultant will determine TBM requirements for cutterhead design and penetration rates in the prevailing rock conditions; to evaluate requirements/feasibility for use of a TBM in squeezing/flowing ground conditions. Other methods which will be considered include drill-and-blast and roadheader methods.

Assumptions

- Specialized Rock Mechanics Testing at Colorado School of Mine is complete
- Substantial completion of field investigations

Task-Specific Approach and Associated Work Elements

Representative samples of the rock materials encountered in the exploratory borings will be selected for laboratory testing to obtain parameters applied in borability evaluations. These tests include unconfined compressive strength, tensile strength, and a variety of abrasivity tests to evaluate wear of mechanical cutters/bits used in tunnel boring machines (TBM) and roadheader machines used for excavation of lower strength rock materials. In addition Petrography Tests (thin sections) will be performed to evaluate presence of minerals affecting abrasiveness of the

rock materials. Borability evaluations will also include consideration of the prevailing discontinuities (bedding, joints, and shearing) in the rock mass.
A comprehensive borability evaluation of the rock materials (for both TBM and roadheader methods) along the proposed tunnel will be performed using the results from the laboratory tests. These evaluations will be made by Dr. Levent Ozdimir of Colorado School of Mines and presented in a report, following completion of the site exploration work.
The existing tunnel was excavated using drill-and-blast methods. Considerations in the use of drill-and-blast methods include limitations needed to protect the existing tunnel from damage, the potential for community complaints/opposition, and safety issues will be addressed.

TM8-03 Acceptance Criteria for Water Inflow and Excavation Tolerances

Purpose and Objectives

The purpose of this TM is to establish certain tunnel construction acceptance criteria, including a threshold on leakage through final liner and the tolerance for alignment and profile deviations. The anticipated groundwater inflows during construction and alternatives for controlling groundwater inflows to the tunnel will be addressed in TM8-07. The excavation alignment and profile tolerances will be defined considering serviceable right-of-way, constructability, and support requirements.

Assumptions

- Characterization of Groundwater Regime will be developed under Tasks 6 and 7
- Hydrogeologic Modeling will be conducted under Task 6.7.

Task-Specific Approach and Associated Work Elements

Water Inflow

The reported water inflows experienced during excavation of the existing tunnel will be thoroughly studied from the construction records to fully understand the nature and details of the reported inflows for design planning and construction purposes. Estimates of anticipated water inflow during excavation of the new tunnel will be developed based on results of hydrogeologic modeling of the groundwater system using the results of borehole permeability tests, and groundwater inflow data from construction of the existing tunnel.
Important criteria that will be considered for acceptable inflow rates during excavation of the new tunnel include:

- Impacts of Tunneling on Groundwater Levels. Potential effects on the existing groundwater regime along the tunnel alignment will be evaluated using groundwater modeling based on available parameters. Acceptable effects on the groundwater regime will be limited within certain boundaries to be determined during the work. It is desirable to minimize effects on the groundwater regime, but construction costs and effects of mitigation on construction progress make it necessary to optimize these efforts. No firm criteria on acceptable limits of inflow considering draw-down of the water table can be provided prior to the exploratory work.
- Control of Groundwater Inflows During Construction. The use of a shielded TBM, along with gasketed, precast concrete, segmental lining for primary ground support will be important tools that will be considered for controlling groundwater inflows and minimizing impacts to the groundwater regime. Precast concrete segmental linings with gaskets have been used successfully on projects with groundwater heads of up to 900 feet. The weakest link under these conditions is the TBM and its ability to control of groundwater inflows

through the TBM cutterhead. This has been attempted using a variety of approaches, but most successfully using pre-excavation grouting methods (injection of grout into the rock) in advance of the TBM, however, with substantial downtime and consequent reduction in tunnel advance rates. The primary ground support method selected for the tunnel can also influence the need to control groundwater inflows during tunnel excavation.

- Permitting Requirements. The maximum allowable inflow rate into the new tunnel during excavation (one or two headings) may be limited by permitting agencies in an effort to minimize impacts to the groundwater regime and sensitive habitats. Such limits may be set based on the results of the hydrogeologic analysis, incorporating possible mitigation during excavation.

In addition to defining maximum anticipated inflow rate based on the above considerations, the Consultant will use the estimated flow rates for determining the required capacity of the water treatment facilities, and to identify potential options for the disposal of the treated groundwater. The Consultant will also look at the tunnel final lining system to control leakage. Our approach will be to evaluate acceptable leakage magnitudes considering O&M requirements, water treatment and disposal, and potential environmental impacts and use this evaluation for design of the final tunnel lining.

Excavation Tolerances

The Consultant will look at alignment tolerances. We will take into account and discuss:

- Modern surveying equipment, and in particular currently available control systems for TBM's.
- Provisions for acceptable rates of correction (inches per linear foot of tunnel) to return to theoretical alignment locations with considerations of both the primary support system and the final lining.
- The maximum allowable horizontal deviation from the theoretical alignment will be considered in selecting the theoretical horizontal alignment. The closest right-of-way boundary should not be violated by deviations of the excavation, or installation of any stabilizing measures such as rock bolts or grouting efforts beyond the right-of-way boundary.

TM8-04 Design Modifications to Existing Irvington Tunnel Portal

Purpose and Objectives

The purpose of this TM is to define requirements for modification to the existing Irvington Tunnel portals and connections to new conduits/portals.

Assumptions

- Configuration of New Irvington Tunnel and Portal have been established
- New tunnel/siphon interface has been defined

Task-Specific Approach and Associated Work Elements

Construction of new manifolds connecting the existing and proposed pipelines to the two tunnels is required. For example, to facilitate construction of the new connections, a modification of the existing Irvington Tunnel Portal will be required. As presently envisioned after the new tunnel is in service, the existing portal bulkhead will have to be moved about 65 feet to the east of its current location to accommodate the proposed new manifold connecting both tunnels with all

five BDPLs. This work will include demolition of the existing tunnel portal structures, and open cut construction to accommodate construction of a new tunnel portal structure and bulkhead for future access to the tunnel. The construction work for these modifications can only be performed once the New Irvington Tunnel is completed and in operation.

A portion of the new manifold at the New Irvington Tunnel Portal will have to be completed with the new tunnel to allow for construction of temporary connections to the BDPL's so the new tunnel can supply water to the BDPL's while the existing tunnel portal modifications are constructed. The remaining portions of the new manifold would be constructed as part of the modifications to the existing tunnel portal. Construction in the congested Irvington Tunnel Portal Area will involve requirements for installation of temporary bridging to protect the BDPL's from damage due to construction. The Consultant will consider a number of factors in determining the optimal layout of the various conduit connections in the two portal areas. These include:

- Need for close coordination between our Team and the Siphon No. 4 and BDPL No. 5 Design Teams to establish the optimal alignment of this facility, and appropriate sequencing of the work.
- Determining if there is a second, western fault trace of the Calaveras Fault (Sinbad Fault) adjacent to the AWP portal
- Evaluating the presence of any particular slope stability issues in the AWP area
- Assessing the condition and structural adequacy of individual existing components potentially integrated into the new systems
- Establishing the needs of the SFPUC operations considerations for facility operations including, maintenance and repairs approaches, redundancy requirements, operational approach for operation of both the new and existing tunnels, access to the inside of the conduits, isolation of the various conduits, and plans for major repairs/upgrade of the existing tunnel
- Assessment of risk to existing facilities given their present location with respect to the proposed construction
- Access and space available for construction of the new tunnel and the connections to all four siphons (AWP) and five BDPL pipelines (Irvington Portal)
- Environmental and regulatory constraints for construction of the facilities

TM8-05 Design of Escobar Shaft

Purpose and Objectives

The purpose of this TM is to define location and configuration of the New Escobar Shaft and define serviceability requirements for the new shaft.

Assumptions

- Completion of configuration of new Irvington Tunnel

Task-Specific Approach and Associated Work Elements

The existing Irvington Tunnel includes a small diameter, shallow shaft with a pump to supply water to several residences near the east end of the tunnel. The need for this water supply facility was established following completion of the existing tunnel, and will remain during operation of the new tunnel. The need for a new, similar facility at the new tunnel to maintain this localized

water supply service will be most urgent during any shutdown of the existing tunnel, e.g., for a major repair and upgrade following completion of the new tunnel facilities, and depending on a future decision of operating mode for the two tunnels during normal operations.
The Consultant will evaluate the new Escobar Shaft connection and establish an appropriate location along the new tunnel, preferably close to the existing shaft. The TM will address excavation methods, linings, size of the shaft, submersible pump size, power supply requirements, discharge conduit sizes, and space required for maintenance and operation of the facilities.

TM8-06 New Tunnel Portals Analysis and Design at AWP and Irvington Portals

Purpose and Objectives

The purpose of this TM is to develop configurations and details of the new portals and connections.

Assumptions

- Access routes to sites have been defined
- Geotechnical Investigations of the sites have been completed
- Connections to existing facilities have been defined.

Task-Specific Approach and Associated Work Elements

The design of each of the new tunnel portals will depend on a number of site–specific factors. The Consultant will analysis the portals and connections considering the following:

- Geologic/geotechnical conditions in each portal area, including topographic conditions, slope conditions, rock mass characteristics, and the presence of any active fault traces.
- Determination of the horizontal and vertical alignment of the tunnel.
- The specific space requirements for the permanent connections and conduits in each portal area.
- Construction staging area and construction assess requirements (for trucks and heavy equipment). Larger space requirements apply if a specific portal area is designated as a working portal for construction of the tunnel.
- Space required during construction of the tunnel for temporary ventilation, power supply, water disposal, worker access, and installation of the tunnel lining is an important factor for entry and exit portals for construction.
- Depending on a number of factors, including steepness and depth of the cut slope, type and extent of overburden soils, strength of rock materials, and characteristics and trends of rock mass discontinuities, the portal cuts require thorough analysis of slope stability and design of required support methods. Soil and rock parameters obtained from the site exploration efforts will be utilized in these analyses.
- Slope stability analyses will include consideration of seismic loading, particularly for the design of permanent slope support systems.
- The final aesthetics of a tunnel portal, and any needs for permanent slope support also need to be considered in design of the temporary configuration and permanent stabilization of the

portal area. The site restoration work following completion of underground construction may involve placement of fills and stabilization of these.

- Provisions for adequate future access to operate and maintain the permanent portal area structures are necessary.
- The environmental setting of a portal area, including topographic relief and proximity to residences, affects the layout of a portal area, any restrictions on work, and the needs for environmental mitigation efforts.

TM8-07 Grouting Program and/or Other Groundwater Infiltration Control Measures

Purpose and Objectives

The purpose of this TM is to define design components/procedures to control groundwater infiltration during tunnel construction to facilitate excavation and support operations and to manage effects on the groundwater regime.

Assumptions

- Geotechnical investigations have been completed
- Review of existing information from construction of existing Irvington Tunnel has been completed
- Feasibility of tunneling methods has been established

Task-Specific Approach and Associated Work Elements

Groundwater inflows will have to be controlled to allow efficient tunnel excavation activities and to minimize the impacts of tunneling. Appropriate control methods depend on the tunnel excavation and lining methods that will be used. If it is determined that it is feasible to excavate the proposed tunnel by a TBM, it will likely be made using gasketed, precast concrete segmental lining for primary rock support. A watertight lining like this is a significant component of the groundwater control measures utilized during excavation of the tunnel. Once this watertight lining system is installed, very little ongoing drawdown of the groundwater table would be anticipated to occur behind the tunnel face area.

For this approach, the weak link in groundwater control is at the tunnel face. Water inflow through the face during excavation may be controlled, at least for lower heads of water, perhaps up to 300 feet, by utilizing a TBM provided with a pressurized face, i.e., provisions for earth pressure balance or slurry pressure modes of operation. An alternative would be to continuously probe ahead of the advancing tunnel by probe holes, and to control significant groundwater rates by pre-excavation grouting ahead of the advancing face.

Based on records from construction of the existing tunnel, and from records from litigation following construction, localized effects on the groundwater regime were noticeable and in some cases significant enough to require mitigation.. Mitigation efforts also included some localized grouting from the tunnel following completion of tunnel construction.

The Consultant will evaluate and develop an optimal system of groundwater control to utilize on this project. The system will be developed during the course of design, and depending on the findings of the geotechnical characterization program, and the need for control of groundwater inflow in addition to what will be provided by the initial lining. The latter will result from modeling analyses of the groundwater regime, and from study of reported occurrences of water inflow indicated in the records from construction of the existing tunnel.

The groundwater level is generally higher than the static hydraulic grade line of operation of the tunnel. There is consequently a long-term potential for infiltration of water into the new tunnel if the final lining for the tunnel is not watertight. Independent of the selection a final lining system, the final lining will be designed to add to the control of groundwater infiltration and mitigate effects on the groundwater regime in the long-term.

TM8-08 Construction Power Requirements

Purpose and Objectives

The purpose of this TM is to define electric power and backup power demand during construction regular maintenance and to define availability of adequate power supply from nearby transmission lines.

Assumptions

- Feasible tunneling methods have been established.
- The adjacent power transmission line capacities have been determined.

Task-Specific Approach and Associated Work Elements

Construction of tunnels, and particularly when mechanical rock excavation methods (such as a TBM) are employed, are relatively demanding in terms of electric power. Adequate ventilation of a longer tunnel by electric fans, pumps to remove groundwater, and the potential use of conveyors to transport the tunnel spoils to the portals are other major sources of electric power consumption.

Both the AWP and the Irvington portals will require electric power supply for the construction operations. The AWP portal will likely be the main construction staging area requiring the most substantial supply of electric power. The Consultant will identify available power supply and anticipated power demand will be evaluated. These evaluations will also be carried out considering the long-term needs for power during operations following construction.

TM8-09 Ventilation Requirements

Purpose and Objectives

The purpose of this TM is to define ventilation requirements for all phases of construction and regular maintenance of the tunnel and to include appropriate provisions in the contract document.

Assumptions

- Ventilation requirements will depend on presence of gas in the ground and the Cal/OSHA classification
- Ventilation requirements will depend on size and type of TBM
- Ventilation requirements will depend on methods for underground haulage and transportation

Task-Specific Approach and Associated Work Elements

Adequate requirements for ventilation of the tunnel headings will be required from the Contractor at all times, locations, and phases of construction. The governing regulations for safe construction of tunnels in California are the California Code of Regulations, and the Federal OSHA Regulations and standards for Underground Construction. Cal/OSHA will classify the tunnel in terms of the potential for occurrence of gasses, which will substantially affect required rates of ventilation, types of electrical and tunnel construction equipment used, and general safety procedures of construction. Considering that methane and hydrogen sulfide gas have been

encountered in the existing tunnel, a classification of at least "Potentially Gassy" and possibly even "Gassy" must be anticipated.
The Consultant will evaluate the ventilation requirements for the tunnel and consider a number of factors including:

- Size and number of diesel-powered equipment pieces used underground
- Length of the tunnel heading
- Number of workers in the tunnel
- Type of construction activities in progress
- Potential for presence of noxious and/or explosive gases (Cal/OSHA classification)
- Ventilation system configuration (i.e., reversible-type system)

The most noticeable ventilation fan required during construction of a tunnel is located adjacent to the construction portal or shaft. These fans can be noisy and a variety of mitigation measures will be evaluated to reduce the noise, depending on the proximity to buildings and residences and applicable local regulations.

TM8-10 Noise and Vibration Control

Purpose and Objectives

The purpose of this TM is to define anticipated levels of noise and vibrations due to blasting, use of TBMs, ventilator fans, materials handling, and use of heavy equipment in the portal areas during construction. Applicable limitation regulations and required mitigation measures will be defined and included in the specifications.

Assumptions

- Feasible tunneling methods have been established
- Construction portal site or sites are identified
- Access road locations have been defined.

Task-Specific Approach and Associated Work Elements

Noise and vibrations resulting from the construction activities will have to be controlled within limits established by local regulations and in accordance with the project permits and EIR. Limitations on noise and vibrations are also likely going to be tied to specific hours of the day. There may consequently be restrictions on hours of permissible truck traffic, traffic consisting of smaller vehicles, and limitations on hours allowing for blasting. In regard to vibrations, limits will likely be applicable for certain locations along the tunnel, including the portal areas, while other locations will not have these restrictions due to their distance relationships to points of activities in the tunnel. Consequently, limits on both noise and vibrations are usually related to specific boundaries, such as property limits or some distance from a particular structure, and in some cases, to reference points related to specific dwellings.
Mostly well-developed theory is available for control of vibrations and noise. For example, for blasting design well developed theory based on weight of explosives set off at any particular instance, and at any particular distance from a structure can be predicted to result in specific vibration characteristics. Other theories apply to design of muffling and noise isolation systems applicable for management of noise potentially emitted from a portal area. The resulting mitigation system may involve construction of noise barriers of certain types and heights, and

sound insulation (or mufflers) for a ventilation fan. The Consultant will investigate work hours limitations and specific control strategies, as discussed above, to determine a recommended preliminary design approach for satisfying EIR mitigation measures and local ordinances with respect to noise and vibration control.

TM8-11 Muck Disposal and Construction Access

Purpose and Objectives

The purpose of this TM is to identify and evaluate alternative muck disposal sites, recommend a preferred site for disposal of excess soil and rock materials, and to define and develop preliminary designs for construction access routes and the disposal area.

Assumptions

- SFPUC owns adjacent sites suitable for muck disposal and disposal of excavated materials.
- Access roads should not expose existing facilities to damage.
- The existing bridge across Alameda Creek is load rated for HS-20-44 loads. As part of this task, the potential need for temporary strengthening of the bridge to handle heavy construction loads will be considered. The design of any required temporary strengthening will be the Contractor's responsibility.

Task-Specific Approach and Associated Work Elements

Approaches to muck disposal vary from project to project requiring thorough evaluations to identify optimal methods of disposal. Potentially feasible disposal sites, and resources for disposal of surplus soil and rock materials, resulting from excavation activities should be located within shortest possible distance from the excavation site or tunnel portal or shaft. The Consultant will evaluate the sites identified in the CER. The initial efforts at identifying muck disposal alternatives may be directed toward beneficial and/or commercial use of the materials. Examples of such approaches would be to identify any abandoned or active quarries where the spoils could be used as fill or regrading materials, or as commercial resources for production of aggregate road base. Other approaches may be to attempt to find temporary disposal sites where the spoils may be stored for use for some identified future project. Special permits may be required to dispose tunnel muck and excess materials from excavations for structures and pipelines.

Additional sites for possible disposal of surplus soil and rock materials were identified in the CER for the proposed alignment. The feasibility of using these will also be evaluated. Additional search for suitable disposal approaches will be investigated. We will also look in to the feasibility of transferring the responsibility for disposal of the spoils to the contractor.

The design of permanent access roads will be made by SFPUC. Depending on timing relative to design of the tunnel, close coordination with these efforts and the design efforts for Siphon No 4 and the BDPL No. 5 projects are required to ensure compatibility. Access to the portal sites, and other points where construction will occur, will be evaluated to assure that necessary roads, and associated rights-of-way, are indeed present for construction. Access also includes assessing and defining any limitations present, e.g., limitations on bridges, and developing general recommendations for upgrades required for the access roads and bridge, including improvements required to ensure appropriate traffic control mitigation.

TM8-12 Construction Staging Layout

Purpose and Objectives

The purpose of this TM is to define space requirements and locations of sites for Contractor's Laydown and Staging needs. The most significant area needs to be located close to the AWP, and a smaller space needs to be made available at the Irvington portal.

Assumptions

- Sufficient and feasible areas are available adjacent to the Alameda West Portal and Irvington Portal.

Task-Specific Approach and Associated Work Elements

It is critical to determine sufficient construction staging areas adjacent to the tunnel portals to support tunnel construction. These areas must be clearly identified in the Contract Documents. If restrictions apply, these need to be identified as well. If additional off-site staging areas are made available by the owner these need to also be identified.

The desired minimum size of a staging area adjacent to a portal is in the order of two to three acres with availability of additional space within a mile or two from the site. Slightly smaller areas are still feasible. These areas need to be reasonably level and connected to acceptable access roads. Desirable characteristics also include adequate separation (distance) from residences and businesses, and locations level with or above urban developments to minimized needs for noise control and work restrictions. The areas need to include space for development of a groundwater treatment facility, and allow for construction of a conduit to a suitable drainage course for disposal of the treated water.

TM8-13 Design of Preliminary and Final Tunnel Liner

Purpose and Objectives

The purpose of this TM is to define optional primary support system compatible with the chosen excavation methods and equipment, and to design a final liner, which provides the required reliability following the design earthquake.

Assumptions

- Completion of the geotechnical characterization
- Completion of the hydrogeologic modeling
- Feasible tunneling methods have been identified

Task-Specific Approach and Associated Work Elements

If it is verified that excavation of the new tunnel using a TBM is feasible, the excavation would likely require use of a gasketed precast concrete segmental lining as primary support and primary lining of the tunnel. Because of the operating HGL being generally below the groundwater level (GWT), exfiltration from the tunnel is not expected to be an issue except in the portal areas and perhaps also at the I-680 crossing. Where the GWT is above the HGL, potential infiltration (or leakage) into the tunnel during design life operation of the facility will be a necessary design consideration for reasons of potential effects on the groundwater regime, and for reasons of water quality if groundwater is mixed into the stream of transported water.

Gasketed Precast Concrete Segmental Liner

The segmental liner, installed from within the tail shield of the TBM, will be designed considering numerous functions and combinations of loading conditions including:

- Axial loading from thrust forces applied to advance the TBM

- Groundwater loads from a restored GWT behind the excavation face
- Ground loads from the varying ground conditions
- Ground loads from ground squeezing/swelling ground
- Moments in the individual segments due to deformation of the segment ring due to ground loads
- Stress concentrations in the lining segments due to high interface loads on the gaskets and segment contact surfaces
- Seismic loading on the segment rings, with and without the final lining system

Tunnel Final Lining

A nominally reinforced concrete lining including both hoop and longitudinal reinforcing steel would include relatively limited amounts of reinforcing steel except in selective areas where more substantial reinforcing would be installed due to specific ground conditions. At the other extreme, too much reinforcing steel could be detrimental to the quality of the completed cast-in-place concrete lining in that it makes quality concrete placement difficult. A nominal reinforcement of the concrete lining results in distribution of shrinkage cracks during hydration of the concrete, and provide ductility due to earthquake loads reducing widths of cracks from developing in the lining. Smaller widths of cracks in the concrete results in reduced permeability of the lining (less inflow of groundwater in this case), and improves the efficiency of consolidation grouting, if required following an earthquake. The improvement of ductility would also mean distribution of cracks, as opposed to formation of fewer, wider cracks due to shaking or raking during an earthquake. In the extreme, this would mean improved resistance to localized fallout of larger blocks of concrete lining, and improved reliability of the system following an earthquake.

Areas requiring more substantial reinforcing include areas with squeezing ground, areas of weak, fractured rock, and areas of flowing ground, and at the ends of steel linings. All of these characteristics were reported to have occurred locally during excavation of the existing tunnel. As a minimum, the new tunnel requires watertight final lining in the areas near the portals where the GWT is above the HGL. Depending on rock mass permeability, and characteristics governing stability of the rock slopes in the portal areas, the minimum length of steel lining in these areas may need to be extended some additional distance along the tunnel. This watertight lining will likely be constructed from steel plate or spiral welded steel pipe. The design of the steel lining will include numerous important considerations:

- The analysis of the steel lining will include evaluation of lining plate thickness based on internal and external pressures, handling and construction loads, and seismic loading.
- Depending on the configuration of the tunnel portal and connections to the near surface conduits, the steel linings are required to be provided with anchor rings to ensure axial stability of the lining in the portal area.
- The points of termination of the steel lining in the portal areas will require one or several seepage rings and grout seals to prevent leakage into the rock mass outside the steel lining.

Another option is to design a one-pass precast concrete segmental lining for both primary support and as the final lining. Higher quality gaskets will have to be specified that will not deteriorate

with time and special hoop reinforcement used to transfer of forces and moments across the joints during an earthquake.
The general location of the GWT above the operating range of the transmission system HGL along the Irvington Tunnel results in a gradient towards the tunnel, and a potential for leakage of groundwater into the tunnel through the final ling, depending on the type of the final lining. There appears to be no compelling reason to provide the tunnel with an expensive, watertight lining to completely prevent infiltration of water, but rather to control such inflow for reasons of minimizing long-term effects on the groundwater regime.
The design of the appurtenances associated with the final lining system in the portal areas requires thorough consideration of numerous aspects of facility operations and maintenance, as well as hydraulic efficiency and security of the facilities.
The most significant requirements for the final lining design for the proposed Irvington Tunnel include the following considerations:

- Ability to control groundwater infiltration to acceptable levels for the design life of the facility.
- Support the head from the GWT.
- Support ground loads, including pressures from squeezing and swelling rock.
- Adequately support ground and water loads under applicable design seismic events.
- Exhibit an appropriate amount of ductility controlling potential damage to the lining due to the design seismic event.
- A final lining that is repairable with relative ease, e.g., a cast-in-place concrete lining can be repaired using shotcrete, or portions of a concrete lining may be partially removed and quickly replaced with new cast in place concrete.
- Well defined provisions for reentry and access into the tunnel will be required to facilitate future inspections and access to inside of the tunnel for maintenance and repair work.

TM8-14 Design of Overflow Shaft

Purpose and Objectives

The purpose of this TM is to define, configure, and design the New Overflow Shaft located in the AWP area.

Assumptions

- The New Overflow Shaft will have characteristic essentially identical to the Existing Overflow Shaft on Irvington Tunnel No. 1.
- All system hydraulic analysis has been completed.
- Geotechnical investigations have been completed.
- Existing Overflow Discharge Conduit will be extended and used.

Task-Specific Approach and Associated Work Elements

It is essential that the modified tunnel transmission system incorporating the new tunnel provides operating characteristics nearly equal to those of the existing system. The modified system needs to have the capability of operating interchangeably, or in parallel, with the existing facilities to provide full redundancy and improved reliability.

The most fundamental aspect of design of the new overflow shaft is the elevation at which overflow occur. This elevation determines the maximum HGL for the new tunnel, and the downstream pipelines, when the new tunnel is operating separately. The required overflow elevation is necessarily identical to the current overflow elevation for operation of both conduits in parallel.

The exact location of the overflow shaft depends on a number of factors, including the horizontal alignment of the tunnel, the topography at the location, and the possibilities for routing of the overflow discharge channel/pipeline. The size and configuration of any surge tank may also effect the exact location. The size of the overflow shaft conduit will be evaluated based on transient flow analysis considering the characteristics of the modified transmission system.

TM8-15 Design of Connections to the Alameda Siphons and the BDPLs

Purpose and Objectives

The purpose of this TM is to define and design all temporary and permanent connections, conduits, valves, vaults, and controls required ensuring reliable operation of either or both of the tunnels.

Assumptions

- Connections to existing facility may not be made until the New Irvington Tunnel and Alameda Siphon No. 4 have been completed.
- Shutdown of the existing transmission system to finalize connections would need long and thorough planning and would be required to be shortest possible in duration.
- Hetch Hetchy water is considered to be treated water and connections would require disinfection of all new conduits.
- If available and applicable, SFPUC standard vault designs will be utilized.
- 8 new valve vaults will be required for valves IT-1, IT-2, T1T2, IT2-1, E-9 and E-10, A-9, B-9, C-9, D-9
- Sketches SK-1 and SK-2, of the RFP identify the limits of the consultant's responsibility for design of connections

Task-Specific Approach and Associated Work Elements

The connections to the existing facilities, and to the new BDPL No 5 and Siphon No4 in respective portal area, will involve construction of several vaults constructed from cast-in-place concrete to house flow control and isolation valves and other mechanical devices. Additionally there will be vaults housing the removable bulkheads providing for future access to the tunnels. These vaults will be provided with electrical power for operation of the valves, and ventilation and light provisions, and likely SCADA systems for remote operation of valves. Additional provisions may include considerations of drainage of the vaults, e.g., a sump and pump. Furthermore, depending on the timing of construction of the separate Siphon No 4 and BDPL No 5 projects, the new tunnel portal areas may be quite congested requiring special consideration in design. The design will likely also include provisions for adequate access to the structures and conduits for future work, including surface-level access for large equipment such as a crane adjacent to the vaults.

These vaults require provisions for safe access for workers for maintenance and inspection. The access provisions also need to include consideration of either horizontal or vertical access such

that a mobile crane may be used for removal and installation of the heavy valves, and for insertion of heavy equipment for possible future use in inspection or maintenance in the tunnels. The design of these vaults need to be made considering important aspects of safe entry such that workers may enter the vaults to work without the need for operation under "Confined Space" regulations.

The Consultant will evaluate and design the portal area connections to the existing facilities and will include the following considerations:

- Locations and termination points of the horizontal alignments of the proposed new BDPL No 5, the new Alameda Siphon No 4 and the new Irvington Tunnel will affect the geometry of the near surface connections. Close coordination with the concurrent, separate teams designing BDPL No 5 and Alameda Siphon No 4 will be required during design of the new Irvington Tunnel to optimize all system component alignments, interfaces, needs for system components, and system controls.
- Sequence of design and construction of the different system components may affect the requirements of the modified system
- The vertical alignment of the new Irvington Tunnel will affect access requirements for construction, and construction methods for both the tunnel and connections
- The results of the geotechnical characterization efforts, including slope stability evaluations, presence of any active fault adjacent to either portal, topographic conditions, and characteristics of the geologic materials
- Operational and serviceability requirements for both new and existing facilities
- Requirements for future access into the conduits
- Adequacy of existing facilities, and feasibility of incorporating individual components
- Needs for, and locations of, temporary conduit systems during construction of the new facilities
- Risks for differential settlements between new and existing facilities/structures
- Short-term operating requirements during connection of the new facilities
- Seismic design considerations
- Facility Security Considerations

The manifolds connecting all conduits in each tunnel portal area, and associated needs for thrust blocks and vaults to house flow control and isolation valves, flow meters, bulkheads for future access into the conduits, required electrical supply system components, vehicle access and parking requirements, and other important components will require substantial, permanent rights-of-way in each portal area. Additionally, right-of-way will be required for adequate access roads to these areas. The portal areas will also require adequate fences and gates, and be restored and graded to assure appropriate and stable slopes, and be esthetically pleasing for the public.

35% Design of Tunnel Connections to Alameda Siphons and BDPLs will include the following:

- Definition of the facility sufficiently to identify all major elements required, and the verification of feasibility of the design; and a list of permit requirements;

- Definition of agreed construction sequence and outages based upon the Conceptual Engineering Report
- Definition of construction contract packaging, if required;
- Preliminary horizontal (plans) and vertical alignments (sections) of the elements being designed;
- Coordination with SFPUC Design Team to establish location of near-surface and surface facilities associated with the elements being designed;
- Summary of design approach, and identification of design issues; outline of specifications; and; long lead item list, major equipment list, reference other studies or reports as appropriate, draft list of potential bidders; drawing list; and
- Update of project interfaces with other construction packages
- Drawings, in conformance with SFPUC standards

65% Design of Tunnel Connections to Alameda Siphons and BDPLs will include the following:

- Documents shall incorporate those agreed upon comments from SFPUC and project team from 35% submittal;
- Integration of drawings and specifications with those produced by SFPUC Design Team, including appropriate drawing numbers, match lines, and cross referencing on all drawings;
- A preliminary list of pre-purchased materials and equipment;
- Updated technical specifications; contract plans/drawings; and bid item descriptions including method of payment to integrate with SFPUC standard descriptions.
- 65% drawing package.

95% Design of Tunnel Connections to Alameda Siphons and BDPLs will include the following:

- Documents shall incorporate agreed upon comments from SFPUC and project team from 65% submittal;
- Incorporation of design interfaces and coordination issues relevant to designs performed by the SFPUC;
- Completion of construction documents and packages for integration with contract plans/drawings and specifications produced by the SFPUC Design Team. The package shall be ready for stamping and signatures by the Engineer of Record and for review by SFPUC Contract Preparation staff.

100% Design of Tunnel Connections to Alameda Siphons and BDPLs will include the following:

- Finalized, signed and wet stamped plans and specifications inclusive of all comments, agreed to be incorporated, generated by SFPUC Contract Preparation staff, reflecting SFPUC and Project Team comments on 95% design documents, and final QA/QC audit;
- All final signed and wet stamped analysis results, design calculations, and design report.

TM8-16 Design of Construction Water Handling and Treatment Systems

Purpose and Objectives

The purpose of this TM is to define requirements, capacity, and type of water treatment plants required in both Irvington and AWP portals to treat water encountered in the tunnel. Additional installations are required for erosion control and sediment removal associated with surface runoff from surface construction.

Assumptions

- Completion of surface grading and permanent drainage design.
- Suitable receptor stream for discharge of treated water is required.

Task-Specific Approach and Associated Work Elements

The AWP portal area is designated the main construction portal for access and support of construction of the new Irvington Tunnel. The area is located on the western edge of Sunol Valley and will involve surface construction on the valley slope as well as construction on gentler sloping and relatively flat terrain. A treatment plant for tunnel construction water is anticipated to be required in this portal area. This treatment plant will be sized to handle groundwater inflows in consideration of the type of primary tunnel employed (i.e., watertight or not) and the groundwater inflow mitigation measures required (such as pre-excavation grouting). Such a treatment plant will likely include construction of a water treatment plant structure housing pH adjustment and flocculation facilities, and use of multi-stage sedimentation ponds. It is anticipated that relatively large concentrations of silt and clay size particle will be suspended in the tunnel construction water during excavation due to the shale rock present. These particles are removed by the flocculation treatment. Extensive use of cement and concrete materials will be used during grouting, primary lining installation, and during construction of a cast-in-place concrete lining. Construction water handled and treated during these phases of construction will require treatment to adjust the pH value of the discharged water as well. Specified treatment levels will be in accordance with NPDES permit requirements. It is anticipated that treated water can be discharged into Alameda Creek adjacent to the portal area. An alternative approach to a discharge stream is to utilize an adjacent, abandoned, water filled quarry as a receptor for the treated water, if feasible.

The Irvington portal area involves, as a minimum, construction of extensive near-surface facilities including tunnel portal development, and excavation of deep and wide trenches for the manifolds and associated valve vaults. Additional earthwork is associated with providing adequate access roads, and construction laydown and worker parking areas. This area is located in sloping terrain and is currently not considered a major construction portal requiring support of extensive underground construction. The anticipated major emphasis for water treatment in this area is surface runoff during the rainy season.

Both portal areas will require application of best practices management of erosion control, surface drainage provisions, and treatment and discharge of surface waters during construction. Both portal areas will consequently require installation of erosion control measures, collection trenches and pipelines for surface water runoff, and construction of sedimentation ponds and/or use of portable water treatment plants (e.g., Baker Tanks) for treatment of water prior to discharge into an acceptable receptor stream. A common objective of the treatment of water prior to discharge is to provide treatment to the quality level of the water in the receptor stream.

Dependencies On / Among Other Tasks

- Task 3 – Review of Existing Information

- Task 4 – Design Criteria
- Task 6 – Geotechnical Investigation
- Task 7 – Geotechnical Reports

Responsible Party

Responsible task leader is Lead Tunnel Design Engineer with assistance from appropriate staff members, under the overall direction of the Consultant Project Manager.

Output / Deliverables

The deliverables under Task 8.1 will include a series of TMs as described above. Each TM must be approved by SFPUC before detailed design can start on the applicable element of the project. The results of this work will be included in the 35% Design Report, GBR, Specifications, and Drawings.

Task 8.2 Preliminary Design (35% Level)

Purpose and Objectives

The purpose of this task is to define and finalize all components of the New Irvington Tunnel facilities, including horizontal and vertical alignment connections, shafts and controls, and to evaluate constructability of the facilities. Complete outlines of technical specifications and development of drawing lists will be prepared.

Assumptions

- Acceptance and verification of the design concepts
- System hydraulic analyses complete and available from the SFPUC
- Programmatic design criteria complete and available from SFPUC
- Close coordination with Siphon No. 4 and BDPL No. 5 design teams

Task-Specific Approach and Associated Work Elements

The design will be completed in steps with the first design effort completed to the 35% level. The design effort will incorporate the results of the TM's from Task 8.1, and will include preparation of the following:

- Design calculations and design reports
- Design drawings
- Technical Specifications
- Assistance to SFPUC in preparation of Division 0 and 1 Specifications
- Construction cost estimates and CPM schedules
- Constructability Reviews
- Value engineering and peer review of design.

Design Calculations and Design Reports

Design analysis will be performed incorporating appropriate seismic loading in analysis and design of all major facility components as applicable for Zone 4. Design and analysis will also account for applicable differential settlement considerations, and the presence and need for preservation of existing, adjacent facilities and structures.

The design efforts will result in production of Technical Memoranda, design reports, and volumes of design calculations covering a wide variety of specialized topics, objectives and levels of design development. Each of these are identified and discussed under a separate heading below.

The production of design memoranda and design reports will be as initially a Draft version for review and comments, to be followed by a Final version incorporating all review comments. Both versions of the documents will be completed incorporating all applicable QA/QC efforts and documentation. Design calculations will only be provided in the final version at completion of detailed design and construction documents. All final versions of design documents will be sealed and signed by appropriately registered professional engineers and geologists.

Design Drawings

The development of design drawings will proceed in an organized manner by developing a drawing list, conforming to SFPUC's standard organization of construction drawings, including the following categories of drawings:

- General
- Civil
- Structural
- Mechanical
- Electrical
- Instrumentation
- Corrosion Protection, and any other category required

A drawing list identifying the anticipated drawing, with assigned drawing numbers will be developed during the preliminary design effort. SFPUC standard drawings applicable for the design package will also be identified and integrated in the project drawing list. Any needs for integration of any SFPUC drawings produced in-house specifically for this project, or drawings produced by other consultants for adjacent water transmission system components, will also be incorporated.

Technical Specifications

Contract Specifications to describe the Work required will be developed in accordance with SFPUC guidelines using the Construction Specifications Institute (CSI) format. The general format consists of 17 divisions or categories of work. The first two of these divisions are generally considered "non-technical" and include the contractual aspects of the Work, and are generally called Special Provisions and General Provisions.

The 15 divisions of technical specifications, Divisions 2 through 16, describes the contract provisions for all aspects of the construction work included in the contract based on a standard CSI approach dividing the work into specific categories assigned to each division, ranging from Earthwork in Division 2 to Electrical Work in Division 16. Each division includes: Part 1 – General - a description of the work, related work, reference codes and standards, qualifications requirements and submittals requirements; Part 2 – Materials - applicable design criteria, performance criteria, and other requirements for the details and components included work; and Part 3 – Execution - Includes requirements for construction, testing, and quality control of the construction work.

Consultant Assistance to SFPUC in Preparation of Division 0 and 1 Specifications

Tunnel construction contracts require specific and special provisions to manage inherent risks of construction, often related to the changed geotechnical conditions, or other potential disputes. It is anticipated that Special Provisions governing the tunnel construction contract will be developed and merged with applicable standard SFPUC General Provisions to provide the necessary contractual framework. The tunnel design consultant will provide the necessary assistance to accomplish this.

Construction Cost Estimates and CPM Schedules

Construction schedules will be developed at each of the stages of development of the design of the project. These schedules will be utilized as a basis for estimates of construction costs. The need for contingency allowances to account for unknown or undefined factors is very important; these will be identified for each level of design. The Request for Proposal for the project provided the following targets for necessary cost estimating accuracy at each stage of design:

- 35 % design level - ± 30 %
- 65 % design level - ± 20 %
- 95 % design level - ±10 %
- 100 % (Engineer's Cost Estimate)- ±10 %

Constructability Review

Due to limited access for construction work, often through one or two portals or shafts, underground tunnel construction work is required to proceed linearly, and sequentially. These characteristics affect all construction activities, and are clearly reflected in schedules and costs. Due to the linearity of tunnel construction, thorough evaluations of feasibility of approaches, durations, and costs are required to be integrated in all design work. These considerations range over a wide spectrum and include consideration of excavation dimensions and methods, clearance requirements, ventilation and power requirements, transportation methods, construction tolerance requirements, safety considerations, and availability and costs of skilled personnel.

Value Engineering and Peer Review of Design

A Value Engineering effort to evaluate the design concept may be chosen by the SFPUC. The Consultant will provide all the technical support required for such an effort, following agreements on an additional task and budget to perform this work.

Reviews of work products will be performed by SFPUC with consultation from a Technical Advisory Panel comprised of independent experts and/or Consultants. The Consultant fully supports this commonly applied, effective approach.

In addition, the Consultant design review panel consisting of recognized tunnel design experts will periodically review progress of the design, and perform reviews of selected design products at appropriate milestones.

Design Process and Deliverables

The design process will consist of two major phases of design work; Preliminary (35 % level) Design Phase, and Detailed (65 %, 95 %, and 100 % levels) Design Phase. Each of these phases of work will include specific work efforts culminating in specific deliverables for review and use

in use for the subsequent levels of design development. Most of the design efforts are interdependent on the results of other efforts.

The main design efforts and deliverables are briefly discussed below.

Preliminary (35 %) Design. The 35% Design Phase involves initiation of numerous design efforts. Some of these efforts will be completed prior to proceeding with the detailed design phase, while others will be ongoing and completed later. The majority of the deliverables of technical nature will be produced in an initial Draft version, and eventually completed as a Final version after review and incorporation of comments.

The 35% design phase will include numerous, extensive efforts of technical nature, which will not involve separate submittals, but will immediately be incorporated into other work after appropriate internal QA/QC efforts. Such work includes:

- All phases of surveying efforts, including utility search information and surveying of geotechnical exploration efforts
- Geotechnical exploration will proceed during the 35% design phase, and information will be incorporated in the design as it becomes available. Significant work will be expanded in developing draft logs from the borings, and then proceed with work on the final documents in parallel with QC efforts for these documents. Development of geologic plans and profiles using existing information, and information from surface mapping and subsurface exploration efforts, will proceed in parallel with work on final logs and civil and structural design efforts.
- Evaluations of construction traffic and needs for Traffic Control
- The URS design team will identify permitting requirements for construction, including NPDES permitting for tunnel construction water and spoils disposal. The Permitting Process will begin during this phase, and following completion of the geotechnical characterization, an application to Cal/OSHA for determination of classification status in regards to occurrence of gas will be made.
- Various technical support efforts for SFPUC in the pursuit of Environmental Impact clearance and Community Outreach efforts handled by the SFPUC employees and other consultants are anticipated in this phase when the definition of the project and associated parameters/issues are finalized.

The technical deliverables during this phase of the design will consist of a combination of technical memoranda, including a comprehensive 35% Design Report, 35% level Design Drawings, Outline of the Construction Specifications, and the Geotechnical Data (GDR) and Interpretive (GIR) reports. The 35% Design Report will outline the scope of work and approach to completing Detailed Design, including preparation of plans, specifications, and construction CPM schedules and cost estimates. The 35% design drawings will include final plans and profiles of surveyed alignments of the tunnel, portals, connections to the BDPL's and the AWP Siphons.

The 35% Design Report will include comprehensive description of the project facilities. The report will also include the final versions of most of the TM's as Appendices. The report will include the final version of TM No 4- Design Criteria, which will include all seismic design criteria applicable for design of all project components. The seismic design criteria will address any crossings of active faults and associated design requirements, and criteria for analysis of the

tunnel and other conduits in regard to shaking and racking during an earthquake. TM No 4 will also present the lining support loads accounting for squeezing ground conditions in certain reaches of the tunnel alignment. The 35% Design Outline of the Construction Specifications and the 35% Design Drawings will be submitted as separately bound appendices.

A topic of particular consideration in Constructability Evaluations will be the evaluation of potential issues associated with use of a TBM in combination with gasketed segmental lining in a tunnel with anticipated, intermittent occurrences of squeezing ground. Specific approaches to deal with such conditions need to be defined and evaluated. The constructability evaluation will also include construction packaging issues and identification and definition of separate construction packages, if applicable.

The 35% Design Report will include the final concepts of treatment and disposal of groundwater, muck disposal approach, and conclusive discussions of Contractor's laydown and staging requirements and associated approaches. The report will identify all permits required for construction. The report will also discuss use of blasting, and the presence of any significant environmental mitigation issues.

The 35% Design Drawings will be completed to a level that identifies the alignments of the tunnel and all pipeline connections. The drawings will also identify all access roads, any bridges, all structures including vaults, and all major civil design details, such as earthwork, deep cuts and fills, grading and drainage provisions, and the special excavation and stabilization efforts required for the tunnel portal developments. Substantial plans and profiles of all conduits and roads will be developed.

The 35% Design Report will include an appropriately detailed construction schedule. The report will also include an initial, contractor's-type construction estimate incorporating a substantial amount of project specific assumptions relating to the level of design development, including ground conditions, excavation size, support type and lining details, and other site conditions for construction of the facilities.

Detailed Design. The Detailed Design phase is divided into three sub-phases of increasingly detailed development of the design; 65 % Design, 95 % Design, and 100 % Design. The levels of the design represent major milestones of progress of the project design, and each includes extensive submittals for review. These submittals will include increasingly detailed and complete sets of contract documents consisting of drawings, specifications, and reports as briefly discussed under the following subheadings.

Dependencies On / Among Other Tasks

- Task 3 – Review of existing information
- Task 4 – Design Criteria
- Task 5 – Surveying
- Task 6 – Geotechnical Investigations
- Task 7 – Geotechnical Reports

Responsible Party

This task will be carried out under the direction of the Lead Tunnel Design Engineer, with assistance from appropriate staff members, under the overall direction of the Project Manager.

Output / Deliverables

- 35% Design Report including Construction Schedule and Cost Estimates

- 35% Design Drawings
- Outline of Specifications

Task 8.3 Detailed Design (65% Level)

Purpose and Objectives

The purpose of this task is to perform design analyses and develop design drawings and specifications to the highest possible level of development for each component. Provide draft of all technical specifications, and details of all facilities.

Assumptions

- Geotechnical investigations and interpretations are complete.
- SFPUC provides Division 0 and Division 1 specifications for review and modification.

Task-Specific Approach and Associated Work Elements

The 65% design work performed during this level of design development includes:

- Design documents shall incorporate resolutions of the comments from the 35 % design level. A formal, separate response to all comments will also be provided.
- Develop civil, structural, mechanical, and electrical drawings from the general layouts, geometry and dimensions of all facilities, roads, earth support, parking, drainage, tunnel, and connections.
- Finalizing hydraulic analysis, including completion of assessments of complete integration of the new facilities with existing and other planned new facilities.
- Perform Corrosion Engineering evaluations and design.
- Perform analysis for portal slope stability, and detailed design of slope support.
- Perform structural, mechanical, and electrical analysis and design for all surface piping, connections, vaults, and appurtenances.
- All structural and mechanical design, and design of larger electrical components and systems, will include analysis for shaking due to an earthquake per project specific seismic design criteria or Building code requirements for Seismic Zone 4.
- The analysis and design of the tunnel lining system will, in addition to analyses for shaking, also be analyzed for racking, i.e., transverse deformations.
- The analysis and design of the tunnel final lining system will also include loads accounting for squeezing ground, as applicable.
- Development of construction specifications will continue throughout the 65 % design level efforts, including both technical and non-technical specifications. It is anticipated that several Divisions of the technical specifications will be nearly complete at the end of this phase of design.
- In the Division 0 and Division 1 specifications, detailed Bid Items will be defined and described, and approaches to the contractual framework and Methods of Payment will be made incorporating SFPUC standard descriptions, as applicable.

This level of design development will also involve evaluation of needs for and advantages of any pre-purchase of equipment and/or construction materials. Consultant will develop a list of any recommended pre-purchased equipment.

Dependencies On / Among Other Tasks

- Task 6 – Geotechnical Investigations
- Task 7 – Geotechnical Reports

Responsible Party

This task will be carried out under the direction of the Lead Tunnel Design Engineer, with assistance from appropriate staff members, under the overall direction of the Project Manager.

Output / Deliverables

Provide plans, specifications, and cost estimates at 65 percent of design completion. Plans and specifications shall be prepared in compliance with standard SFPUC format.

Task 8.4 Detailed Design (95% Level)

Purpose and Objectives

The purpose of this task is to complete all design analysis, complete drawings and specifications, the GBR and the Draft Final Design Report.

Assumptions

- All supplemental geotechnical investigations have been completed.
- No permitting issues causing delays or project changes remain.

Task-Specific Approach and Associated Work Elements

The 95% design work performed during this level of design development includes:

- Design documents shall incorporate resolutions of the comments from the 65 % design level. A formal, separate response to all comments will also be provided.
- Complete incorporation of applicable design interfaces with work designed by SFPUC design Team and other consultants, as applicable.
- Completion of all civil, structural, mechanical, corrosion engineering, and electrical drawings
- Completion of all technical construction specifications, and all Division 0 and Division 1 General, and Special Provisions specifications
- Development of a Draft Final Design Report including most of the design calculations
- Updates of the Construction Schedule and the Construction Cost Estimate

Dependencies On / Among Other Tasks

- Task 6 – Geotechnical Investigations
- Task 7 – Geotechnical Reports

Responsible Party

This task will be carried out under the direction of our Lead Tunnel Design Engineer, with assistance from appropriate staff members, under the overall direction of the Project Manager.

Output / Deliverables

- Provide plans, specifications, and cost estimates at 95 percent of design completion. Plans and specifications shall be prepared in compliance with standard SFPUC format.

- Draft Final Design Report

Task 8.5 Bid Ready Design (100 % Level)

Purpose and Objectives

The purpose of this task is to finalize all design drawings and specifications, the GBR, the Final Design Report with Design Calculations, the Construction Schedule, and the Engineer's Cost Estimate, accounting for comments from the SFPUC Legal and Construction Contract Preparation Department. All design documents will be sealed and signed.

Assumptions

- No major changes result from reviews by the SFPUC Legal and Construction Contract Department.
- The Construction Contract will proceed directly from Design to Advertising for Bids.

Task-Specific Approach and Associated Work Elements

On completion of legal and contract procurement reviews, and incorporation of any changes/comments from the reviews of the 95% submittal, and final QA/QC audit, these documents will be designated as 100% Design Drawings, sealed and signed by the Engineer of Record, and "Bid Ready" for authorization by the City Government, advertising for bids and subsequent construction. The 100% design submittal will also include the Final Design Report A Bid Ready level construction schedule will be completed by updating the 95% level schedule. Similarly, the Engineer's Cost Estimate will be produced from a final update of the 95% design cost estimate. Both schedule and estimate will include considerations of all recent developments of costs, including predicted trends, and consideration of late changes to the construction contract provisions.

Dependencies On / Among Other Tasks

None

Responsible Party

This task will be carried out under the direction of our Lead Tunnel Design Engineer, with assistance from appropriate staff members, under the overall direction of the Project Manager.

Output / Deliverables

- Provide plans, specifications, GBR, and cost estimates at 100 percent (bid ready) of design completion. Plans and specifications shall be prepared in compliance with standard SFPUC format. This final submittal of design documents shall encompass 1 bound copy and 1 unbound copy of reports; 1 reproducible master set of the construction documents; a vellum set; and a digital copy of the drawings in AutoCAD, and all other documents
- Final Design Report

Task 9: Provide Engineering Support Services for Environmental Assessment

Purpose and Objectives

The purpose of this Task will be to provide engineering input as needed during development of environmental studies related to construction staging and access, portal development, tunnel and shaft construction, muck disposal, and other potential impacts of tunnel construction.

Assumptions

- For budgeting purposes and the preparation of the Fee Schedule, an allowance has been provided for this task.

Task-Specific Approach and Associated Work Elements

Provide engineering support services for the tunnel and associated facilities during the environmental documentation phase as follows:

- Review the potential area of effect related to groundwater, streams, wells, springs and biological resources and provide comment to the CEQA Team as to adequacy and potential impacts during construction and operation.
- Review the groundwater, streams, wells, springs and biological resources inventory report and provide comments to the CEQA Team.
- Provide as-needed technical support to SFPUC engineering and environmental efforts for local agency permit, environmental permitting process, and negotiation of ROW agreements and easements. These services may include attending public meetings, responding to questions from environmental agencies, providing information supporting environmental impact assessments, etc.

Dependencies On / Among Other Tasks

None.

Responsible Party

The Consultant Project Manager will be responsible for coordinating this task with support from the key discipline leads as needed. Responsibility for specific aspects of the work will be delegated according to the needs of the CEQA Team.

Output / Deliverables

- Technical memoranda summarizing relevant environmental issues and their potential effects on construction; approaches to mitigation of environmental issues.
- Review comments on groundwater resources and biological resources inventories prepared by CEQA team.
- Responses to questions from environmental agencies including additional information as required in support of the environmental documentation phase of the project.

Task 10: Provide Engineering Support Services During Bid and Award

Purpose and Objectives

The purpose of this Task is to provide engineering support services to the SFPUC project team during the Bid and Award period for the New Irvington Tunnel Project.

Assumptions

- For budgeting purposes and the preparation of the Fee Schedule, an allowance has been provided for this task.

Task-Specific Approach and Associated Work Elements

Provide engineering support services during the bidding period for the New Irvington Tunnel Project including: attending a site visit and a pre-bid conference with prospective bidders, responding to questions as directed by SFPUC, assisting SFPUC on any Contractor's Pre-

qualification, taking notes on questions that may arise, providing written responses to bidder inquiries, preparing addenda to contract documents, assisting SFPUC in the analysis and evaluation of bids, and reviewing product substitutions.

As part of this task, the Consultant and SFPUC shall assess the feasibility of using the Interactive Bidding Process (IBP) on the New Irvington Tunnel Project. If IBP is used, prospective pre-qualified Bidders will be invited to review a draft of the Contract Documents at the 65-80% Completion Level and to provide feedback on the documents before the design is completed. Consultant shall also organize a one-day contractor workshop to discuss the project and receive contractor review comments; collate and synthesize contractor comments; review collated comments with the SFPUC; and incorporate agreed-upon comments into the final Contract Documents.

Dependencies On / Among Other Tasks

The Task 8 Design Documents must be complete or nearly complete before the Bid and Award Process can be completed. As indicated above, if the SFPUC opts to use the IBP, pre-qualification of bidders should be initiated early in the Final Design Process.

Responsible Party

Engineering support during Bid and Award will be provided under the direction of Consultant Project Manager, with assistance from Lead Engineers and appropriate technical staff.

Output / Deliverables

- Responses to bidders' questions on "construction contract document" related questions;
- Addenda to contract drawings and specifications, as required;
- Analysis and evaluation of bids submitted.
- In addition, if the IBP process is used, Consultant shall provide a collated and synthesized set of Contractor review comments on the draft Contract Documents for incorporation in the final design documents.

Task 11: Provide Engineering Support Services During Construction

Purpose and Objectives

To evaluate and confirm compliance of Contractor's work with the requirements specified in the Contract Documents, to provide appropriate design review and develop any needed design changes, to assist with inspection, testing and start-up, to provide design engineering support to the separate CM team, and to verify critical geotechnical and other design assumptions.

Assumptions

- It is SFPUC's intent to engage, under separate contract, a CM team including experienced tunneling construction site superintendent and inspector(s) to manage/oversee the tunneling construction and relevant activities. The Consultant services under this task will not include the activities to be performed by the CM team.
- For budgeting purposes and the preparation of the Fee Schedule, an allowance has been provided for this task.

Task-Specific Approach and Associated Work Elements

Under this task, Consultant shall provide engineering support services during the construction phase of the New Irvington Tunnel Project, including but not necessarily limited to the following areas of work, in support of the CM team:

- Review and respond to shop drawings, submittals, and requests for substitution from the contractor.
- Respond to design-related Requests for Clarification (RFCs) and Requests for Information (RFIs).
- Prepare scope of Consultant/SFPUC proposed change orders.
- Perform analysis of contractor proposed change orders.
- Evaluate merits of Contractor claims regarding Differing Site Conditions.
- Provide technical input and assist in facilitation of Disputes Review Board (DRB) meetings.
- Update contract drawings to reflect as-built information provided by construction contractor.
- Attend project progress meetings at construction site and issue-specific meetings at job sites and SFPUC offices.
- Identify construction phase items requiring presence of engineer in the field, and coordinate with construction management team on scheduling related site visits.
- Identify elements or structures requiring monitoring by the construction management team, and coordinate to provide instructions or training to construction management personnel for proper monitoring and documentation.
- Prepare tunnel inspection procedures for construction acceptance and for future maintenance of the existing and new Irvington tunnels. Construction acceptance criteria will include inflow and excavation alignment/profile criteria developed in TM8-03.
- Provide technical assistance during testing and startup.
- Provide technical opinion to facilitate resolution of design-related contract disputes.
- Provide observation and analysis of geotechnical instrumentation and well data collected during construction.
- Collect geologic data at the tunnel face, if feasible, and assemble geologic tunnel map documenting conditions encountered during excavation of the tunnel.

Dependencies On / Among Other Tasks

None. Work in this phase will be initiated after Contract Award and NTP is given to Irvington Tunnel Contractor

Responsible Party

The responsible task leader will be the Lead Tunnel Engineer, with input and support from the Lead Geotechnical Engineer and appropriate technical staff as needed, under direction of the Consultant Project Manager.

Output / Deliverables

- Response/review comments, within scope of Consultant's design work, to applicable submittals, shop drawings, substitution requests, RFIs, proposed change orders, and claims.

- Draft and final inspection procedures for construction acceptance and for future maintenance of the existing and new Irvington tunnels.
- Recommendations and drafts of field monitoring, testing and startup procedures, for inclusion in the Operations Manual.
- Draft and final reports on the methods used and results generated in support of field monitoring, testing, and startup.
- Field logs and notes of observations made on geologic conditions encountered during tunneling operations, and observations made from installed instrumentation and monitoring wells.
- Updated, as-built drawings based on information provided by the construction contractor.
- Tunnel geologic condition report documenting geology, water inflow, excavation advance rates, and any significant excavation/support issues encountered during tunnel construction.

Task 12: Provide Technology Transfer / Cross-Training

Purpose and Objectives

The purpose of this task is to conduct training sessions in areas related to the scope of services for design of the New Irvington Tunnel project, with the objective of transferring technical design knowledge and skills to SFPUC staff.

Assumptions

- Parts of the documents developed under other tasks can be used as some of the training material.
- For budgeting purposes, assume 150 hours for this task, including time required to prepare the training sessions and produce training material.
- For budgeting purposes and the preparation of the Fee Schedule, an allowance has been provided for this task.
- In-office training sessions will take place at the SFPUC Headquarters.

Task-Specific Approach and Associated Work Elements

Services to be provided under this task include preparing, coordinating, and providing training sessions, both in the field and in the office. These training sessions (field visits and in-office seminars) shall be independent of other workshops held for this project and other services provided for other tasks. It is however assumed that parts of the documents developed under other tasks can be used as some of the training material. In-office training sessions will take place at the SFPUC Headquarters.

Training topics will be determined jointly with SFPUC during the Design Phase. The training session formats will be established in consultation with the SFPUC.

Dependencies On / Among Other Tasks

None.

Responsible Party

The training sessions will be coordinated and scheduled by SFPUC. The Consultant Project Manager will organize the technical content of the sessions, with assistance from the Lead Tunnel Engineer, the Lead Geotechnical Engineer, and additional technical staff.

Output / Deliverables

- 50 copies of material/handouts for each training session in hard copy and 1 copy in digital format.

Task 13: Communication and Public Outreach (Optional)

Purpose and Objectives

The purpose of this Task is to provide assistance to SFPUC staff in development and implementation of public outreach and public participation activities. The objective of public outreach is to inform potentially interested parties in the planning and progress of the work. Public Outreach support will likely be needed at the onset of the project before geotechnical investigations are started and following submittal of key milestone deliverables as the project evolves. Additionally, construction related impacts and their mitigation will continue to be a "hot" topic for the public and related agencies in the project areas, particularly considering that SFPUC will have a number projects occurring in the area during the same period of time. As design and construction planning progress, Consultant will provide the SFPUC with sufficient and up-to-date information to evaluate potential impacts and develop necessary mitigation plans. A proactive approach in working with the public on such "hot" topics will help to advance and implement the project on schedule.

Assumptions

- For budgeting purposes and preparation of the Fee Schedule, an allowance has been provided for this task.
- Consultant will meet with SFPUC at the onset of the project to determine specific assistance needs and key contact people.

Task-Specific Approach and Associated Work Elements

This task will include assistance in implementation of public participation and public outreach activities in support of the detailed design of the New Irvington Tunnel Project. These might include, but are not limited to the following types of activities:

- Public Meeting Logistics
- Creation of illustrative displays, collateral material for distribution and other support for meetings related to the design work being performed. Note taking during the meeting and production of meeting follow-up documents.
- Support of SFPUC Speakers
- Assist SFPUC staff in speaking about the New Irvington Tunnel Project at local neighborhood, community, and merchant association meetings.
- Other outreach services as needed.

Dependencies On / Among Other Tasks

The key tasks that will likely initiate the need for public outreach include the Task 1, Project Management (Project Schedule details), Task 6, Geotechnical Investigations (Investigations scope and schedule), and the Task 8 Milestone deliverables (35%, 65%, and 95%-level design submittals).

Responsible Party

Consultant Project Manager will have overall responsibility for coordinating with the SFPUC to assess the scope and timing of its needs; developing scope, schedules and budgets for the needed services; and directing staff efforts to complete the agreed-upon services.

Output / Deliverables

- Illustrative displays, collateral material for distribution, and other support materials needed for public meetings related to the project.
- Minutes of meetings and follow-up documents.

Task 14: As-Needed Design and Inspection Services (Optional)

Purpose and Objectives

The purpose of this Task is to provide staff and resources on an as-needed basis to assist the SFPUC in completing necessary work associated with the design of the New Irvington Tunnel that is not specifically identified elsewhere in the Scope of Work.

Assumptions

- For budgeting purposes and the preparation of the Fee Schedule an allowance has been provided for this task.

Task-Specific Approach and Associated Work Elements

The intent of this task is to provide the SFPUC with the means to complete additional required design work not already covered elsewhere under the Scope of Services. The work to be included in this task will generally be of an unanticipated nature, based on developments or discoveries during the course of design.

Several potential work subtasks are described below. Additional subtasks will be added as needed at the discretion of the SFPUC.

- Provide as-needed design services related to the design of chemical injection systems needed to address potential water quality issues associated with the operation procedures for the new and existing Irvington tunnels. Note that the design limits at Alameda West Portal for this activity may extend eastward beyond the limits of work identified in Appendix L of the RFP.
- Procure as-needed services of a geologist to review relevant reports and perform geological assessment of the Escobar and Telles properties including mapping of underground springs and existing facilities constructed on the Telles and Escobar properties per the 1949 agreement connecting to the existing Irvington Tunnel.
- Provide additional as-needed design services related to connection of new and existing Alameda Siphons to new and existing tunnel, including coordination of construction contracts.

Dependencies On / Among Other Tasks

None. However, Consultant shall confer with the SFPUC early on in the project to assess the timing and extent of SFPUC's needs and resources.

Responsible Party

The Consultant Project Manager will have overall responsibility for coordinating with the SFPUC to assess the scope and timing of its needs; developing scope, schedules and budgets for the needed services; and directing staff efforts to complete the agreed-upon services.

Output / Deliverables

Design deliverables, reports, and/or other documents, as required; to be defined as part of the scoping process for each work subtask required by the SFPUC.

2. Additional Services

Contractor may also be asked to provide the following services:

- Presentations to the SFPUC, the Board of Supervisors, and neighborhood or community meetings;
- Professional consultations and peer review;
- Field inspections and field or crisis management at project sites. Confined space entry may be required;
- Ability and willingness to obtain unusual or specific expertise on short notice;
- Emergency response; and
- Other services, in addition to the above, which will be negotiated between the SFPUC and Contractor as part of the scope of work of that task.

3. Reports

Contractor shall submit written reports as requested by the SFPUC Project Manager. Reports shall be thorough, competent and professional. Draft reports submitted for review shall be analyzed for technical content. Clarity, language or technical content shall be grounds for resubmission as referred to in Contract Item 11 describing "Acceptance of Work". The SFPUC Project Manager shall determine the format for the content of such reports. Submission of all reports shall be in accordance with the schedule set forth in individual task orders. The reports, including any copies, shall be submitted on recycled paper and printed on double-sided pages to the maximum extent possible.

4. Performance of Services

Performance of engineering services for Agreement No. CS-820, Engineering Services, The New Irvington Tunnel, will be executed according to a task order process. The SFPUC Project Manager will initially identify tasks and request the contractor to prepare a work scope, sub tasks, staffing plan, DBE utilization, schedule, deliverables, budget and costs to complete the tasks in accordance with this Agreement and the Consultant's proposal. A final task order scope will be negotiated between the SFPUC Project Manager and the Contractor and then submitted to Project Management Bureau Manager for approval. Labor rates, overhead rates and certain other unit costs or prices, including profit will be in accordance with Appendix B. However, as provided in the RFP, the budget identified for tasks in Appendix B is an estimate, and the City reserves the right to modify the budget allocated to any task as more specific information concerning the task order scope becomes available.

The task order request will be processed for Controller certification of funding, after which a *Notice to Proceed* will be issued. The Contractor is hereby notified that work cannot commence until the Contractor receives a written Notice to Proceed in accordance with Chapter 6 of the San Francisco Administrative Code. ***Any work performed without a Notice to Proceed will be at the Contractor's own commercial risk.*** The calculations of costs and methods of compensation for all task orders under this contract shall be in accordance with the negotiated master contract and billing rates set forth in Appendix B.

5. Department Liaison

In performing the services provided for in this Agreement, Contractor's liaison with the SFPUC will be the Project Manager, Gilbert Tang.

6. Performance Evaluation

Performance evaluations support the SFPUC's objective of continuously improving the quality of Contractor services. The SFPUC may or may not, at its sole discretion, conduct evaluation(s) of Contractor's performance. Ratings are ultimately the decision of the SFPUC and are not subject to negotiation with the Contractor. Contractor may provide comments on a performance evaluation form if an evaluation is performed. In the event that the SFPUC conducts performance evaluation(s) of Contractor, such performance evaluation(s) shall not confer any express or implied rights upon Contractor, nor shall they shift any liability to the SFPUC for Contractor's performance of the contract.

7. Anticipated Task Schedule

Task No.	Task Name	Orig Dur	Early Start	Early Finish	Labor Hours
	General	**0 mons**	**Wed 7/5/06**	**Wed 7/5/06**	
	Notice to Proceed	0 mons	Wed 7/5/06	Wed 7/5/06	
1	**Management and Coordination of Consultants Services**	**26 mons**	**Wed 7/5/06**	**Tue 7/1/08**	**4256**
1.1	Develop Management Work Plan (MWP)	1.25 mons	Wed 7/5/06	Tue 8/8/06	
	Draft Management Work Plan	0 mons	Wed 7/19/06	Wed 7/19/06	
	Final Management Plan	0 mons	Wed 8/9/06	Wed 8/9/06	
1.2	Prepare for and Attend Project Kick-off Meeting	0 mons	Thu 7/13/06	Thu 7/13/06	
	Meeting Minutes from Kick-off meeting	0 mons	Mon 7/17/06	Mon 7/17/06	
1.4	Prepare, Present Interim and Final Design Submittals	9.15 mons	Wed 8/15/07	Fri 4/25/08	
	Present 35% Design	0 mons	Wed 8/15/07	Wed 8/15/07	
	Present 65% Design	0 mons	Wed 12/19/07	Wed 12/19/07	

Task No.	Task Name	Orig Dur	Early Start	Early Finish	Labor Hours
	Present 95% Design	0 mons	Fri 4/25/08	Fri 4/25/08	
1.7	Maintain Project Files	26 mons	Wed 7/5/06	Tue 7/1/08	
	Records Turnover	0 mons	Tue 7/1/08	Tue 7/1/08	
1.8	Coordinate Work Product Review Comments	0 mons	Wed 7/5/06	Wed 7/5/06	
	Response to Review Comments for 35 % Design	0 mons	Wed 9/5/07	Wed 9/5/07	
	Response to Review Comments for 65 % Design	0 mons	Tue 1/8/08	Tue 1/8/08	
	Response to Review Comments for 95 % Design	0 mons	Fri 5/9/08	Fri 5/9/08	
2	**Quality Assurance/Quality Control**	**26 mons**	**Wed 7/5/06**	**Tue 7/1/08**	**1564**
2.1	Quality Assurance/Quality Control	26 mons	Wed 7/5/06	Tue 7/1/08	
	Draft QA/QC Plan	0 mons	Wed 7/19/06	Wed 7/19/06	
	Final QA/QC Plan	0 mons	Wed 8/9/06	Wed 8/9/06	
3	**Review Background Information**	**5.4 mons**	**Fri 7/14/06**	**Tue 12/12/06**	**826**
3.1	Review Background Information	5.4 mons	Fri 7/14/06	Tue 12/12/06	
	Draft Technical Memorandum	0 mons	Tue 11/21/06	Tue 11/21/06	
	Final Technical Memorandum	0 mons	Tue 12/12/06	Tue 12/12/06	
4	**Establish Design Criteria**	**2.5 mons**	**Wed 10/4/06**	**Wed 12/13/06**	**1296**
4.1	Establish Design Criteria	2.5 mons	Wed 10/4/06	Wed 12/13/06	
	Draft Design Criteria Technical Memorandum	0 mons	Tue 11/21/06	Tue 11/21/06	
	Final Design Criteria Technical Memorandum	0 mons	Tue 12/12/06	Tue 12/12/06	
5	**Conduct Necessary Surveying, Mapping, and Underground Utility Search**	**3 mons**	**Fri 7/14/06**	**Thu 10/5/06**	**1044**
5.1	Conduct Necessary Surveying, Mapping, and Underground Utility Search	3 mons	Fri 7/14/06	Thu 10/5/06	
	Utility Drawings	0 mons	Thu 9/7/06	Thu 9/7/06	
	Draft Technical Memorandum	0 mons	Thu 9/7/06	Thu 9/7/06	
	Final Technical Memorandum in 3 Months from NTP	0 mons	Thu 10/5/06	Thu 10/5/06	
6	**Perform Geotechnical Investigation and Site Characterization**	**9.05 mons**	**Fri 7/14/06**	**Fri 3/23/07**	**6324**

Task No.	Task Name	Orig Dur	Early Start	Early Finish	Labor Hours
6.1	Develop Geotechnical Investigation and Site Characterization Work Plan	1.75 mons	Wed 7/26/06	Tue 9/12/06	
	Draft Work Plan	0 mons	Tue 8/22/06	Tue 8/22/06	
	Final Work Plan	0 mons	Wed 9/13/06	Wed 9/13/06	
6.2	Geologic Mapping and Well and Spring Survey	1.05 mons	Wed 9/13/06	Wed 10/11/06	
6.3	Environmental Clearance and Reporting	6 mons	Fri 7/14/06	Thu 12/28/06	
6.4	Fault Tracing and Seismic Refraction Surveys	1 mon	Mon 11/6/06	Fri 12/1/06	
6.5	Subsurface Investigations and Lab Testing	5 mons	Mon 11/6/06	Fri 3/23/07	
7	**Prepare Geotechnical Reports**	**15.6 mons**	**Thu 2/8/07**	**Fri 4/18/08**	**3050**
7.1	Prepare Draft and Final Geotechnical Data Report (GDR)	4.6 mons	Thu 2/8/07	Fri 6/15/07	
	Draft GDR in 10 Months from NTP	0 mons	Fri 5/4/07	Fri 5/4/07	
	Final GDR	0 mons	Fri 6/15/07	Fri 6/15/07	
7.2	Prepare Draft and Final Geotechnical Interpretive Report (GIR)	5.25 mons	Mon 6/18/07	Fri 11/9/07	
	Draft GIR	0 mons	Wed 8/8/07	Wed 8/8/07	
	Final GIR	0 mons	Mon 12/10/07	Mon 12/10/07	
7.3	Prepare Draft and Final Geotechnical Baseline Report (GBR)	6.85 mons	Thu 9/6/07	Fri 3/14/08	
	Draft GBR	0 mons	Mon 12/10/07	Mon 12/10/07	
	Final GBR	0 mons	Fri 4/18/08	Fri 4/18/08	
8	**Design and Prepare the Construction Contract Documents**	**19.55 mons**	**Wed 12/13/06**	**Wed 6/11/08**	**24690**
8.1	Design Development	12.5 mons	Wed 12/13/06	Tue 11/27/07	
8.2	Preliminary Design (35% Level)	6.45 mons	Fri 2/9/07	Wed 8/8/07	
	35 % Design Report	0 mons	Wed 8/8/07	Wed 8/8/07	
	35 % Design Drawings	0 mons	Wed 8/8/07	Wed 8/8/07	
8.3	Detailed Design (65% Level)	3.4 mons	Thu 9/6/07	Mon 12/10/07	
	65 % Design Documents	0 mons	Mon 12/10/07	Mon 12/10/07	
8.4	Detailed Design (95% Level)	3 mons	Mon 1/28/08	Fri 4/18/08	
	95% Design Documents	0 mons	Fri 4/18/08	Fri 4/18/08	

Task No.	Task Name	Orig Dur	Early Start	Early Finish	Labor Hours
8.5	Bid Ready Design (100% Level)	1 mon	Thu 5/15/08	Wed 6/11/08	
	Bid Ready Construction Documents in 24 Months from NTP	0 mons	Wed 6/11/08	Wed 6/11/08	
9	**Provide Engineering Support Services for Environmental Assessment**	**80.9 mons**	**Wed 7/5/06**	**Fri 9/14/12**	**124**
10	**Provide Engineering Support Services During Bid and Award**	**6.95 mons**	**Wed 8/20/08**	**Mon 3/2/09**	**279**
11	**Provide Engineering Support Services During Construction**	**46.2 mons**	**Tue 3/3/09**	**Fri 9/14/12**	**3078**
12	**Provide Technology Transfer / Cross-Training**	**80.9 mons**	**Wed 7/5/06**	**Fri 9/14/12**	**146**
13	**Communication and Public Outreach (Optional)**	**80.9 mons**	**Wed 7/5/06**	**Fri 9/14/12**	**146**
14	**As-Needed Design and Inspection Services (Optional)**	**0.05 mons**	**Wed 7/5/06**	**Wed 7/5/06**	**2321**

Appendix B
Calculation of Charges

As part of Contractor's proposal, dated February 28, 2006, Contractor submitted, in detail, proposed costs and fees for requested task(s) in a Fee Schedule, attached hereto as part of Appendix B-1. However, as provided in the RFP, the budget identified for tasks in Appendix B is an estimate, and the City reserves the right to modify the budget allocated to any task as more specific information concerning the task order scope becomes available.

Contractor, with the assistance of the SFPUC, will be required to define the detailed scope for tasks under this Agreement. All costs associated with the development of the scope of work shall be borne by Contractor.

Eligibility of project costs, direct and overhead, will be determined per the Code of Federal Acquisition Regulations (FAR)—Title 48, Volume I, Parts 1-51 and other appropriate financial standards.

Pursuant to San Francisco Administrative Code §21.35, any Contractor, subcontractor or contractor who submits a false claim shall be liable to the City for three times the amount of damages which the City sustains because of the false claim. A Contractor, subcontractor or contractor who submits a false claim shall also be liable to the City for the costs, including attorneys' fees, of a civil action brought to recover any of those penalties or damages, and may be liable to the City for a civil penalty of up to $10,000 for each false claim. A contractor, subcontractor or contractor will be deemed to have submitted a false claim to the City if the contractor, subcontractor or contractor: (a) knowingly presents or causes to be presented to an officer or employee of the City a false claim or request for payment or approval; (b) knowingly makes, uses, or causes to be made or used a false record or statement to get a false claim paid or approved by the City; (c) conspires to defraud the City by getting a false claim allowed or paid by the City; (d) knowingly makes, uses, or causes to be made or used a false record or statement to conceal, avoid, or decrease an obligation to pay or transmit money or property to the City; or (e) is a beneficiary of an inadvertent submission of a false claim to the City, subsequently discovers the falsity of the claim, and fails to disclose the false claim to the City within a reasonable time after discovery of the false claim.

1. **Billing Rate & Effective Project Multiplier**:

Contractor's billing rates provided in the Fee Schedule, attached hereto as Appendix B-1 will be the billing rate for the listed individuals. Contractor will be allowed to escalate its 2006 billing rates based only on the annual percentage change of the Consumer Price Index (CPI) for the San Francisco Bay Area for Urban Wage Earners and Clerical Workers. The Effective Project Multiplier will apply to the billing rate of substitute and unnamed staff and subcontractors assigned later. The Effective Project Multiplier will apply to all contract Amendments. Contractor's billing rates are not subject to audit with respect to the makeup or composition of the rates but actual salary must be verifiable by certified payroll records.

The billing rate for each listed individual may not exceed the lowest rate charged to any other governmental entity. Additionally, billing rates shall not exceed Federal Acquisition Regulations (FAR) or Generally Accepted Accounting Principles (GAAP) rate, whichever is applicable, if both, whichever is lowest.

- Direct Labor is limited to actual salaries of project personnel
- Effective Project Multiplier: **2.77**

2. **Staff Changes**: The SFPUC Project Manager/Bureau Manager must approve the assignment of staff prior to beginning a task order as well as any staff changes proposed by Contractor. The SFPUC

2. **Staff Changes**: The SFPUC Project Manager/Bureau Manager must approve the assignment of staff prior to beginning a task order as well as any staff changes proposed by Contractor. The SFPUC Project Manager must also approve **in writing** any personnel changes proposed by Contractor after Notice to Proceed has been issued. The City will only approve project staff substitutions where that change in personnel is requested by the City and/or beyond the control of the Contractor. Individuals listed in the Fee Schedule and for whom resumes and qualifications have been submitted as part of the proposal are expected to be provided to the project team. Hourly billing rates for substituted staff and staff assigned later shall be calculated by multiplying the actual hourly salary of an employee by Contractor's Effective Project Multiplier. The Effective Project Multiplier includes direct rate, overhead (including other direct and miscellaneous costs), salary burden, fringe benefits and profit.

3. **Additional Subcontractors:** Second-tier and pass-through subcontracting is prohibited. However, in the event that the prime Contractor and its approved subcontractors lack the necessary skills or expertise to perform requested services that are within the scope of the contract, additional subcontractors may be added to the Contractor team after obtaining pre-authorization by the SFPUC Project Manager and Bureau/Division Manager.

4. **Other Direct Costs (ODC):** Most indirect costs are expected to be included in the firm's fringe and overhead categories. Costs that are not attributable to direct labor or otherwise not captured through overhead rates are classified as ODC's and subject to pre-approval in writing by the SFPUC Project Manager and Bureau/Division Manager.

Clerical and administrative costs shall be included as part of the overhead rate. The only exception to this provision shall be clerical and administrative time utilized in the production of a specific deliverables. ODC's shall not include any labor charges or pass-throughs. Meals including refreshments and working lunches with SFPUC staff will not be reimbursed. Invoice preparation will not be allowed. All ODC's will be reimbursed at actual cost and no mark up shall be included.

The following ODC's will be eligible for reimbursement. All other ODC's must be pre-approved in writing with supporting documentation.

A) Travel and Relocation. In accordance with guidance and policies established by the Office of the Controller and the applicable Federal Agencies, will be reimbursed at cost or applicable Continental U. S. travel per diem Allowances (CONUS) rates whichever is lower, and with proper documentation:

- Travel expenses **outside** the nine Bay Area counties, for travel per Federal Travel Regulations (http://www.gsa.gov), to include: transportation, lodging, meals and incidentals such as bridge tolls, except for relocation and long term assigned staff working more than six months;
- Travel expenses **inside** the nine Bay Area counties to include: 1) mileage, when privately owned vehicles (POV) are used from the home office to SFPUC facilities; 2) rental car reimbursement per Federal Travel Regulations (http://www.gsa.gov) and with prior approval; 3) local travel (bus, taxi, rail, POV) from home office to SFPUC facilities; and
- Relocation Costs: During the project, if staff assigned short term (less than six months) with special skills is needed for specific tasks and those skills are not available from Contractor staff in the San Francisco Bay Area, travel and temporary housing costs may be charged to the contract if those charges are pre-approved by the SFPUC. Any travel and temporary housing costs will be reimbursed at cost or the Federal

Government's CONUS standards, whichever is lower. The SFPUC will not pay relocation costs for Contractor staff assigned to the contract on a full-time or on-going basis more than six months

B) Communications/Mail/Reprographics, in accordance with the guidance and policies established by the Office of the Controller and the applicable Federal Agencies, and with proper documentation:

- Overnight/priority mail related to a specific deliverable identified in the task order;
- Long distance/toll telephone calls and facsimiles from remote locations (not Contractor's home office); and
- Reprographics and printing at remote locations (not Contractor's home office) and/or for special requirements.

C) Equipment/Computers/Utilities/Facilities, in accordance with the guidance and policies established by the Office of the Controller and the applicable Federal Agencies, and with proper documentation:

- Use of specialty computer hardware, software and project equipment not provided by the SFPUC and identified in Contractor's proposal and approved by PM/Bureau Manager on the task order;
- Telecommunications lines/Utility hook ups to remote locations when required and identified in Contractor's proposal and approved by PM on the task order; and
- Conference Rooms required for briefings/presentations at remote locations identified in Contractor's proposal.

D) Other, in accordance with the guidance and policies established by the Office of the Controller and the applicable Federal Agencies:

- Laboratory tests supporting a deliverable and identified in the task order; and
- Permits, as required by Federal, State, and local governments.

5. **Subconsultant Fees**:

- Subject to above restrictions;
- Shall be subject to written pre-approval by the SFPUC Project Manager; and
- Subcontractor administration markup is limited to *actual cost not to exceed 5%.*

6. **Direct Labor Rates**: Direct labor payroll rates can be adjusted annually limited to a maximum of the CPI (San Francisco Bay Area for Urban Wage Earners and Clerical Workers) for the previous year. Adjustments for individual Contractor employees may exceed the maximum provided that the total adjustment dollars for Contractor employees dedicated to this contract do not exceed the maximum dollars based on the total direct salary paid on the contract for the previous year plus the CPI.

7. **Retention**: Five percent (5%) of each invoice payment will be withheld for each task order. When the work for the task order or defined critical milestones has been completed to the satisfaction of the SFPUC Project Manager and all work products have been received and approved by the SFPUC Project Manager, Contractor may request that the retention be released. In lieu of money retention, an irrevocable letter of credit acceptable to the City will be accepted.

8. **Invoice Requirements**: Contractor shall submit one original invoice package with the appropriate HRC reporting forms and supporting documentation to substantiate the time, mileage

and ODCs for the prime and subcontractors. A standard invoice format shall be developed by Contractor anticipating project complexity and used thereafter. Each invoice must be with an HRC Form No. 7 to identify the participation and amount payable to subcontractors. Timesheets, cards or logs must include a brief description memorializing, on a daily basis, when and what work was performed. Mileage logs must include the beginning and ending mileage to substantiate the variable portal-to-portal distance and local driving required while performing the work. Any "Other Direct Costs" must be substantiated with receipts including a brief description for each receipt memorializing the purpose. Complete invoice packages should be sent directly to the SFPUC Project Manager.

HRC Form No. 9 must be sent to the Project Manager within ten (10) days of receiving payment for each invoice to document the subcontractor's payment by the prime Contractor.

HRC Form No. 8 must be sent to the Project Manager with the final invoice for each task order to authenticate the total subcontractor participation and close out the Purchase Order Release.

9. **Audited financial Statements:** Within ninety (90) days after the end of Contractor's fiscal year, Contractor shall submit to client year-end financial statements and an unqualified audit report certified by an independent Certified Public Accountant (CPA). This report shall state that the audit was conducted in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in Government Auditing Standards, issued by the comptroller General of the United States. Contractor shall also provide schedules of indirect cost rates and accompanying audit report by its independent Certified Public Accountant. This report shall also state that the audit was conducted in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in Government Auditing Standards, issued by the Comptroller General of the United States, and that the schedule of indirect cost rates were prepared on the basis of accounting practices prescribed by Chapter 1, Part 31, of the Federal Acquisition Regulation (FAR) and other applicable federal and state regulations. Contractor shall pay for the cost of the foregoing audit.

10. **Audit**: All costs submitted for payment by Contractor are subject to audit as stipulated in Section 28 (a) Audit and Inspection of Records. Contractor's billing rates are not subject to audit with respect to the makeup or composition of the rates but actual salary must be verifiable by certified payroll records.

CS-820: Engineering Services for the New Irvington Tunnel
URS Corporation

FEE SCHEDULE APPENDIX B-1

Task No. [A]	Task Summary [B]	Staff Classification [C]	Name of Proposed Staff Person [D]	Consultant Name [E]	Estimated Number of Hours [F]	Base Hourly Rate ($/hour) [G]	Base Labor Cost ($) = (F)*(G) [H]	Billing Rate ($/hour) [I]	Actual Labor Cost ($) = (F)*(I) [J]
1	Management and Coordination of Consultant Services:	Project/Engineering Manager	John Bischoff	URS	1,660	$113.00	$187,580	$250.00	$415,000
		Project Principal	Noel Wong	URS	160	$78.40	$12,544	$200.00	$32,000
		Lead Geotechnical Engineer	Ted Feldsher	URS	260	$47.24	$12,282	$133.22	$34,636
		QA/QC Coordinator	Chris Mueller	URS	140	$69.24	$9,694	$195.26	$27,336
		Lead Civil/Pipeline Engineer	Dan Drew	URS	120	$46.40	$5,568	$130.85	$15,702
		Graduate Civil/Geotechnical Engineer	Sathish Murugaiah	URS	240	$28.40	$6,816	$80.09	$19,221
		Project Assistant	Dan Mattox	URS	800	$24.68	$19,744	$69.60	$55,678
		Senior Graphic Designer	Lisa Jackson	URS	80	$30.56	$2,445	$86.18	$6,894
		Project Assistant	Oxana Sounkova	URS	240	$19.72	$4,733	$55.61	$13,346
		Word Processor	Iris Eschen	URS	144	$23.56	$3,393	$66.44	$9,567
		Lead Tunnel Engineer	Glenn Boyce	JA	320	$61.80	$19,776	$182.31	$58,339
		Senior Tunnel Consultant	Steve Klein	JA	16	$82.00	$1,312	$200.00	$3,200
		Principal Geologist 2	Keith Kelson	WLA	60	$66.35	$3,981	$180.00	$10,800
		Principal Geologist 1	John Baldwin	WLA	16	$54.18	$867	$160.00	$2,560
				TASK 1 TOTAL	4,256	-	$290,734	-	$704,281
2	Quality Assurance/Quality Control:	Project/Engineering Manager	John Bischoff	URS	80	$113.00	$9,040	$250.00	$20,000
		QA/QC Coordinator	Chris Mueller	URS	524	$69.24	$36,282	$195.26	$102,315
		Technical Advisory Panel	Tom Martin	URS	120	$75.00	$9,000	$200.00	$24,000
		Senior Constructability Reviewer	Carl Linden	URS	80	$84.16	$6,733	$200.00	$16,000
		Senior Geotechnical Engineer	Carlos Jaramillo	URS	120	$58.66	$7,039	$165.42	$19,851
		Senior Civil Engineer	Gregory Reichert	URS	80	$63.72	$5,098	$179.69	$14,375
		Project Principal	Noel Wong	URS	80	$78.40	$6,272	$200.00	$16,000
		Senior Engineering Geologist	David Simpson	URS	80	$48.76	$3,901	$137.50	$11,000
		Senior Civil Engineer	Dwyane Deutscher	URS	40	$62.52	$2,501	$176.31	$7,052
		Senior Tunnel Consultant	Steve Klein	JA	120	$82.00	$9,840	$200.00	$24,000
		Technical Advisory Panel	Jack Lemley	LA	120	$200.00	$24,000	$200.00	$24,000
		Technical Advisory Panel	Gregg Korbin	IC	120	$200.00	$24,000	$200.00	$24,000
				TASK 2 TOTAL	1,564	-	$143,705	-	$302,593
3	Review Background Information:	Project/Engineering Manager	John Bischoff	URS	32	$113.00	$3,616	$250.00	$8,000
		Lead Engineering Geologist	Mark Schmoll	URS	40	$54.84	$2,194	$154.65	$6,186
		Lead Geotechnical Engineer	Ted Feldsher	URS	60	$47.24	$2,834	$133.22	$7,993
		Senior Tunnel Engineer	Todd Wanless	URS	40	$51.72	$2,069	$145.85	$5,834
		Project Civil/Geotechnical Engineer	Samuel Gambino	URS	160	$36.56	$5,850	$103.10	$16,496
		Civil Engineer	Nikolai Meyer	URS	80	$29.56	$2,365	$83.36	$6,668
		Graduate Geologist	Kyle Wolfe	URS	80	$24.04	$1,923	$67.79	$5,423
		Lead Tunnel Engineer	Glenn Boyce	JA	40	$61.80	$2,472	$182.31	$7,292
		Project Tunnel Engineer	Dave Hopkins	JA	40	$37.90	$1,516	$111.81	$4,472
		Staff Tunnel Engineer	Brad Murray	JA	160	$29.70	$4,752	$87.62	$14,018
		Principal Geologist 2	Keith Kelson	WLA	8	$66.35	$531	$180.00	$1,440
		Principal Geologist 1	John Baldwin	WLA	16	$54.18	$867	$160.00	$2,560
		Project Geologist	Justin Pearce	WLA	30	$34.28	$1,028	$105.00	$3,150
		Senior Civil Engineer	Dave McPherson	MWH	40	$42.13	$1,685	$134.82	$5,393
				TASK 3 TOTAL	826	-	$33,702	-	$94,927

CS-820: Engineering Services for the New Irvington Tunnel
URS Corporation

FEE SCHEDULE APPENDIX B-1

Task No. [A]	Task Summary [B]	Staff Classification [C]	Name of Proposed Staff Person [D]	Consultant Name [E]	Estimated Number of Hours [F]	Base Hourly Rate ($/hour) [G]	Base Labor Cost ($) = (F)*(G) [H]	Billing Rate ($/hour) [I]	Actual Labor Cost ($) = (F)*(I) [J]
4	Establish Design Criteria:	Project/Engineering Manager	John Bischoff	URS	40	$113.00	$4,520	$250.00	$10,000
		Lead Geotechnical Engineer	Ted Feldsher	URS	120	$47.24	$5,669	$133.22	$15,986
		Senior Geotechnical Engineer	Carlos Jaramillo	URS	120	$58.66	$7,039	$165.42	$19,851
		Senior Civil Engineer	Gregory Reichert	URS	100	$63.72	$6,372	$179.69	$17,969
		Lead Civil/Pipeline Engineer	Dan Drew	URS	140	$46.40	$6,496	$130.85	$18,319
		Project Electrical Engineer	Henry Oquendo	URS	140	$36.64	$5,130	$103.32	$14,465
		Senior Civil Engineer	Dwyane Deutscher	URS	120	$62.52	$7,502	$176.31	$21,157
		Control Systems Specialist	Mike Worthington	URS	80	$42.80	$3,424	$120.70	$9,656
		Senior Tunnel Consultant	Steve Klein	JA	40	$82.00	$3,280	$200.00	$8,000
		Lead Tunnel Engineer	Glenn Boyce	JA	80	$61.80	$4,944	$182.31	$14,585
		Senior Tunnel Engineer	David Crouthamel	JA	80	$55.45	$4,436	$163.58	$13,086
		Staff Tunnel Engineer	Brad Murray	JA	80	$29.70	$2,376	$87.62	$7,009
		Principal Geologist 2	Keith Kelson	WLA	8	$66.35	$531	$180.00	$1,440
		Principal Geologist 1	John Baldwin	WLA	8	$54.18	$433	$160.00	$1,280
		Senior Pipeline Engineer	John Bergen	MWH	40	$62.81	$2,512	$200.00	$8,000
		Principal Structural Engineer	Craig Wilcox	MWH	60	$66.96	$4,018	$200.00	$12,000
		Senior Engineer	Dan Crosby	MWH	40	$45.02	$1,801	$144.06	$5,762
				TASK 4 TOTAL	**1,296**	**-**	**$70,483**	**-**	**$198,565**
5	Conduct Necessary Surveying, Mapping and Underground Utility Se	Senior Civil Engineer	Sunjan Punyamurthula	URS	120	$58.68	$7,042	$165.48	$19,857
		Lead Geotechnical Engineer	Ted Feldsher	URS	120	$47.24	$5,669	$133.22	$15,986
		Lead Civil/Pipeline Engineer	Dan Drew	URS	60	$46.40	$2,784	$130.85	$7,851
		Supervising Senior Surveyor	Skip Christensen	URS	24	$70.92	$1,702	$199.99	$4,800
		Project Surveyor	Robert Abbott	URS	60	$44.00	$2,640	$124.08	$7,445
		Survey Party Chief	Irving Kurasaki	URS	60	$40.20	$2,412	$113.36	$6,802
		Rod/Instrument Technician	Christopher Daniels	URS	60	$29.18	$1,750	$82.23	$4,934
		Civil Engineer	Nikolai Meyer	URS	80	$29.56	$2,365	$83.36	$6,669
		Senior CADD Designer	Nadine Hutton	URS	80	$34.48	$2,758	$97.23	$7,779
		CADD Technician	Salvador Godinez	URS	120	$25.32	$3,038	$71.40	$8,568
		Principal Engineer	Meonor Chan	TEC	80	$45.00	$3,600	$132.75	$10,620
		Engineer III	Stella Chiu	TEC	100	$28.84	$2,884	$85.08	$8,508
		CAD Drafter II	Irene Liu	TEC	80	$25.99	$2,079	$76.67	$6,134
				TASK 5 TOTAL	**1,044**	**-**	**$40,723**	**-**	**$115,952**
6	Perform Geotechnical Investigation and Site Characterization:	Project/Engineering Manager	John Bischoff	URS	80	$113.00	$9,040	$250.00	$20,000
		Lead Engineering Geologist	Mark Schmoll	URS	480	$54.84	$26,323	$154.65	$74,231
		Lead Geotechnical Engineer	Ted Feldsher	URS	512	$47.24	$24,187	$133.22	$68,207
		Senior Geotechnical Engineer	Leilo Mejia	URS	80	$75.00	$6,000	$200.00	$16,000
		Project Civil Engineer	Jim Zhang	URS	300	$43.28	$12,984	$122.05	$36,615
		Project Hydrogeologist	Peter Sinton	URS	300	$44.68	$13,404	$126.00	$37,799
		Senior Instrumentation Engineer	John Paxton	URS	80	$43.28	$3,462	$122.05	$9,764
		Project Civil/Geotechnical Engineer	Samuel Gambino	URS	600	$36.56	$21,936	$103.10	$61,860
		Civil/Geotechnical Engineer	Jiaer Wu	URS	320	$32.24	$10,317	$90.92	$29,093
		Graduate Civil/Geotechnical Engineer	Shobhna Upadhyaya	URS	120	$29.36	$3,523	$82.80	$9,935
		Civil/Geotechnical Engineer	Segaran Logeswaran	URS	60	$30.32	$1,819	$85.50	$5,130
		Graduate Geologist	Kyle Wolfe	URS	640	$24.04	$15,386	$67.79	$43,387
		Senior Field Technician	Rogelio Taraya	URS	80	$28.63	$2,290	$80.74	$6,459
		Senior CADD Designer	Nadine Hutton	URS	80	$34.48	$2,758	$97.23	$7,779
		CADD Technician	Salvador Godinez	URS	100	$25.32	$2,532	$71.40	$7,140

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		Word Processor	Iris Eschen	URS	80	$23.56	$1,885	$66.44	$5,315
		Senior Environmental Scientist	Bill Martin	URS	160	$45.68	$7,309	$128.82	$20,611
		Senior Biologist	Steve Leach	URS	60	$60.12	$3,607	$169.54	$10,172
		Senior Anthropologist	Brian Hatfoff	URS	60	$48.08	$2,885	$135.59	$8,136
		Staff Environmental Scientist	Daniel Weinberg	URS	240	$26.64	$6,394	$75.12	$18,030
		Staff Environmental Scientist	Michelle St. Clair	URS	160	$25.24	$4,038	$71.18	$11,388
		Lead Tunnel Engineer	Glenn Boyce	JA	40	$61.80	$2,472	$182.31	$7,292
		Project Tunnel Engineer	Yiming Sun	JA	240	$49.70	$11,928	$146.62	$35,188
		Principal Geologist 2	Keith Kelson	WLA	64	$66.35	$4,246	$180.00	$11,520
		Principal Geologist 1	John Baldwin	WLA	80	$54.18	$4,334	$160.00	$12,800
		Project Geologist	Justin Pearce	WLA	196	$34.28	$6,719	$105.00	$20,580
		Staff Geologist	Robert Givler	WLA	168	$32.07	$5,388	$83.00	$13,944
		GIS Operator	David Slayter	WLA	48	$37.60	$1,805	$106.00	$5,088
		Graphic Illustrator	Jason Holmberg	WLA	8	$30.96	$248	$78.00	$624
		Technical Typist	Thea Carrillo	WLA	8	$26.54	$212	$72.00	$576
		Principal Geotechnical Engineer	Robert Chew	RYCGI	80	$65.38	$5,230	$180.00	$14,400
		Senior Geotechnical Engineer	Mark McKee	RYCGI	260	$39.28	$10,213	$113.64	$29,546
		Project Engineer	Eric Ntmbakwa	RYCGI	120	$28.61	$3,433	$82.77	$9,932
		Senior Geotechnical Engineer	Bahram Khamenehpour	AGS	80	$66.00	$5,280	$192.72	$15,418
		Project Engineer	Mikko Valkonen	AGS	220	$35.50	$7,810	$103.66	$22,805
		Staff Engineer	Douglas Herold	AGS	120	$25.50	$3,060	$74.46	$8,935
				TASK 6 TOTAL	**6,324**	**-**	**$254,458**	**-**	**$715,791**
7	Prepare Geotechnical Reports	Project/Engineering Manager	John Bischoff	URS	80	$113.00	$9,040	$250.00	$20,000
		Lead Geotechnical Engineer	Ted Feldsher	URS	320	$47.24	$15,117	$133.22	$42,629
		Senior Geotechnical Engineer	Carlos Jaramillo	URS	80	$58.66	$4,693	$165.42	$13,234
		Senior Geotechnical Engineer	Lelio Mejia	URS	24	$75.00	$1,800	$200.00	$4,800
		Senior Tunnel Engineer	Galen Klein	URS	80	$51.20	$4,096	$144.38	$11,551
		Lead Engineering Geologist	Mark Schmoll	URS	120	$54.84	$6,581	$154.65	$18,558
		Senior Engineering Geologist	David Simpson	URS	80	$48.76	$3,901	$137.50	$11,000
		Senior Tunnel Engineer	Todd Wanless	URS	80	$51.72	$4,138	$145.85	$11,668
		Project Civil/Geotechnical Engineer	Samuel Gambino	URS	320	$36.56	$11,699	$103.10	$32,992
		Graduate Civil/Geotechnical Engineer	Sathish Murugaiah	URS	360	$28.40	$10,224	$80.09	$28,832
		Senior CADD Designer	Nadine Hutton	URS	80	$34.48	$2,758	$97.23	$7,779
		CADD Technician	Salvador Godinez	URS	80	$25.32	$2,026	$71.40	$5,712
		Senior Graphic Designer	Lisa Jackson	URS	40	$30.56	$1,222	$86.18	$3,447
		Lead Tunnel Engineer	Glenn Boyce	JA	80	$61.80	$4,944	$182.31	$14,585
		Senior Tunnel Engineer	Rick Notting	JA	310	$62.40	$19,344	$184.08	$57,065
		Staff Tunnel Engineer	Brad Murray	JA	280	$29.70	$8,316	$87.62	$24,532
		Principal Geologist 2	Keith Kelson	WLA	72	$66.35	$4,777	$180.00	$12,960
		Principal Geologist 1	John Baldwin	WLA	64	$54.18	$3,468	$160.00	$10,240
		Project Geologist	Justin Pearce	WLA	120	$34.28	$4,114	$105.00	$12,600
		Staff Geologist	Robert Givler	WLA	48	$32.07	$1,539	$83.00	$3,984
		GIS Operator	David Slayter	WLA	64	$37.60	$2,406	$106.00	$6,784
		Graphic Illustrator	Jason Holmberg	WLA	96	$30.96	$2,972	$78.00	$7,488
		Technical Typist	Thea Carrillo	WLA	32	$26.54	$849	$72.00	$2,304
		Principal Engineer	Mennor Chan	TEC	40	$45.00	$1,800	$132.75	$5,310
		CAD Drafter II	Irene Liu	TEC	100	$25.99	$2,599	$76.67	$7,667
				TASK 7 TOTAL	**3,050**	**-**	**$134,423**	**-**	**$377,720**

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8	Final Design and Construction Contract Documents	Project/Engineering Manager	John Bischoff	URS	220	$113.00	$24,860	$250.00	$55,000
		Project Principal	Noel Wong	URS	120	$78.40	$9,408	$200.00	$24,000
		Senior Risk Analyst	Ram Kulkarni	URS	80	$70.00	$5,600	$197.40	$15,792
		Senior Tunnel Engineer	Todd Wanless	URS	540	$51.72	$27,929	$145.85	$78,759
		Senior Tunnel Engineer	Galen Klein	URS	260	$51.20	$13,312	$144.38	$37,540
		Lead Geotechnical Engineer	Ted Feldsher	URS	960	$47.24	$45,350	$133.22	$127,888
		Lead Civil/Pipeline Engineer	Dan Drew	URS	840	$46.40	$38,976	$130.85	$109,912
		Facilities Security Specialist	Kevin Richmond	URS	240	$45.48	$10,915	$126.25	$30,781
		Senior Instrumentation Engineer	John Paxton	URS	220	$43.28	$9,522	$122.05	$26,851
		Control Systems Specialist	Mike Worthington	URS	260	$42.80	$11,128	$120.70	$31,381
		Project Electrical Engineer	Henry Oquendo	URS	360	$36.64	$13,190	$103.32	$37,197
		Civil Engineer	Nikolai Meyer	URS	1,040	$29.56	$30,742	$83.36	$86,694
		Senior CADD Designer	Nadine Hutton	URS	400	$34.48	$13,792	$97.23	$38,893
		CADD Technician	Salvador Godinez	URS	660	$25.32	$16,711	$71.40	$47,126
		Project Assistant	Dan Matfox	URS	360	$24.68	$8,885	$69.60	$25,055
		Word Processor	Iris Eschen	URS	440	$23.56	$10,366	$66.44	$29,233
		Lead Tunnel Engineer	Glenn Boyce	JA	2,120	$61.80	$131,016	$182.31	$386,497
		Senior Tunnel Engineer	Rick Nolting	JA	660	$62.40	$41,184	$184.08	$121,493
		Project Tunnel Engineer	Doug Hall	JA	2,020	$41.60	$84,436	$123.31	$249,086
		Staff Tunnel Engineer	Brad Murray	JA	2,420	$29.70	$71,874	$87.62	$212,028
		Project Tunnel Engineer	Dave Hopkins	JA	2,120	$37.90	$80,348	$111.81	$237,027
		Senior Tunnel Engineer	David Crouthamel	JA	800	$55.45	$44,360	$163.58	$130,862
		Senior Tunnel Engineer	Jan Van Greunen	JA	960	$61.65	$59,184	$181.87	$174,593
		Project Tunnel Engineer	Isabelle Pawlik	JA	980	$38.05	$37,289	$112.25	$110,003
		Senior Cost Engineer	John Stolz	JA	240	$63.00	$15,120	$185.85	$44,604
		Project Tunnel Engineer	Paul Dutton	JA	300	$35.35	$10,605	$104.28	$31,285
		Project Tunnel Engineer	Yiming Sun	JA	350	$49.70	$17,395	$146.62	$51,315
		Senior Tunnel Engineer	Rene Starck	JA	1,960	$48.48	$94,982	$142.96	$280,196
		Principal Engineer	Mennor Chan	TEC	260	$45.00	$11,700	$132.75	$34,515
		CAD Drafter II	Irene Liu	TEC	280	$25.99	$7,277	$76.67	$21,468
		Senior Engineer	Dan Crosby	MWH	800	$45.02	$36,016	$144.06	$115,248
		Principal Structural Engineer	Craig Wilcox	MWH	500	$66.96	$33,480	$200.00	$100,000
		Senior Electrical Engineer	Can Quach	MWH	200	$55.80	$11,160	$178.55	$35,710
		Senior Designer	Roger Sasaki	MWH	720	$46.47	$33,458	$148.70	$107,064
				TASK 8 TOTAL	**24,690**	-	**$1,111,571**	-	**$3,245,095**
9	Provide Engineering Support Services for Environmental Assessmen	Project/Engineering Manager	John Bischoff	URS	8	$113.00	$904	$250.00	$2,000
		Lead Geotechnical Engineer	Ted Feldsher	URS	50	$47.24	$2,362	$133.22	$6,661
		Senior Environmental Scientist	Bill Martin	URS	45	$45.68	$2,056	$128.82	$5,797
		Senior Graphic Designer	Lisa Jackson	URS	12	$30.56	$367	$86.18	$1,034
		Project Assistant	Oxana Sourikova	URS	9	$19.72	$177	$55.61	$500
				TASK 9 TOTAL	**124**	-	**$5,866**	-	**$15,992**

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10	Provide Engineering Support Services During Bid and Award:	Project/Engineering Manager	John Bischoff	URS	24	$113.00	$2,712	$250.00	$6,000
		Lead Geotechnical Engineer	Ted Feldsher	URS	110	$47.24	$5,196	$133.22	$14,654
		Lead Civil/Pipeline Engineer	Dan Drew	URS	20	$46.40	$928	$130.85	$2,617
		Lead Tunnel Engineer	Glenn Boyce	JA	24	$61.80	$1,483	$182.31	$4,375
		Senior Pipeline Engineer	John Bergen	MWH	8	$62.81	$502	$200.00	$1,600
		Principal Structural Engineer	Craig Wilcox	MWH	8	$66.96	$536	$200.00	$1,600
		Principal Engineer	Mennor Chan	TEC	40	$45.00	$1,800	$132.75	$5,310
		Engineer III	Stella Chiu	TEC	45	$28.84	$1,298	$85.08	$3,829
				TASK 10 TOTAL	**279**	-	**$14,456**	-	**$39,985**
11	Provide Engineering Support Services During Construction:	Project/Engineering Manager	John Bischoff	URS	40	$113.00	$4,520	$250.00	$10,000
		Senior Constructability Reviewer	Carl Linden	URS	40	$84.16	$3,366	$200.00	$8,000
		QA/QC Coordinator	Chris Mueller	URS	80	$69.24	$5,539	$195.26	$15,621
		Senior Tunnel Engineer	Galen Klein	URS	120	$51.20	$6,144	$144.38	$17,326
		Lead Geotechnical Engineer	Ted Feldsher	URS	400	$47.24	$18,896	$133.22	$53,287
		Project Tunnel Engineer	Gil Garcia	URS	80	$48.80	$3,904	$137.62	$11,009
		Lead Civil/Pipeline Engineer	Dan Drew	URS	120	$46.40	$5,568	$130.85	$15,702
		Senior Engineering Geologist	David Simpson	URS	80	$48.76	$3,901	$137.50	$11,000
		Project Geologist	Thomas Kolbe	URS	118	$40.88	$4,824	$115.28	$13,603
		Project Civil/Geotechnical Engineer	Samuel Gambino	URS	200	$36.56	$7,312	$103.10	$20,620
		Graduate Civil/Geotechnical Engineer	Sathish Murugaiah	URS	200	$28.40	$5,680	$80.09	$16,018
		Lead Tunnel Engineer	Glenn Boyce	JA	500	$61.80	$30,900	$182.31	$91,155
		Project Tunnel Engineer	Ted DePooter	JA	600	$54.55	$32,730	$160.92	$96,554
		Senior Tunnel Consultant	Carl LaFraugh	JA	500	$75.00	$37,500	$200.00	$100,000
				TASK 11 TOTAL	**3,078**	-	**$170,784**	-	**$479,894**
12	Provide Technology Transfer/Cross-Training:	Project/Engineering Manager	John Bischoff	URS	8	$113.00	$904	$250.00	$2,000
		Project Principal	Noel Wong	URS	32	$78.40	$2,509	$200.00	$6,400
		Lead Geotechnical Engineer	Ted Feldsher	URS	20	$47.24	$945	$133.22	$2,664
		QA/QC Coordinator	Chris Mueller	URS	24	$69.24	$1,662	$195.26	$4,686
		Senior Graphic Designer	Lisa Jackson	URS	22	$30.56	$672	$86.18	$1,896
		Lead Tunnel Engineer	Glenn Boyce	JA	40	$61.80	$2,472	$182.31	$7,292
				TASK 12 TOTAL	**146**	-	**$9,164**	-	**$24,939**
13	Communication and Public Outreach:	Project/Engineering Manager	John Bischoff	URS	8	$113.00	$904	$250.00	$2,000
		Project Principal	Noel Wong	URS	8	$78.40	$627	$200.00	$1,600
		Lead Geotechnical Engineer	Ted Feldsher	URS	11	$47.24	$520	$133.22	$1,465
		Senior Graphic Designer	Lisa Jackson	URS	11	$30.56	$336	$86.18	$948
		Public Outreach Specialist	Daroiyn Davis	DA	108	$60.00	$6,480	$175.56	$18,960
				TASK 13 TOTAL	**146**	-	**$8,867**	-	**$24,974**
14	As-Needed Design and Inspection Services:	Project/Engineering Manager	John Bischoff	URS	24	$113.00	$2,712	$250.00	$6,000
		Lead Geotechnical Engineer	Ted Feldsher	URS	260	$47.24	$12,282	$133.22	$34,636
		Lead Engineering Geologist	Mark Schmoll	URS	120	$54.84	$6,581	$154.65	$18,558
		Senior Engineering Geologist	David Simpson	URS	120	$48.76	$5,851	$137.50	$16,500
		Graduate Geologist	Kyle Wolfe	URS	127	$24.04	$3,053	$67.79	$8,610
		Lead Civil/Pipeline Engineer	Dan Drew	URS	320	$46.40	$14,848	$130.85	$41,871
		Senior Civil Engineer	Dwyane Deutscher	URS	120	$62.52	$7,502	$176.31	$21,157

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		Control Systems Specialist	Mike Worthington	URS	120	$42.80	$5,136	$120.70	$14,484
		Project Electrical Engineer	Henry Oquendo	URS	160	$36.64	$5,862	$103.32	$16,532
		Senior Civil Engineer	Surjan Punyamurthula	URS	240	$58.66	$14,083	$165.48	$39,715
		Facilities Security Specialist	Kevin Richmond	URS	120	$45.48	$5,458	$128.25	$15,390
		Senior CADD Designer	Nadine Hutton	URS	110	$34.48	$3,793	$97.23	$10,696
		Civil Engineer	Nikolai Meyer	URS	180	$29.56	$5,321	$83.36	$15,005
		Senior Graphic Designer	Lisa Jackson	URS	40	$30.56	$1,222	$86.18	$3,447
		Senior Pipeline Engineer	John Bergen	MWH	40	$62.81	$2,512	$200.00	$8,000
		Senior Engineer	Dan Crosby	MWH	40	$45.02	$1,801	$144.06	$5,762
		Senior Electrical Engineer	Can Quach	MWH	40	$55.80	$2,232	$178.55	$7,142
		Senior Geotechnical Engineer	Bahram Khamenehpour	AGS	20	$66.00	$1,320	$192.72	$3,854
		Project Engineer	Mikko Valkonen	AGS	40	$35.50	$1,420	$103.66	$4,146
		Principal Engineer	Mennor Chan	TEC	40	$45.00	$1,800	$132.75	$5,310
		CAD Drafter II	Irene Liu	TEC	40	$25.99	$1,040	$76.67	$3,067
				TASK 14 TOTAL	2,321	-	$105,830	-	$299,882
				PROJECT TOTAL	49,144	-	$2,394,765	-	$6,640,499

Other Direct Costs (ODCs)

	Description	Cost
1	Core Drilling	$650,000
2	Packer Testing	$18,000
3	Piezometer Data Recorder Equipment	$15,000
4	Downhole and Surface Geophysical Surveys	$38,000
5	Boring Log Drafting; gINT Database	$22,000
6	Misc. Field Supplies, Expenses, Vehicle Rental	$13,000
7	Fault Trench Excavation, Protection, Backfill	$24,000
8	Test Pit Excavation and Backfill	$6,000
9	Erosion Control; Exploration Site Restoration	$40,000
10	Laboratory Testing	$45,000
11	Report Reproduction, Delivery	$60,000
12	Computer Usage, Software	$4,000
13	Drilling/Well Permit Fees	$2,500
14	Utility Location	$10,000
15	Corrosion Consultant (MJ Schiff)	$30,000
16		
17		
18		
	TOTAL OTHER DIRECT COSTS	$977,500

Effective Project Multiplier[1] 2.77
(= Total Actual Labor Cost / Total Base Labor Cost)
Maximum Allowable Effective Project Multiplier = 3.20

TOTAL PROJECT COST BREAKDOWN

Total Actual Labor Cost:	$6,640,499
Total Other Direct Costs (ODCs) (Refer to Appendix B of Professional Services Agreement for allowable ODCs)	$977,500
Markup on Subconsultant Labor Cost (Maximum Allowable: 5% of subconsultant labor costs)	$173,338
TOTAL PROJECT COST[2]	**$7,791,337**